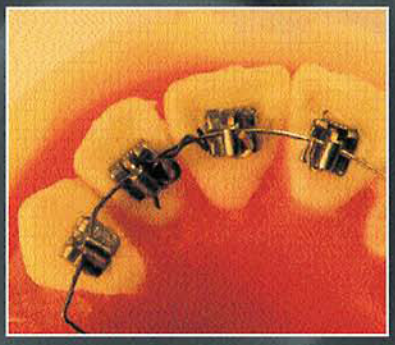
ORTHODONTIC PEARLS

A SELECTION OF PRACTICAL TIPS AND CLINICAL EXPERTISE



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Orthodontic Pearls

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A selection of practical tips and clinical expertise

Edited by

Eliakim Mizrahi **BDS DOrthRCS FDSRCS MSc PhD**

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CONTENTS

CONTRIBUTORS

Simon Ash BDS MSC MOrth FDS RCS
Department of Orthodontics
Whipps Cross University Hospital
Whipps Cross Road
Leytonstone, London E11 1NR
UK

Kees Booij
Orthodontist
Gezellelaan 11
9721 WJ Groningen
The Netherlands

Richard N Carter DMD MS
3250 NW 185th
Portland
Oregon
OR 97229–3404
USA

Glen W Cooper BDS MOrth MSC
80 Southover
Woodside Park
London N12 7HB
UK

Luc Dermut DMD PhD
Department of Orthodontics
Universiteit Gent
De Pintelaan 185
B-9000 Gent
Belgium

Gerald Gavron BDS HdipDent MDent(Orth)
Division of Orthodontics
Faculty of Oral Health Sciences
University of Witwatersrand
Private Bag 3 Wits
Johannesburg 2050
South Africa

Lee W Graber DDS MS MS PhD
450 Green Bay Road
Kenilworth
IL 60043
USA

Matie Grobler BchD DDO RFPS MchD Orth
1050 Schoeman Street
Hatfield
Pretoria 0083
South Africa

Nigel WT Harradine LDS BDS MOrth RCS MSC FDS RCS MRCS LRCP
62 Woodstock Road
Redland
Bristol BS6 7ER
UK

Jack Hickham DDS MSD
PO Box 24129
Hilton Head Island
SC 29925
USA

André O Hugo BDS MDent
PO Box 3596
Randburg
Gauteng 2125
South Africa

Alec Jacobson DMD MS MDS PhD
3605 Dover Court
Birmingham
AL 35223–2865
USA

Laurence Jerrold DDS JD
School of Orthodontics
Jacksonville University
2800 University Blvd
North Jacksonville
FL 32211
USA

Robert A Katz BDS MSc
165 Hale Lane
Edgeware
Middlesex HA8 9QN
UK

Brett Kerr BDS LDS RCS MDSc
265 Waterworks Road
Ashgrove
Queensland 4060
Australia

Victor Lalieu BDS MDent (Orth)
4 Westminister Road
Indooroopilly, Brisbane
Queensland 4068
Australia

Anthony GH McCollum BDS DOrth MDent (Orth)
PO Box 67104
Bryanston 2021
South Africa

Ronald G Melville BDS DOrth FDS RCS
39 Kloof Street Gardens
Cape Town 8001
South Africa

Eliakim Mizrahi BDS DOrth RCS FDSRCS MSc PhD
11 Dolphin Court
High Road
Chigwell
Essex IG7 6XA
UK

Alison M Murray BDS DOrth MOrth RCS MSc FDS RCPS
Woodstock Station Road
Bakewell
Derbyshire DE45 1GA
UK

Brian Nebbe BDS MDent PhD
1005 9717 111 Street
Edmonton
Alberta T5K 2M6
Canada

Farah R Padhani LDS BDS FDS DOrth MOrth RCS
5 Sudbury Court Drive
Harrow
Middlesex HA1 3SZ
UK

Demetri Patrikios BDS HdipDent MDent
18 Cawarra Street
Carseldine
Brisbane, Queensland 4034
Australia

Effie Patrikios BA
18 Cawarra Street
Carseldine, Brisbane
Queensland 4034
Australia

Matthew Power BDS MSc FDS RCPS MOrth RCS
13/14 Mary Rose Mall
Beckton District Centre
Beckton
London E6 5LX
UK

Adam A Ryan BDSc FDS MOrth MSc
Pond Cottage
Rocky Lane
Rotherfield
Greys, Henley-on-Thames
Oxford RG9 4RD
UK

P Jonathan Sandler BDS FDS RCPS MSc MOrth RCS
Woodstock Station Road
Bakewell
Derbyshire DE45 1GA
UK

Winston B Senior LDS RCS DDO RCPS
Northenden House
Sale Road
Northenden
Manchester M23 0DF
UK

John J Sheridan DDS MSD
Department of Orthodontics
Louisiana State University
1100 Florida Avenue
New Orleans
FL 70119-2799
USA

Desmond Solomon LOTA
Whipps Cross University Hospital
Orthodontic Laboratory
Whipps Cross Road
Leytonstone
London E11 1NR
UK

Renton Tindall BDS MdentOrth
Ground Floor
St. Andrew's House
St. Mary's Walk
Maidenhead
Berkshire SL6 1QZ
UK

Pieter van Heerden BChD MDent MChD
13 St. Peter's Road
St. Albans
Herts AL1 3RU
UK

Colin Wallis BDS LDS DOrth MOrth RCS
Meadowside
Ravensmere
Epping
Essex CM16 4PS
UK

Ziegfried J Weber BDS MSc MDent
PO Box 3596
Randburg 2125
South Africa

Tom Weinberger BDS FDS DOrth RCS
43A Emek Refaim
Jerusalem 93141
Israel

MANUFACTURERS

AJ Wilcock
Scientific and Engineering Equipment
45 Yea Road
Whittlesea
Victoria 3757
Australia

American Orthodontics
1714 Cambridge Avenue
Sheboygan
WI 53082
USA

DB Orthodontics
Acorn Business Park
Keighley Road
Skipton
North Yorkshire BD23 2UE
UK

Dentronix Inc
101 Steamwhistle Drive
Ivyland
PA 18974
USA

EM Natt Ltd
45–47 Friern Barnet Road
London N11 3EG
UK

Erkodent Erich Kopp GmbH
Siemensstraße 3
Postfach 1140
D-7293 Pfalzgrafenweiler
Germany

Forrestadent Ltd
21 Carters Lane
Kiln Farm 12
Milton Keynes MK11 3HL
UK

Fujifilm Corporation
26–30 Nishiazabu
2-Chome
Minato-ku
Tokyo 106-8620
Japan

GAC International Inc
185 Oval Drive
Islandia
NY 11749-1413
USA

Great Lakes Orthodontics, Ltd
200 Cooper Avenue
Tonawanda
New York
NY 14151-5111
USA

Kerr Dental Products
1717 West Collins Orange
CA 92867
USA

Kyocera Corporation (Yashica)
5–22 Kitainoue-cho
Higashino
Yamashima-ku
Yamashima
Japan

Masel Orthodontic Products
2701 Bartram Road
Bristol
PA 19007
USA

Nikon Corporation
Fuji Building
2–3 Marunouchi 3-chome
Chiyoda-ku
Tokyo 100-8331
Japan

Ormco Corporation
1332 South Lone Hill Avenue
Glendora
CA 91740
USA

OrthoCad Caldent Inc
8 Industrial Avenue
Fairview
NJ 07022
USA

Ortho-Care (UK) Ltd
5 Oxford Place
Bradford
West Yorkshire BD3 0EF
UK

Oscar Inc
8025 Castleway Drive
Indianapolis
IN 46250
USA

Plydentco Inc
325 Philmont Avenue
Unit "A"
Feasterville
PA 19053
USA

Precision Orthodontics
Ashley House
58–60 Ashley Road
Hampton
Middlesex TW12 2HU
UK

Rocky Mountain Orthodontics
Corporate Office/Plant
PO Box 17085
Denver
CO 80217-0085
USA

TP Orthodontics Inc
100 Center Plaza
LaPorte
IN 46350-9672
USA

3M Unitek
Dental Products Division
2724 South Peck Road
Monrovia
CA 91016
USA

INTRODUCTION

I acknowledge that the formal education provided by most dental schools as well as existing textbooks and journals equip the contemporary orthodontist with an excellent foundation in the science and art of orthodontics. However, I believe there is a pool of knowledge and information that is not provided by formal education and only becomes available and acquired with time and experience in clinical practice.

The administration and running of an orthodontic practice is not an aspect of orthodontics that is taught extensively or formally in most schools; it is information that students, as well as young and old orthodontists glean with experience, from interchange with professional colleagues and from general reading. In time it comes to reflect the individual nature of a practice and becomes a component of the practice driven and moulded by the personality of the individual orthodontist.

In this book I hope to present the reader with information on administrative and clinical aspects of practice sourced from experienced orthodontists worldwide; to show how they manage their patients and their practices. What patterns do their conversations follow, what do they say to their patients at different appointments and what do they say to parents? It is important to know just how much clinical information to give to patients and what information should be provided in correspondence to both the patient and the referring dentists. I hope the sample letters used by orthodontists in different parts of the world will be of assistance and will reflect the varying nature of practices.

With regard to the clinical aspect, current teaching on the theory and technique of orthodontics continues to evolve and expand and cannot be faulted. However, with the development of prescription-type brackets and the concepts of straight wire and preformed arches, students over the last few years may not have been exposed to some of the intricacies and complexities of wire bending. While it is commendable that clinical procedures should continue to be simplified and streamlined, there are a number of occasions in practice when the orthodontist is presented with different malocclusions and individual situations where additional wire bending or the use of an additional auxiliary will facilitate and improve the treatment and final result. This concept is well described in an editorial by Robert Rubin 'Why we still have to bend wires'.[1] He concludes in his last sentence 'In fact, in some areas of the arch, the risk benefit ratios suggest that wire bending will always be a wise choice'.

With time and experience orthodontists learn many technique adjuncts that work for them and which facilitate the clinical treatment of their patients. A number of these adjuncts are published in different journals. In this book I tried to collate some of these clinical tips and to present information from an international selection of orthodontists using varying techniques. I hope that this component of the book will be of value to the graduate student, the neophyte orthodontist as well as the established orthodontist wherever he or she may be practicing.

This book is not intended to compete with the major texts on the theory and techniques that form the basis of contemporary orthodontic teaching and practice. I hope that in an informal style, more akin to a seminar or tutorial, this book will provide the reader with information which will be helpful in both the administrative and clinical components of orthodontic practice.

I concede that it has not been possible to cover the complete orthodontic scenario; there are omissions particularly in the areas

of non-compliance and functional appliances. I have no doubt there are many clinicians who have ideas, tips and techniques that have not been included, perhaps these gaps could be filled in future editions.

Much of the information submitted by different clinicians has been gleaned from experience, lectures, courses and journals; where possible references are listed at the end of each chapter. Unfortunately, in certain cases the exact reference or source of an idea or a technique cannot be recalled, in such cases, none of the contributing authors knowingly claim originality for any idea or technique described.

The literary style varies with each contribution and I have tried not to alter this variation but rather to retain the individuality of each author. In certain sections the reader may encounter some repetition, once again this has been retained with the intent of maintaining the integrity of each individual contributor.

A hallmark of our profession is the diversity of individual opinion on both clinical and administrative issues, this diversity on the management of certain aspects of practice may be apparent to the reader. I have made no attempt to try to achieve consensus but have chosen, once again, to retain the individuality of the contributor. I hope the reader will benefit by being exposed to the different views and will take from the text what suits his or her own circumstances, personality and practice environment.

Comment

I believe that orthodontics is one of the finest professions; it combines the best of both the science and art of dentistry. We are privileged to treat a group of patients who actively seek our services, and the general level of work satisfaction and patient appreciation is high, I have yet to meet an unhappy orthodontist. Whether you run an individual single practice or a multiple surgery/operatory type of practice is an individual choice and I believe is more related to personality and character type rather than to financial consideration. Which of these makes for a happy orthodontist? I don't know. In our professional context, what is happiness, how do you define it? A simple definition given to me by a friend states: 'Happiness is when your earning power equals your yearning power'. By all means be ambitious but above all be honest with yourself and with your patients. Be happy and content with what you do.

I would like to acknowledge and thank every contributor for his or her effort and input. No matter how small or large their contribution, it takes time and effort to put pen to paper, and for this I and I am sure our readers are grateful. I must also thank my colleagues and postgraduate students at the Department of Orthodontics, Whipps Cross Hospital, London, for their stimulus in the initiation of this work, I hope the end result is worthy of their confidence.

Finally, let me say to every reader, the greatest appreciation you can demonstrate to your profession is to impart and pass on your knowledge and expertise to your students and fellow colleagues. To those of you already involved with teaching we acknowledge your services. To the others, I encourage you to get involved with teaching to a level and extent that suits you. I hope that, via this book, our colleagues who have put pen to paper are in their way giving something back to the profession they so enjoy. I leave you with what has probably been the best pearl in my career.

Pearl: For me the most satisfying professional experience has been the mix of clinical orthodontic practice combined with part time teaching.

Invitation

I would like to take this opportunity to invite any reader who believes that they have one or more pearls of information that could be included in any possible future edition of this book, to feel free to contact me. (My address is included in the List of Contributors.)

Eliakim Mizrahi

A LITTLE PHILOSOPHY

The following are a few experiences and lessons gleaned as I travelled as a practice manager for thirty-six years through the life of an orthodontic office. I learnt that:

- Orthodontists hold in their hands a capacity to generate financial benefits allowing them to lead a comfortable and generous lifestyle.
- That all of this is irrelevant if they do not acknowledge that their opportunity of altering the position of the teeth should be joined with a positive experience in the lives of their patients.
- That it is important to remember that as each potential patient walks through the door they do not only bring misaligned teeth with them. They are part of a social structure interwoven with expectations and dreams of their own. They belong to a family, whether it is a nuclear or single parent family. They belong to an educational facility or the workforce. They each have a life outside of their teeth. Consideration of their individual circumstances helps to form a bond between clinician and patient early on in treatment. This individual consideration will also assist greatly in their cooperation during treatment. It is as well to remember that this 'customer' or 'consumer' is going to share at least eighteen months of their life's experience with you.

Pearl: Cultivate, as much as you can, to share this experience on an individual basis with your patient and if possible without another family member being present.

Effie Patrikios

REFERENCE

1. Rubin RM. Why we still have to bend wire. The Editors Corner. J Clin Orthod (1996) 30: 541–542.

I Administration

1 THE PRACTICE

PHYSICAL APPEARANCE AND LAYOUT

It is important to appreciate and understand that for a new patient, or for that matter any visitor, the external approach, the entrance, the appearance and atmosphere of the reception and waiting area, all contribute to create the first and lasting impression of your practice. The whole environment should be appealing to the eye and give the impression of being bright, clean and airy. Whether you prefer modern contemporary or older period style is your personal taste, but the overriding principle still holds, keep it bright and light.

Lighting should be bright but not necessarily harsh. Bright areas help to elevate the mood of both the staff and the patients. This theme of brightness and light should be carried throughout the entire practice. The choice of colours and decor once again is a matter of personal taste and choice; try to select light as opposed to dark and oppressive colours and furniture.

Pearl: Keep it bright, light and clean.

Cleanliness should be a given and not need to be mentioned but this issue is so important I feel it needs to be stressed. Both clinical and non-clinical areas need to be kept spotless. Whether in-house staff members are responsible for cleaning or you employ a cleaning service, it is not always easy to get staff to clean to the standard that we would like. Unfortunately, it is an area of administration that needs constant monitoring.

Pearl: To make cleaning easier, try to keep the area uncluttered, use simple lightweight furniture, easy to move and easy to clean under.

Physical Layout

Remember, buildings and alterations are long-term investments and physical structures that cannot easily be changed; you need to do some careful research and plan well. Consideration of the physical design and layout are important at the new surgery/office planning stage, during the lifespan of the surgery/office, and as the working life of the clinician starts tailing off. The latter scenario is seldom given adequate consideration, Hamula points out that when the time comes to either sell your practice or take in an associate, a refurbished, modernized surgery/office is more marketable and will attract a higher price.[1] He believes that money spent in refurbishing an old tired-looking practice will be more than recovered in the final sale.

Two major issues will govern the physical layout. First, are you designing the practice from scratch with an open area available to you, or are you limited by an existing physical structure? Second, and probably more important, what is your available budget? Within the constraints of these limitations, there are some overriding principles that should be borne in mind.

Patient flow

A patient entering the reception room will generally be seen first at the reception counter/desk and depending on the nature of the visit, the new patient will either be guided to a seat in the waiting area, or directed through to a consulting office or for patients under treatment, directed through to the surgery/operatory.

Pearl: Access to these two areas should be as direct as possible without the patient having to pass through any other rooms.

From these two areas, there should be access to the radiology room or other such designated area reserved for radiology. If possible access to the radiology room should be direct so that patients attending specifically for radiographs would not need to pass through other areas, such as the surgery/operatory or consulting office, where other patients may be under treatment. It is not necessary for patients to have access or sight of the accounts office, the laboratory or the sterilizing area. On the other hand, staff should be able to move easily to all areas without too much interference with patient flow. If possible it is an advantage to have a second private entrance to the premises, this allows the orthodontist to arrive and leave whenever necessary without having to pass through the main entrance where there may be patients sitting in the waiting area.

Budget

Once again this is a very personal consideration specific to each individual and his or her particular circumstances, however, there are certain principles and generalizations that can be discussed. With regard to the cost of the physical structure, there is not much that can be said except that it is important to get more than one quote for the job; building costs do vary with different contractors. Try to get references on the contractor and speak to people for whom they may have worked for in the past. If possible do not use a contractor who is a personal friend or a relative. Very often disputes arise regarding failure to meet certain specifications or time-related deadlines. It is far easier to be objective, demanding and firm when dealing with a stranger on a purely business basis than when dealing with a personal friend or family member.

As opposed to the physical structures, the furniture and fittings can be more easily adapted to suit various budgets.

Pearl: For clinicians with a limited budget such as the newly qualified practitioner starting a new practice, keep the costs as low as possible particularly if the alternative will mean going into debt.

Shop around for furniture and equipment. There is available, low budget equipment and furniture, which looks good, and functions well. It may not last forever, but that is not so serious, once the practice is well established and there is a good income, you can afford to change or upgrade equipment and as a bonus there may be possible tax advantages. Very expensive equipment, which will probably last for many years is a disadvantage, in some cases. Often, when you have been functioning for some years, you may find that the practice needs a refurbishment or you may feel that you would like to change the image of the practice. If the fittings and equipment were originally very expensive then you may be reluctant to change, however, if they were low budget items, you may well be happy to change or upgrade.

Reception Area

Pearl: Remember, this room creates the first impression and sets the tone for the entire practice.

Keep it bright, airy and clean. If your budget will allow, seek the advice of a professional interior decorator.

The front desk, depending on the size of the practice, can vary from a single desk to a large counter; either way, keep the counter level low, a high counter makes the room feel smaller, and sets up a physical and psychological barrier between the patient and the practice. Even with a low counter, it is still possible, with tops of varying widths, to keep any private documents and appointment books out of direct sight of the patient. As a rule, try to keep the counter surface free of clutter, keep patient cards or files and any other papers on counter levels below the main top. Make adequate provision for computer terminals and keyboards.

Pay careful attention to the selection of floor surfaces, furnishings, lighting and seating. Remember that hard floors and surfaces contribute to higher noise levels. Try to keep the room warm, bright and easy to clean.

In a practice with a large young patient caseload, parents, siblings and friends often accompany these patients; these extra people take up space and adequate seating needs to be provided. Unfortunately, some parents do not exercise adequate control over some of the accompanying smaller children who can create considerable turmoil and mess, consider providing toys and books for young children. The furnishings should allow for a quick clean and tidy up.

Surgery/Operatory

Chair layout

Whether you opt for single chair surgeries or open-plan multiple chair surgeries is your personal choice. Orthodontics is the one branch of dentistry that lends itself to open plan surgeries. The concept has been used for many years; it makes efficient use of space and equipment, it contributes to informality, which in turn makes for a pleasant and relaxed working atmosphere. The layout of chairs and cabinets are dependent on the shape of the area available. Square areas allow for a circular wheel-and-spoke, staggered, four chair corner, or straight-line chair layout, whereas, rectangular areas usually limit you to a staggered or straight-line option.

Cabinets

Generally, surgery cabinets are custom-made and fitted for each surgery/operatory. These are not cheap items. However, as an alternative, consider visiting office furniture showrooms. Office furniture and accessories, such as desk extensions, can easily be adapted as surgery items. Colours can be changed; legs can be chrome-plated or powder-coated and most important they can be made mobile by fitting castors. While custom-built cabinetry is usually fitted to the walls and floors, there are advantages to making them mobile. If you need to move premises, expand or change the practice layout, moving fixed cabinets is a problem. In spite of manufacturers' claims that the cabinets are demountable, invariably this process results in damage to the cabinets and walls.

> **Pearl:** Mobile cabinets are easy to move, and facilitate layout changes.

This mobility also helps in cleaning and maintenance of the floor areas and surrounding walls.

Every building authority has its specific health and safety codes and specifications with which the contractor should be familiar; these are usually fixed and inflexible.

Two aspects specific to dental/orthodontic surgeries with which contractors are not always that au fait with are the positioning of electrical outlets/points and plumbing requirements.

Electrical outlets

Plan to have more than the minimum number of electrical outlets/points, do not skimp. Once the practice is up and running, invariably you will over the years keep purchasing appliances and gadgets which require power supply and with time you often find yourself running out of electrical outlets. Site them correctly in relation to the working areas and at the correct heights. Depending on your cabinets, the electrical outlets should be at counter height for appliances that will rest on the counter tops and at skirting board heights for the rest. Try to avoid having a lot of loose wires hanging around particularly in the surgery/operatory. Included in the electrical planning make adequate provision for telephone and computer terminals and links. It is advisable to have the power for computers on a different circuit to the general equipment circuits.

Plumbing items

Plumbing items are fixed and need careful planning, if budgets and space allow, try to provide for extra key sites and junction boxes which may not be required at present, but will be valuable for future expansion. Plastic pipes incorporated in dental equipment may, with wear and tear, burst or become disconnected. Invariably, this will happen at night when mains water pressure increases.

Pearl: To prevent such accidents, it is advisable to provide for one valve or key (solenoid switch) strategically situated near the suite exit, which allows the last member of staff leaving the rooms at night to switch off both water and electrical supply to the entire suite (but not the power for computers).

Floor covering

Whereas some areas of the practice offer you the choice of soft carpeted or hard flooring, the floors of the surgery must be of the hard type, either plastic, rubber or ceramic. Each surface type has advantages and disadvantages. The surface must be easy to wash and clean and in some countries it is a requirement for all joints in the floor surface to be sealed including the skirting board area. Ceramic surfaces may be attractive, however, remember that if you drop orthodontic pliers on the floor, and at some stage you will, ceramic tiles will eventually start to show evidence of small chips. The surface should allow free movement of the operator's stool. Floor colouring is part of the overall decor, however, when choosing a colour, remember plain colours readily show shoe prints while mottled colours make it difficult to find any small item, such as a bracket or even a band, that may fall on the floor. Floor colours or patterns can be used in an attractive manner to demarcate different areas in a multi-chair surgery.

Ambient lighting

The modern operating light as a component of the dental chair unit provides more than adequate light. However, the ambient light in the surgery is an important feature that is often neglected. Dentistry/orthodontics is an activity that requires precise visual and digital activity. The eye performs increasingly better as illumination is increased but levels off as the light intensity reaches above 20 000 lux. Operating lights generally exceed 22 000 lux, consequently, if there is a large difference between the light intensity in the mouth and outside the mouth, the eye is forced to adapt to a continual change in light intensity as you focus in and out of the mouth. This continual adaptation induces excess eyestrain and fatigue. Not only is the intensity of light important, but also of equal importance is the quality and colour temperature of the light. It is believed that working under the correct kind of light is physiologically beneficial to the operator's health; we need to work under lighting with a colour temperature of 5000 kelvin or above. There are European and International Standards for dental surgery illumination levels. Din standard 67505 and ISO 9680: *The Right Light for Dental Surgeries*. The standards lay down the amount of light, its distribution and its quality.[2] All these factors need to be taken into consideration when planning and designing your surgery/operatory, particularly as we often spend more time at work than we do at home.

Consulting Office

Ideally, this is a room apart from the surgery. If space and budget allow, try to include an examination chair in this room. It is very useful to have the facility to examine a new patient in a non-surgical environment. It is a less threatening environment for the child patient and a more private environment for an adult patient. It also allows clinical work to carry on uninterrupted in the main surgery. The examination chair located in the consulting office need not be a large or fancy expensive dental chair, as an alternative, look for semi-reclining office chairs, or look through catalogues of hairdresser chairs. There are neat, modern, attractive low voltage lights on flexible arms, which can be used for the clinical examination. With the current mandatory use of gloves, it is preferable but not essential to include a washbasin in such a consulting office; if you do go out the room to wash your hands, it is advisable to let the patient see you fit on a new pair of gloves before carrying out any examination.

The design, shape and placement of the desk should also lend itself to being informal. Provision should be made for a viewing box to display radiographs or slides, this may be either cut into the desktop or placed at the

side. The placement of a computer monitor will depend on what the clinician intends using the computer for, if both the clinician and the patient need to have sight of the screen, then make use of swivel bases and if space is a factor, use flat screens.

Pearl: Keep the desk surface uncluttered; clutter on a desk distracts the patient's attention and does not contribute to a professional atmosphere.

Radiology/Photography Room

While this facility could be incorporated into the clinical area of a large surgery/operatory, it is preferable to have a separate room for radiology and photography. The design and size of the area will depend on the equipment available. The essential components are:

- Intra-oral x-ray unit
- Panoramic x-ray unit
- Cephalometer
- Photographic set up for extra- and intra-oral photographs and slides
- Conventional radiograph tracing table, or a digitizer
- Provision for any of the above to be digital either from the outset, or for future conversion with the possible incorporation of scanners, computers and all the other necessary supporting hardware
- Provision for a facility to darken the room to assist in tracing or digitizing radiographs.

Pearl: The physical structure of the room and walls will need to comply with ionizing radiation regulations specific to the local or national building and planning authorities.

Laboratory

The size and sophistication of the laboratory will depend on how much in-house laboratory work you intend to do. Make provision for adequate sinks and hot and cold water taps. Possible components for a small in-house laboratory are:

- A model trimmer, which will need to be placed on a firm base and have a connection to both the cold water supply and to the drain
- A plaster trap is essential to prevent blockage of the main drain
- A laboratory handpiece
- A polishing lathe with a pumice trough
- Vibrator for casting models
- A pressure or vacuum-forming machine for retainer and appliance fabrication
- Depending on the amount of trimming that will take place, a dust evacuation system is desirable
- A Bunsen burner and a soldering flame connected to either the gas mains or an independent gas tank. There are some very neat, small stand-alone soldering gas torches available either from orthodontic supply houses or general hardware shops
- Good lighting and ventilation.

If the laboratory is to double up as a model storage area, then make provision for the maximum amount of shelving the room will allow. Model storage is a problem that compounds itself with the ageing of the practice.

Pearl: Make sure that the noise and smells from the laboratory do not permeate the rest of the suite, fit a good quality door.

Accounts Office

This office can be out of sight of the patients. The requirements of an accounts office will vary with the size of the practice. Some of the basic requirements are:

- Adequate desk space
- Provision for telephone and computer terminals
- Filing cabinets
- Adequate storage space for stationery and any other office requirements.

If this office doubles up as the office for the practice manager, and if the sighting in the overall plan will allow, place a one-way

mirror overlooking the reception area. This allows the practice manager to view and control this very important area.

Pearl: The more you can keep in this office the less clutter you will have at the front reception desk.

Cloakroom

The cloakroom and toilets must conform to planning authority requirements. This facility may be part of the main building or it may be an integral part of your suite. If it is your responsibility, then provide mirrors and counter space for ladies' toiletries and make-up requirements. Keep the area fresh, clean and continually replenish all toiletry requirements.

STAFF

You will probably find over the years that managing staff and their related issues and problems will tax and stress you more than any malocclusion. We are trained to treat patients with malocclusions, we are not trained in the philosophy and psychology of human nature nor are we trained in employment laws and their practise.

Second only to patients, the staff comprise the most important component of your practice, they can almost make or break your practice. It is necessary for you to devote a major percentage of your energy and time to the management of your staff. The following suggestions may help you manage this difficult and sensitive component of clinical practice.

- Whenever possible attend courses on staff management, you will invariably learn something helpful.
- When selecting new staff, have a structured interview protocol.
- Understand that selection criteria for a front office/receptionist will be different to the criteria for a chairside assistant.
- For a young practice, where running costs are a significant factor, keep staff numbers to a minimum. As the practice grows, so you will increase the number of staff. When you can afford the salary, aim to employ more than the minimum number, an extra member of staff acting as a back-up helps to reduce the stress generated by absenteeism. If possible consider appointing one member of staff as the practice manager.
- Study the labour rules and regulations as they apply to your area and your practice. These laws are important and at all costs try to avoid and prevent any confrontation with staff that may result in legal proceedings. It is often more expedient to swallow one's pride, settle and avoid litigation.
- If you are unhappy with a staff member early on in their employment, replace the individual. Experience has shown that individuals do not easily change their character; the problems you experience with an employee in the early days, do not disappear, in fact they get worse. Unfortunately, the more time and effort you expend on training, the more hesitant and reluctant you become to changing staff and as time passes you may tend to settle for second best.

Pearl: Once you have good staff, make every effort to keep them.

Discharging a member of staff is probably one of the most unpleasant tasks we occasionally need to perform. Before confronting a member of staff, make sure that you conform with the current labour laws as they apply to you. In an editorial White gives some thoughts on firing staff, unfortunately there is no easy way to fire an individual.[3] Whatever the reasons that led to the need to fire a member of staff, it is essential that you remember to conduct yourself in a professional manner, protect the dignity of the employee, be courteous, be understanding and never embarrass the individual.

Staff Motivation

Victor Lalieu

We have a 'Staff Social Club' – all members of staff contribute a small weekly amount to this fund and this is used to help fund various staff social functions with accompanying partners, for example, canoeing, weekends away to Sea World or to the wine-making district, 'skirmish' encounters, various dinners, go-cart racing, etc. I find that if the staff members have at least contributed some money (I make up the difference), they are more appreciative and involved in the outing (they want to get the most out of their contributions!). At our monthly staff meetings, each staff member must provide one point of interest or a new idea to improve the practice.

Staff Relationships

Effie Patrikios

I believe that it is imperative to understand that the execution of running a successful practice depends on several people and circumstances. I believe certain standards need to be maintained within the office procedures. A major part is the understanding of the needs of staff and your expectations of the delivery of their duties. You need a team that can be relied upon to work together for the ultimate benefit of all in the field. Just as a driver in a racing car on the race track needs to have so many different items serviced as he pulls into the pit so too does the orthodontic practice need to function. Each member of the team has a function to fulfil, together with the absolute consideration of all concerned in the team. Staff meetings provide a necessary and functional forum to assist in the process. Just as each patient brings their social structure to the practice so too does each member of staff (including the orthodontist). Consideration and intuitive recognition of these individual circumstances are vital.

Pearl: Each day, each patient and each member of staff will bring something different with them through the door.

FORMS AND STATIONERY

All forms required for the administration and running of the practice can be purchased or custom-designed to suit your requirements. Before settling on a final design, why not first design the form on your own computer, print out a few, use them, and alter them until you are happy with the final design. The forms can then be produced commercially or printed in-house. Desktop publishing can add a new dimension to the administration of your practice. The content and design of the forms will be dictated by your personal preferences. Essentially, you will need standard information for administrative purposes, forms for medical and dental history, for clinical examination and a record card for noting all treatment procedures. Many contemporary practices have dispensed with paper forms and all data and clinical procedures are computerized. Before deciding on your own preference it is essential to research the subject extensively,[4] and consider some of the following issues:

- Your own level of computer literacy and technical know-how. Your dependence on the computer and the effect any computer breakdown will have on your practice.
- The availability and the quality of support for both hardware and software.
- The reliability of back-up systems and the quality, reliability and discipline of your staff to maintain the back-up procedures.
- The admissibility of electronic data as evidence in the medico-legal context. Digital data, such as record cards, photographs and radiographs, can all be altered and their reliability questioned.

Pearl: Both the paper and paperless systems do have their advantages and disadvantages. There is no 'all or nothing' rule, each clinician should take from each system what he feels comfortable with.

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II Pre-treatment

2 MANAGEMENT OF THE NEW PATIENT

FIRST CONSULTATION

Before a new patient arrives for their consultation, they invariably will have experienced their first contact with your practice via the telephone. The importance and the art of managing the initial call, has been the core of many courses and articles. This issue is succinctly described in an article by Thompson, who explains that there is a science and art to the correct handling of the initial call.[1] The science covers the information to be gathered and the information to be given, and the art is the ability to communicate what is relevant to each individual patient.

On arrival at your office, the new patient will be seen first at the reception desk where all the basic administration data are recorded. From the reception area, the new patient should be escorted into the consulting office. Before seating the patient in a dental or examination chair, let them first sit at the desk. Depending on the configuration of the desk, you may sit on the same side (some orthodontists feel this arrangement is less intimidating for the patient) or more conventionally on the opposite side of the desk.

When more than one individual is sitting across the desk, such as a parent, spouse or friend, direct most of your attention and conversation to the patient. Talk to the patient and try to establish why they have come to see you, what their complaint is and who referred them. Obviously, you will vary your approach and language depending on the age of the patient. Particularly with children, try to keep the conversation at an informal level, joke with them and try to make them smile. Try to gauge the patient's attitude to wearing appliances, the sullen teenager who is reluctant to engage in conversation with you, keeps looking away from you and is disinterested, is not going to be a good orthodontic patient (Chapter 7). At the other end of the age spectrum, the very young patient who is reluctant to let you touch his or her teeth is also going to give you a hard time and make your day more stressful.

Adult patients have become, for many orthodontic practices, a significant component of practice and there is little doubt that the number of adult orthodontic patients will continue to grow. Adult patients are generally good orthodontic patients, their level of cooperation is high and their degree of appreciation is gratifying. However, there are a few adult patients, who have an unrealistic level of expectation, it is important for you to recognize the adult patient who has some other problem in life and expects orthodontic treatment to solve some social or emotional shortcoming (Chapter 6).

After the initial opening conversation invite the patient to the examination chair, at this stage, before examining the patient, it is essential to take a medical and dental history.

Medical and dental history

Taking a comprehensive medical and dental history is accepted as standard clinical practice. It is essential that, as the clinician, you are aware of any local and systemic conditions that may have a bearing on your management of the patient. Apart from the obvious relevance of the dental history to orthodontic treatment, questioning the patient also gives you a good insight into their dental IQ (awareness), and their motivation. This can help to assess the degree of compliance you might expect. Some clinicians prefer to have the relevant forms completed by an assistant prior to the clinical examination while others prefer to ask the relevant questions face-to-face with the patient.

Initial clinical examination

For the initial clinical examination, the only instruments required are: a mirror, probe and tweezers, preferably all on a disposable plastic or paper tray. It is not necessary to invest in a fixed bracket table for the consulting office. A small mobile trolley is very useful; it can be used in lieu of a bracket table during the initial examination and then easily rolled out of the way. After examining the patient and recording the relevant notes, let the patient hold a mirror and if relevant invite the parent to come closer and briefly show and explain the problem to them. Once the examination is completed, explain to the parent or patient what the next step will be and your reasons for their recommendation. Depending on the physical layout, this can be done at the chairside or you can all move back to the desk.

Before taking a decision on which of the treatment options you will propose to the patient or parent, I believe that it is essential for a full mouth panoramic radiograph to be taken. As a specialist, you cannot afford to be surprised by some abnormal development of the dentition at a later date, you need to know how that particular dentition will develop over the next few years. Explain to the patient why it is necessary to do a preliminary radiographic examination. After viewing the radiograph, you should be in a position to explain the following treatment options to the patient or parent.

TREATMENT OPTIONS

Too young

The patient is still too young and will be placed on a recall system. Recall patients are an important component of the practice. These patients form a pool of patients, which over the years will continue to feed the practice. They should be nurtured and carefully managed. Your preference will dictate whether you use a computerized or manual recall system. Depending on the patient's age and the presenting malocclusion, they will generally be recalled at six or twelve monthly intervals. Some of the patients in this group may require extraction of certain deciduous teeth. Whether you wish to do a full orthodontic investigation for these patients depends on your philosophy, in today's climate you must be aware of the resistance to the taking of unnecessary radiographs.

Pearl: You must be able to justify the need for such radiographs.

Ready to start

The patient is ready to start treatment and the next step will be a full orthodontic investigation requiring a comprehensive clinical examination, study models, radiographs, and photographs (Chapters 3 and 4). A separate appointment is scheduled for the investigations. In some practices, this investigation is carried out at the first consultation. I prefer to give the patient and the parent a chance to go home and have an opportunity to think about my recommendations. Particularly when a financial consideration is involved, by giving the other parent or spouse a chance to have some input into the decision making process, I have found that this helps to avoid later problems.

The group of patients who are ready to start active treatment, comprise two categories, those in the full permanent dentition requiring a single phase of comprehensive treatment, and those in the mixed dentition who might benefit from a two stage approach to treatment. There is no doubt that certain cases need a first stage of treatment, however, the benefit of two stage treatment for many cases is an issue that is still extensively debated in the orthodontic literature.[2] Your philosophy on two stage treatment will dictate how you handle the early mixed dentition patients. Be aware that very young patients may not cooperate as well as you would hope for and furthermore, with time, the majority of young first stage treatment patients will need a second stage of comprehensive treatment, this may in time increase your practice caseload above that which you can manage satisfactorily.

Place on waiting list

The patient is ready for treatment but because of the demand for treatment and the current clinical caseload of the practice, the patient will be placed on a waiting list. If you are fortunate to be in an area where the demand for orthodontic treatment exceeds availability of orthodontic services, it is necessary to establish a waiting list. This list can be organized on a purely sequential basis where patients are entered on the list when you believe them to be ready to start active treatment, or where patients entered on the list are prioritized according to need, urgency and severity. The former system is more objective and the easier to handle, whereas the latter may be more subjective and possibly more applicable when treatment resources are limited.

No need for treatment

The patient does not need orthodontic treatment. Until quite recently the decision taken by the orthodontist that 'the malocclusion is mild and does not need treatment' would have been accepted without question by the patient or parent. Currently, however, the concept of patient empowerment and the establishment of a patient's charter are tending to shift a degree of decision-making from the doctor to the patient. The belief that 'the doctor knows best' is no longer generally accepted. This subject and the concept of the acceptability of treatment plans directed at satisfying the patients wishes, is well debated in an editorial by Gotlieb.[3] Despite these developments, I believe that your clinical freedom to treat what you believe is in the best interests of the patient remains a pillar of ethical practice and, with good communication skills, will continue to be acceptable to your patients.

A different approach to the management of a new patient and possibly a more contemporary but less personal approach is for the patient to be seen first by a clinical auxiliary who will take initial notes and digital photographs. These are then displayed on a computer screen in the consulting office following which, the orthodontist enters the scene and picks up on the conversation.

Pearl: For the smooth and efficient running of a practice, all the above options require the correct administrative procedures to be in place and for the correct correspondence to follow.

Every clinician will develop his or her own style of delivery related to their personality and to the level of formality they choose to adopt in their relationship with their patients. However, irrespective of the style of delivery, the content of the discussion and the explanations given should convey certain basic information.

Depending on your philosophy, you will explain to the patient or parent why one of the preceding treatment options applies to this case. It is important that you start to give an indication of the costs involved for each of the options. Tell the patient/parent exactly what you charge for a recall appointment, what you charge for a full investigation and give an indication of the approximate range of fees for the treatment. Explain that the exact cost and the method of payment will be presented to them at the case discussion.

CORRESPONDENCE

Pearl: The main avenue of documented communication between you the clinician, the referring dentist and the patient, is an efficient system of correspondence. It is an essential component of practice marketing, and is a crucial element in the medico-legal field.

It is difficult to imagine a contemporary orthodontic practice that does not have computerized word-processing facilities. The addresses of all referring dentists and letters for most conceivable situations can be pre-formatted and stored in a word-processing package or in a comprehensive orthodontic software package. For each group of letters, there will always be certain options; these can be stated in different paragraphs. Use a number to

designate different letter subjects and letters of the alphabet to designate different paragraphs. When dictating the letter, it will only be necessary for you to state the letter number and then identify the required paragraphs. Within each paragraph, if there are variations for insertion, such as teeth or patient's name or gender, then leave identifiable blank spaces (see Appendices). Irrespective of the system used, there are certain principles to follow and basic information that needs to be conveyed in the correspondence.

- Respond promptly; all your correspondence should be dealt with on a daily basis, either you deal with it at odd intervals during the day whenever you get some time, or it is placed on your desk and you deal with it at the end of the day.
- Personalize all letters, the letter should address each dentist by his or her name and each letter must be signed by you.
- When writing to a patient use language that the patient can understand. Whereas the dentist will understand the term Class II, for the patient, 'a retruded lower jaw in relation to the upper jaw' would be more meaningful.
- Following your consultation with a new patient, a letter of thanks and appreciation should be sent to the referring dentist. This letter should contain a very brief statement of your clinical findings. (Remember you have not carried out a full investigation at this stage.) Explain that the patient will either be placed on a recall system, a waiting list or an appointment will be scheduled for a full investigation to be carried out following which you will send the dentist a full report.
- If at this stage you recommend the extraction of certain deciduous teeth, then include the request in this initial letter. One assumes that you will not request the extraction of permanent teeth without having carried out a comprehensive orthodontic investigation.
- If another patient of the practice referred the patient, send a letter of thanks to the referring patient.
- Make sure to use a tooth numbering system that is well understood by all your referring dentists.
- Double check the teeth to be extracted with your clinical notes.

Pearl: Copies of all correspondence should be kept in the patient's file. If you are using a paperless system make sure all correspondence is attached to the patient's electronic file and is adequately backed up.

A PERSPECTIVE ON THE TECHNOLOGICAL REVOLUTION

An editorial by Keim gives a good, brief description of the dramatic changes that technological progress has induced in orthodontic practice.[4] Haeger also highlights this in an article in the same journal.[5] There is no doubt that the contemporary orthodontist must and will incorporate these technological advances into clinical practice; but in the midst of all these remarkable changes it is as well to remember that the tooth, periodontium, bone and facial muscles are unaware of these changes, they still react to pressure and tension in the same way as they did fifty or more years ago.

Pearl: Despite modern computerized and digital office management systems, diagnostic aids, bracket and wires, it is still your hands and fingers in the patient's mouth that will place, activate and control any tooth-moving device.

It is your decisions and your hands, not the computer, that will determine the standard of your finished cases.

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3 ORTHODONTIC INVESTIGATIONS

Prior to establishing a diagnosis and treatment plan, it is essential to carry out a comprehensive orthodontic investigation consisting of:

- Medical and dental history (Chapter 2)
- Clinical examination
- Study models
- Bite registration
- Radiographs
- Photographs (Chapter 4).

CLINICAL EXAMINATION

This should comprise a comprehensive clinical extra-oral and intra-oral examination with all findings recorded clearly on a record sheet or electronically entered on the patient's computer file. The record sheet can be customized to suit your own requirements then either printed commercially or computer-generated in house. The recordings should include both morphological and functional features.

Pearl: Remember the patient is a three-dimensional object and as such must be examined in three planes, sagittal, vertical and coronal.

STUDY MODELS

Full upper and lower impressions are generally taken in alginate. While explaining to an apprehensive patient exactly what you intend doing, select impression trays carefully and make sure they are large enough. If a tray is too small it is not possible to seat the impression deeply enough and if the rim of the tray touches the alveolus, it can be extremely painful. Use a deep tray that extends well into the sulcus. Trays can be either metal or disposable plastic. The metal trays will last many years but they need to be cleaned and sterilized after each impression. Disposable trays will be more expensive but the cleaning and sterilizing procedures are eliminated. If the trays do not have sufficient perforations, they will need to be coated with a tray adhesive. If possible, use the paint-on adhesive and not the spray adhesive. If you use the spray adhesive, the atomized adhesive in the air gradually settles on the floor and with time, the floor surface becomes tacky and dirty as the dust and debris stick to the floor surface. Use a fast-setting alginate; having an impression taken is not a comfortable procedure so for the patient's sake you should remove it from the mouth as soon as possible.

To routinely obtain a good impression free of air bubbles and well extended, it is advisable to first load the labial sulcus in the incisor region for both upper and lower impressions. Always take the lower impression first, for the patient, it is the more comfortable of the two and it helps to familiarize the patient with the procedure before the more uncomfortable upper impression is taken. Do not overload the upper tray particularly in the posterior region. If the patient starts to gag, quickly use the mouth mirror to clear away any excess moving down the throat, tilt the head down on to the chest and ask the patient to concentrate on breathing deeply. Reassure the patient and explain that you cannot remove the impression until the material has set, otherwise it will stick to the teeth and palate and to make matters worse, you will have to retake the impression. By the time you have gone through this routine, the impression should be ready to be removed. For removal of the upper impression, ask the patient to

seal their lips and blow as if they were blowing up a balloon. This lifts the soft palate and helps to break the air seal at the back of the palate, as they blow, tilt the tray down at the back and it will come away from the palate easily. The patient can assist by using the tongue to lift the lower impression.

Pearl: With patients who have tight hypertonic lips, be careful when removing the tray, the lips may easily dislodge the posterior buccal part of the impression from the tray. If this goes unnoticed, you end up with a model showing distorted molars.

Once the impressions have been removed from the mouth, they should be well rinsed in running water, sprayed with a disinfectant spray, wrapped in a wet paper towel and sealed in a plastic bag. If the impressions are processed within your in-house laboratory, they should be removed from the surgery, still wrapped in a wet paper towel, and cast/poured in white stone as soon as possible.

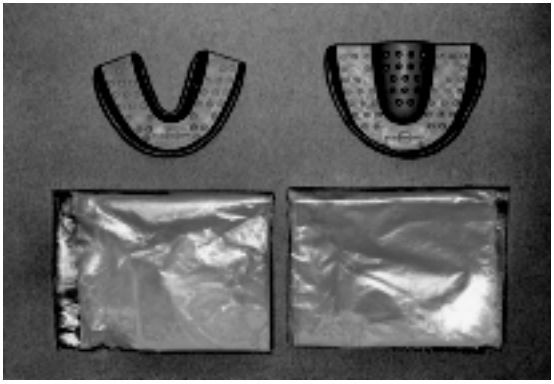
With the continuing advancements in digital computer technology it is now possible to obtain scanned images of study models that can be manipulated and viewed from different angles (OrthoCad Inc, USA). As with computerized cephalometrics, measurements and analyses of the dental arches are incorporated in the provision of digital study models; there is little doubt that this form of study model presentation will continue to expand and in time may well replace conventional study models. Apart from the extra diagnostic data provided by digital study models, the saving in storage space alone, will be a driving force in the development and acceptance of this new diagnostic tool.[1]

Alginate Impression Technique

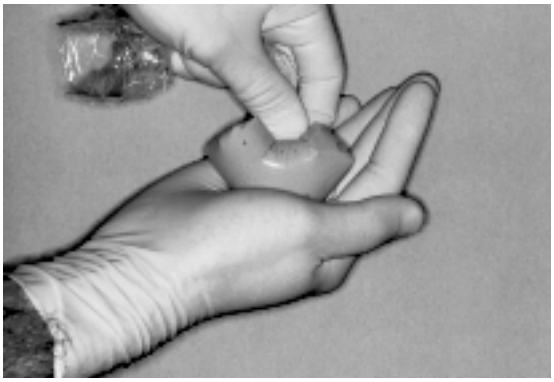
Pieter van Heerden

The following procedure is used as an alternative to mixing alginate impression material using the conventional mixing bowl and spatula. The aim of this procedure is to provide a reproducible technique that minimizes mess and requires very little cleaning.

- Alginate impression material is pre-packed into small plastic sandwich bags: measure the correct amount of powder according to the manufacturer's recommendations or your personal preference. Separate bags are made up for upper and lower impressions and stored in study model boxes or with the impression trays (Figure 3.1a).
- The correct amount of water is poured into the plastic bag, holding it in such a way that the powder and water will run down and be located towards one of the corners of the bag.
- The open end of the bag is then twisted up tightly to prevent water and powder leaking out.
- Mixing takes place by placing the corner of the bag filled with water and powder in the palm of your left hand and by using a circular motion with your right hand and gently pushing down into the palm of your left hand the alginate and water will mix into a paste (Figure 3.1b).
- You will find that an air gap appears during the mixing process as the water is absorbed into the powder.
- Untwist the bag to let out the air then reclose the open end of the bag as described above. Following this step will ensure that air is not incorporated into the mixture and will eliminate unnecessary air bubbles.
- You will have a very direct feel for the consistency of the alginate impression material. Once mixing is complete, cut off the corner of the bag with a pair of scissors (Figure 3.1c), and gently squeeze the alginate into the tray (Figure 3.1d).
- The plastic bag with alginate residue and the tip of the bag that was cut off is then discarded. This technique eliminates the use of a spatula, mixing bowl and the associated cleaning procedures.



(a)



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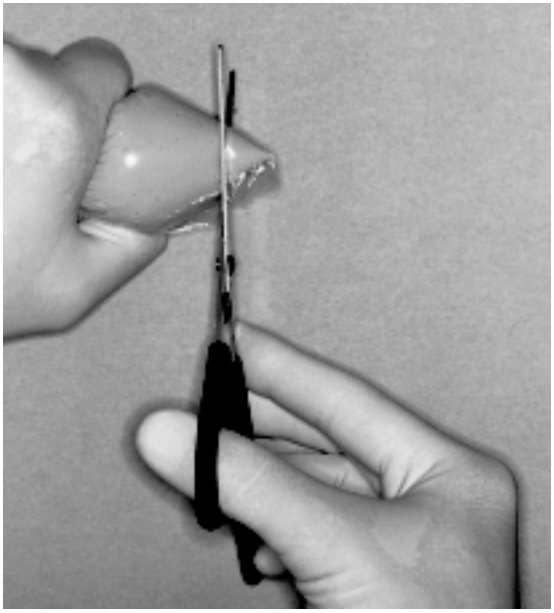

(c)

(d)

Figure 3.1

No-mess impression technique.

(a) Pre-packed impression material. (b) Mixing pre-packed impression material. (c) Cut off one corner of the plastic bag. (d) Squeeze the mixed alginate into the impression tray.

Tips for Impression-taking

Anthony GH McCollum

Taking an impression provides an opportunity for you to gain the confidence of your patient. A close confident relationship will enhance the vital cooperation of the patient, so necessary in ultimately obtaining an excellent orthodontic result.

Patients often have negative preconceived ideas at the thought of having an impression taken, this may be due to friends, colleagues or siblings having imparted their experiences to them; if you or your oral hygienist performs the impression-taking process with sensitivity and a touch of humour it could go a long way to cementing a close relationship.

The patient's apprehension can be allayed by using humour, for example tell the patient

that the impression material is 'quite edible and the staff have it for lunch'. The patient does not know whether to believe this or not and this kind of comment has the effect of defusing their anxiety. Encourage them to smell the alginate in the plastic bag or tin, as most manufacturers today add a pleasant odour (e.g. vanilla), this action can further reduce anxiety.

With super-sensitive, nervous patients, it is often wiser for you to take the impression yourself rather than the oral hygienist. While not wishing to reflect on the ability of the oral hygienist, taking the impression yourself demonstrates to the patient that you really care. If this kind of patient is not treated with special consideration, they are often quick to spread harmful comments about the practice, particularly with adult patients.

The selection of impression trays is important, warn the patient that the tray will stretch their cheeks a little and that they should relax and not attempt to over open and stretch their mouth in an attempt to assist the placement of the trays.

It is always helpful to fit the lower tray first as it can be used to detect whether the patient has an enhanced gag reflex. These patients require more counselling; tell them to relax, not to hyperventilate but instead to breathe steadily and calmly through the nose. Ask the patient to tip the head down and forward so that the chin touches the chest. This seals the pharynx in a more anterior and elevated position, thus diminishing the gag reflex. This technique is very successful in preventing this reflex and it is very seldom necessary to anaesthetize the dorsum of the tongue with topical anaesthetics.

When taking the lower impression, it is important to tell the patient to elevate and protrude the tongue, as this will ensure accurate definition of the floor of the mouth. For example, tell them to 'point your tongue at me, this is your last chance'. This helps to distract their attention.

When the upper impression is seated it is important, especially in children, to continue to divert their attention. There are many examples and techniques, consider some of the following; tell them to wink with one eye and then the other. They often cannot do this, closing both eyes at the same time. Tell them to concentrate on winking with alternate eyes or as an alternative tell them to lift one foot and then the other. Ask them which one is left and which one is right and they should indicate this with a hand or by lifting the leg. Confuse them by answering to the opposite. All these suggestions help to divert their attention and raise a little humour.

The removal of the impression is done gently and if the suction or vacuum effect of the impression is too great, ask the patient to close their lips and nose and to blow hard into their mouth. This helps reduce the suction effect and facilitates its removal.

> **Pearl:** Try to convert impression taking from a fearsome, daunting process into a 'fun' process.

Each practitioner can develop his or her own individual techniques to divert attention and if done with honesty and a sense of humour will greatly enhance patient confidence and trust, improving the prospects of an excellent treatment outcome.

BITE REGISTRATION

Before taking a bite registration, check the bite carefully; look for posturing of the mandible particularly in young patients. Explain to the patient what you will be doing with the wax wafer and what you require the patient to do, let the patient practise closing on the molar teeth. Use a horseshoe or V-shaped wafer rather than a sheet of wax extending across the mouth and interfering with the tongue. Place the softened wafer on the upper teeth then watch the path of closure as the mandible closes up into occlusion.

Wax bite wafers can be purchased commercially or pre-made by your staff. Cut across a sheet of modelling wax into strips 2 cm (1 inch) wide (Figure 3.2a). Warm the strip of wax either in hot water or with a flame, fold it lengthwise to double the thickness then twist it in the centre to create a V-shaped wafer (Figure 3.2b, c).

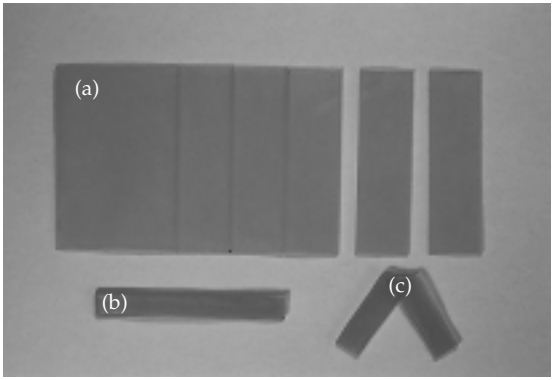

Figure 3.2

Making a bite wafer.

(a) Score and cut a sheet of wax into strips 2 cm (1 inch) wide. (b) Warm and fold into double thickness strips. (c) Warm and twist the folded strip into a V-shaped wafer.

Wax Bite

Matie Grobler

When taking a wax bite, while the wax is still soft, squash the wax with your thumb and forefingers on to the buccal surface of the teeth. This gives better stability when articulating the study models. Cut off any wax extending distal to the last molar, it interferes when occluding the maxillary and mandibular models.

Bite Registration

Luc Dermut

If the patient has trouble biting correctly, you should let him or her hold a hand mirror to see what they doing and how they should close correctly.

There is some debate as to the need for mounting all study models on an adjustable articulator. Currently, I believe the majority of orthodontists do not routinely mount their study models on this. If it is necessary to mount the models on an adjustable articulator, then a facebow reading will need to be taken.

RADIOGRAPHS

A comprehensive radiographic examination is an indispensable component of an orthodontic investigation. It should provide data on the dental, skeletal and soft tissue elements of the dento-facial complex. As with photography, the advent of digital and computerized radiography has introduced a new dimension into this aspect of clinical practice. Fully digital x-ray machines using 'charged coupled device (CCD) imaging' are commercially available as well as facilities for changing conventional cassettes used with standard x-ray machines to 'photo-stimulable phosphor (PSP)' cassettes that produce digital images. The advantages and disadvantages of both the conventional and digital systems have been extensively debated, there can be little doubt that as we progress into the twenty-first century, digital systems will replace the older conventional systems. If you are starting a new practice and your budget will allow the expense, I would recommend that you purchase a digital system. Those of us already in practice will gradually convert to digital, as and when individual circumstances indicate the need to change. Irrespective of the system used, the principles of good radiography should still remain unaltered.

The attitude of both patients and the profession to radiographs and exposure to ionizing radiation has changed over the last few years. The current principles regarding radiographs in clinical orthodontics are well documented and presented in a publication by Isaacson and Thom.[2] They state that 'Radiographs are justified only when the management of a patient is dependent on the information obtained'. In the past, it was common practice to take initial radiographs, progress radiographs as well as post-treatment radiographs, this approach must change in view of their recommendations.

Pearl: Due consideration for patient safety dictates: 'No patient should be expected to receive additional radiation dose and risk as part of a course of dental treatment unless there is likely to be a benefit in terms of improved management of the patient'.

While there is general agreement on the need for initial radiographs taken at the start of treatment, the need for progress and final radiographs may be questioned. If you need clarification or confirmation of root angulations or the degree of torque achieved or any aspect of treatment that cannot be clinically visualized, then taking radiographs prior to the removal of appliances could be justified. Taking final radiographs following the removal of appliances cannot, in most cases, be considered as being of benefit for the patient.

Dental Panoramic Tomogram (DPT)

Good quality panoramic radiographs give excellent views of the dental and skeletal structures extending from the left to the right mandibular condyle. Areas of the radiograph where the clarity of the image may be suspect usually occur in the maxillary and mandibular incisor regions. The clarity of this region is dependent on the quality of the equipment and the accuracy of positioning the dental arches within the focal trough of the machine. Reference to the specifications related to your x-ray machine should be read in conjunction with information provided by many textbooks on dental radiography.

Occlusal Radiographs

Structures, such as supernumerary teeth occurring in the incisor region, are often palatally displaced and consequently out of the focal trough of a DPT machine resulting in an indistinct unidentifiable opacity. For this reason, some clinicians maintain that for all patients receiving their first orthodontic radiographic examination, occlusal or peri-apical radiographs of the anterior teeth should be taken to supplement the DPT radiograph. Using an occlusal film folded in half and placed between the incisors, it is possible to expose both upper and lower teeth without removing the film from the mouth. This view gives a good image of the roots and supporting alveolar bone in the incisor region but a limited view of the palate.

Bitewing Radiographs

These may be considered essential for certain caries-prone patients and they are also useful for assessing alveolar bone levels. Conventional bitewing radiographs can be supplemented by the vertical bitewing view when clinical examination suggests excessive alveolar bone loss. These views are more relevant and essential for adult patients particularly those presenting with mutilated dentitions.

Pearl: The accuracy, reliability and clinical usefulness of intra-oral radiographs are greatly enhanced by the use of film-positioning devices.

Radiographic Techniques for Locating Impacted Teeth

Locating the position of unerupted and impacted teeth is an essential component of diagnosis and treatment planning. Of particular concern is the labio-lingual position of impacted teeth in relation to the roots of the adjacent teeth. There are many radiographic views available for such diagnosis and these are well described by Becker.[3–5] The most frequently used technique is the 'parallax method' where two peri-apical views of the same subject are taken from two different angles. The tooth furthest from the tube will appear to move in the same direction as the x-ray tube.

Computerized tomography (CT) scanning can also be used for identifying the exact position of an impacted tooth; unfortunately, the high radiation dose and high cost discourage the common use of this technique.

Palatally Displaced Canine

Luc Dermut

On a panoramic radiograph, a unilateral palatally displaced canine will appear enlarged compared to the contralateral canine. This enlargement is due to the fact that canine-film distance is larger for a palatally positioned canine than for a normally positioned canine since the film is in front of the teeth and the x-ray source behind the head. This results in a larger image of a canine in the palatal position.

Lateral Skull Radiographs / Cephalographs

Lateral skull radiographs routinely taken in a standard cephalostat are considered a standard requirement of any comprehensive orthodontic examination. A good quality film should show clearly all the dental and skeletal elements of the craniofacial structures. There are a number of auxiliary components either built into the cephalometer or placed on the cassette that will also allow visualization of the soft tissue profile. Accurate positioning of the head is essential and this may be gauged by the concentricity of the ear rod rings.

A lateral skull radiograph without a corresponding cephalometric tracing and analysis is of limited value. There are many analyses available to the contemporary clinician and with time and experience; each individual tends to favour a particular analysis that suits his or her requirements. Since its inception, lateral skull radiographs have been traced using conventional light boxes and acetate tracing paper, however, once again with the development of digital technology, radiographs may now be digitized either on a digitizing tablet or directly on a computer screen. There are numerous software packages which provide facilities for computerized drawings, different analyses, automatic angular and linear measurements, comparisons of values with standard norms, superimpositions, visual treatment projections, as well as orthognathic surgical projections and visualizations. The visual treatment objective (VTO) is an important tool often used by orthodontists to predict treatment and growth changes that will take place in the growing patient. The early workers in this field were Magness,[6] Rickets,[7,8] Holdaway,[9,10] and Jacobson and Sadowsky.[11] How much dependence each clinician places on the analysis is a matter of personal choice, but crucial to any evaluation of whatever analysis is used, is the accuracy and reliability of the original landmark identification.

Lateral Cephalometric Measurements—How Accurate?

Alec Jacobson

Lateral cephalometric measurements are often used to measure growth and/or treatment changes in patients. Lines connecting specific anatomical points many times are used as baselines from which angular and metrical measurements are made. Two such popular parameters are Frankfort Horizontal and the linear distance from Condylion to Gnathion, which is a measure of effective length of the mandible.

To test the accuracy of landmark identification, three faculty members were asked to select from their private practices two of their best lateral cephalometric radiographs. Of these, three were finally selected as being the best. Three crosses were scratched through the emulsion of each of the selected radiographs for purposes of accurate superimposition. Eight experienced clinicians were asked to identify specific landmarks. To ensure consistency, definitions of the landmarks were provided. A dot pencilled on to the acetate paper was used to identify each

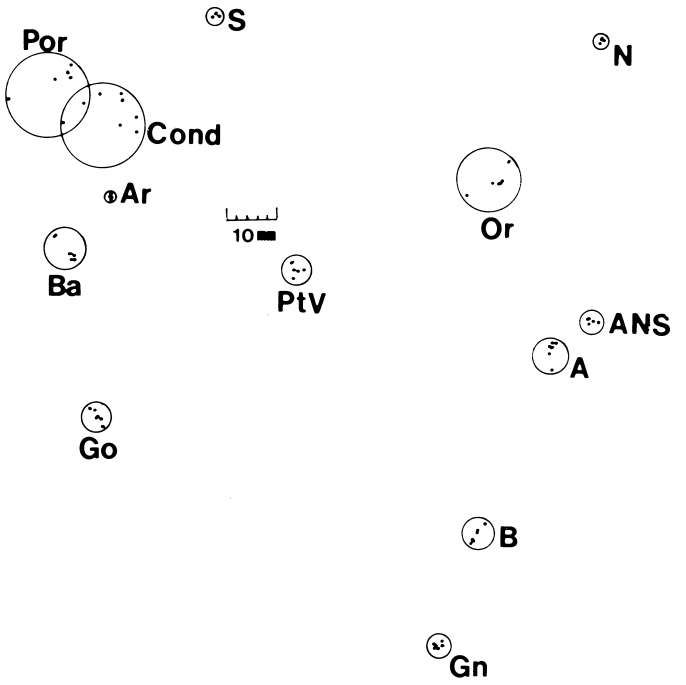

Figure 3.3

A scatter diagram showing the distribution of dots representing certain cephalometric landmarks. The smaller the circle the more readily identifiable and more accurate the localization of the landmark. A = A Point, ANS = Anterior nasal spine, Ar = Articulare, B = B Point, Ba = Basion, Cond = Condylion, Gn = Gnathion, Go = Gonion, N = Nasion, Or = Orbitale, Por = Porion, PTV = Pterygo-maxillary fissure, posterior convexity, S = Sella.

landmark. On completion, the eight tracings were placed on top of each other on a transilluminating table with the three crosses accurately superimposed. The dots representing the specific landmarks were scattered in the vicinity of each landmark. The smallest circle was drawn to encompass all the dots representing each landmark; the smaller the circle, the more readily identifiable the landmark[12] (Figure 3.3). Sella, Nasion and Articulare were shown to be relatively easy landmarks to identify (the latter, however, not being an anatomical landmark).

Pearl: The larger circles embracing the cluster of pencil dots in the region of landmarks Porion, Condylion and Orbitale suggest an inability to accurately pinpoint these anatomic points.

Linear measurement considerations

The images of anatomic structures closer to the anode and furthest from the central ray are magnified more than those closer to the film and central ray. Consequently, the different film images of the left and right craniofacial landmarks. This poses a question; in measuring the effective length of the mandible (Condylion to Gnathion), does one register left or right condylion, or a point midway between them? What in fact is measured is an oblique line, Condylion being a lateral landmark and Gnathion a midsagittal point.

Additional factors that can cause lateral anatomic landmarks to be spaced are ear rods of the cephalometer not properly inserted into the external auditory meatii, and lack of symmetry of the auditory meatii in the skull, both antero-posteriorly and vertically. All the above, and including sample size are factors that warrant consideration when interpreting data gleaned from serial head film tracings. How accurate are our tracings?

Pearl: Possibly best summed up in the words of Nobel Prize winner in physics, Richard L Feynmann who stated: 'Scientific knowledge is a body of statements with varying degrees of certainty—some most unsure, some nearly sure, none absolutely certain'.

CEPHALOMETRIC TRACING

Demetri Patrikios

Basic Principles

Over the years, I have tried many methods and analyses before finally settling on a few principles that I now wish to share with colleagues. These principles have been tried and tested until they satisfied my desire to be as accurate as possible and at the same time they allow the operator to develop a more complete appreciation of the malocclusion.

The term 'cephalometric' comes from two Greek words meaning 'head' and 'measurement' and the procedure is nothing more or less than that.

When measuring and evaluating the bony and soft tissue relationships, we need to consider *all* the measurements and their interactions with one another. To base a treatment plan on the angle of one or two measurements exclusively, such as the lower incisor to the mandibular plane or the antero-posterior (APO) line (as I have seen done many times), is not cephalometrics since the rest of the head is not involved. All hard and soft tissue measurements need to be integrated and understood to even begin to suggest a line of treatment. Of course, many other factors are involved, but my comments will be confined to cephalometrics.

It is infinitely more valuable to the treatment planning process if the orthodontist personally does the tracings. I have found that when I am presented with a set of measurements that someone else has done or computer-generated measurements, I lack the intimate contact and understanding that comes with tracing and measuring the films myself. In doing the latter, a depth of feeling for a particular case develops that goes beyond the measurements and this feeling allows you to understand, evaluate and possibly adjust the measurements with due regard to the extremes of normal ranges. Using a computer is mathematically accurate, but it cannot compete with the 'computer between your temples' when the fine nuances of heredity, presenting morphology and psychological make-up of the patient need to be evaluated to help you decide on the correct line of treatment.

When tracing and measuring a cephalometric radiograph, the latter needs to have certain essential characteristics if your tracing is to be accurate, meaningful and capable of scientific comparison with subsequent films. The characteristics can be listed as follows:

- Anode to midsagittal plane distance of 1.5 m (5 feet).
- Film as close to the patient as the cephalostat will allow. This will reduce magnification to about 7% or 8%.
- Place the horizontal edge of the film cassette parallel to the floor. I prefer this to be in landscape mode, this view includes more of the head in the antero-posterior dimension.
- The patient's teeth must be in centric occlusion. If the ear rods of the cephalostat are pushed too far into the soft tissue external acoustic meatus, when the teeth are brought into occlusion the condyle presses against the ear rods and this may be painful; consequently, the patient will simply not keep the teeth in centric occlusion. To make sure the patient is comfortable, place the ear rods in the ear and then back them off a little.
- The patient's head must be orientated so that the Frankfort horizontal plane is parallel to the floor. For this purpose most cephalostats have a pointer that can be placed on orbitale. This pointer should be mounted in such a way so that if a horizontal line is drawn it will be tangent to the top of the ring around the ear rod of the same side (effectively cephalometric porion) and this should in turn be parallel to the floor. This is very important in order that the head and profile are always orientated in the same relationship to the film edge. This aids in tracing and later comparison with subsequent films.
- The lips should be closed gently without undue pressure. This allows for the measurement of lip strain and its incorporation in treatment planning with the intention of normalization of the lip relationships without undue strain.[13] I am aware that some clinicians prefer to have the patient relax their lips.

- Now, the problem of exposure of the radiographic film arises. What we require is a clear film allowing us to trace both the hard and soft tissues with equal ease. The roentgenographic problem is that it is virtually impossible to get both the hard and soft tissues clearly defined on the same film. The drape of the soft tissues cannot be appreciated on the average film even though some of the soft tissue outline may be discerned. When one can see the drape of the soft tissue well, the bone appears too light (under-exposed) and cannot be traced accurately. A film that is in between both is equally frustrating as point 'A' is almost impossible to visualize.

Numerous ways have been used to try to overcome the above problem. Most are unsatisfactory. They include:

- Placing a barrier on the outside of the cassette in the region where the soft tissue profile will be recorded to reduce the exposure in this area.
- Placing paper over the same area within the cassette to reduce the effect of the intensifying screen.
- A special cassette can be used which has been manufactured in such a way that it limits the x-ray penetration in the area of the soft tissue profile.
- Partial collimation of the x-ray beam as it leaves the generator.
- An exposure may be worked out to give some appreciation of the soft tissue profile while not completely underexposing the bone. This is trying to get the best of both worlds and achieves neither.

Pearl: The answer to the above problem is simply to use two x-ray films with one exposure. One film is placed between the intensifying screens in the cassette. This film will show up all the bony areas satisfactorily when exposed correctly. The second film is placed outside one of the intensifying screens so that the latter has no intensifying effect on this film when the exposure takes place.

This will record the soft tissue nicely, since the exposure is low. The drape of the soft tissues can also be visually appreciated. For those who are concerned about economics, the film that is used 'outside' the intensifying screens can be halved, as it only has to record the soft tissue profile. To ensure that the half film is placed in the correct position, mark the cassette on the outside to easily identify the orientation. Of course, in order to use this technique, one of the intensifying screens must be loose with the sticky back on it removed. I have always placed this latter film in such a way so that the x-ray beam will strike the film between the intensifying screens first and then pass through to the film, which is outside the intensifying screens.

The one criticism levelled at the above method has been that when tracing, the tracing paper has to be moved from one x-ray film to another. Usually on the soft tissue exposure there is a faint outline of the bone, which enables one to superimpose the tracing on to it once the main film has been traced. With practice this is no problem at all.

Tracing the Cephalometric Radiograph

The tracing film

The acetate tracing film supplied by orthodontic companies is thin and quite transparent. However, it is only coated on one side and as a consequence tends to curl up especially after the tracing has been done. The other disadvantage is that unless the pencil you are using is quite soft (at least HB or softer), it does not show up the drawn lines in a satisfactory manner. The tracing is therefore only seen well when placing a sheet of white paper under it. Furthermore, this acetate picks up marks from the natural oils of the skin. To overcome these problems, I visited drawing office supplies where a range of tracing film is available. The film is generally coated on both sides (and therefore stays completely flat) and comes in varying thickness and opacities. No smudging from fingers occurs, and a harder pencil can readily be used to obtain thin, clean, crisp lines. You can order any size you wish and it is usually cheaper than that obtained from orthodontic companies.

Tracing

We have all traced x-ray films and this is a relatively simple procedure. However, there are a few pointers that I have found useful:

- First, the x-ray film must be stuck down on to the tracing box screen square to your position as you sit. Ideally, the Frankfort plane is parallel to the edge of the radiograph. Use masking tape to secure the radiograph rather than 'sticky tape' as the former peels off more cleanly when removed. Stick down only the two corners away from you so that the radiograph can be lifted up from the bottom if so desired. The overlying tracing film should be similarly stuck down.
- With the radiograph in position and before placing the tracing paper in position, draw the Frankfort plane directly on to the radiograph. I use a blue pencil in order to clearly see this line once the tracing paper has been placed in position.
- At this stage, it is necessary to identify and mark true Porion. This is defined as the uppermost point on a circle representing the bony external acoustic meatus, which is located up and back from the ear rod Porion. To establish true Porion, I generally outline the articular eminence (found by looking directly below Sella Turcica) and the condylar fossa. Then using a Ricketts Dome tracing template I outline these and the corresponding bony external acoustic meatus, which is adjacent on the tracing template. Orbitale is easily identified and then the Frankfort plane can be drawn to true Porion. I do not use the ear rods as representing Porion.
- Now, the tracing film is placed over the radiograph in such a way as to have the long edge (the tracing film is used in landscape mode) parallel to the drawn Frankfort horizontal and covering the image adequately. The reason for this is that all films traced in this way will have the drawing of the head orientated in the same position on the tracing film. This makes comparison of subsequent tracings of a particular case much easier and the eye can pick up changes in the soft tissue profile more readily.
- To help with paralleling the tracing paper edge to the Frankfort horizontal, a W+G Douglas Combination Protractor and Parallel Rule is used. This instrument has many uses and I would not be without it (found in drawing office supplies). You can set the edge of the tracing film parallel to whatever line you wish and you can draw lines parallel to other lines or at right angles to chosen lines and measure angles. It is possible to measure angles between lines that do not meet on your tracing paper by placing one edge of the W+G protractor against a line while sliding a protractor at right angles along the adjacent edge of the W+G protractor until the appropriate point on the sliding protractor intersects the other line, then taking the 90 degree mark as zero, you need to read off the angle between the two lines.
- The tracing is now done in the usual way. I use an H pencil on the drafting film and when drawing lines, the pencil is simultaneously rotated in the fingers to keep the lines crisp and not to wear a 'flat' on to the pencil point. The pencil is sharpened at the beginning and at least once during tracing. I also use clutch pencils with different hardness lead inserts and also different colours.
- A good quality protractor is also a good investment. Tracing paper is harder than ordinary paper and tends to wear the markings on poor quality protractors rather quickly.
- When tracing I like to draw in the ala of the nose to visualize the nasal opening and to outline the vermilion border of upper and lower lips in the same way as Ricketts does. This imparts a 'human' quality to the tracing so that it does not look too sterile. I also include an outline of the back of the head (as far as possible) as this completes the picture and gives a proper perspective to the head you are viewing.
- As a general rule, the initial tracing is in black, the visual treatment objective (VTO) in red, progress in blue and the end of treatment tracing in red.

Should any reader require more comprehensive information on the Holdaway Soft Tissue Analysis and VTO, the author will be happy to provide details on the technique.

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4 ORTHODONTIC PHOTOGRAPHY

P Jonathan Sandler and Alison M Murray

Photographs are an essential component of comprehensive orthodontic investigations; they may be taken as conventional colour photographs, Polaroid photographs, colour slides or digital photographs.[1] Personal preference will dictate which of these formats you choose for your practice. Slides are invaluable for an individual who will use this material for lectures and teaching purposes, but unless they are projected, they are of limited value with regard to communication with the patient. Photographs on the other hand are excellent for patient communication but of limited value for lecture purposes. The advent of digital photography provides the clinician with the facility to use the material both for lecturing purposes as well as providing the facility to print a hard copy photograph for the patient to handle and appreciate.

Photographs are an invaluable aid at the start, during and at the end of treatment.

Treatment planning

When working out a treatment plan in the confines of your office, without the presence of the patient, it is not always possible for you to recall important features of each patient. Photographs assist you in recalling both intra- and extra-oral features relevant to different possible treatment plans.

Case discussions

When a patient, whether it is a child with his/her parents or an adult patient, sits down at the desk for a case discussion, they are immediately drawn to and fascinated by their photographs on the desk or on the computer screen. They have never seen their teeth from this aspect. At this session, photographs aid you in pointing out and explaining to the patient adverse tooth positions, gingival conditions, as well as relevant features of the patient's smile and profile. Remember, patients rarely see their own profile.

As an aid during treatment

Often during treatment and particularly as you get close to the end of treatment it is helpful for you to recall what the original malocclusion looked like (e.g. was the overbite very deep, was there a diastema etc.?). Instead of having to retrieve the study models, it is far easier to access the photographs from the file, or call them up on the computer screen.

Patient reminder

As an aid to remind patients what their teeth looked like before treatment. Patients have a short memory; they forget what their teeth were like before treatment. Showing the patient during treatment, what they looked like before and explaining just how far they have come in a comparatively short time encourages cooperation and is an excellent motivator.

Practice builder and marketing tool

At the end of treatment, when the patient is looking in the mirror and seeing his or her

teeth without appliances, showing them the original photographs boosts their feeling of satisfaction and appreciation for what you have done for them. Some practitioners make a point of presenting the patients with a 'before and after' set of photographs.

As a defence tool in medico-legal conflicts

Claims by patients or their parents that certain conditions, such as chipped incisal edges or decalcification marks or adverse gingival margins, were caused by treatment, can in many cases be refuted by showing the patient that this particular condition was present at the start of treatment. Such evidence can in many cases prevent a complaint progressing to a more serious level.

CAMERA REQUIREMENTS

The camera selected should require as few adjustments as possible, such as change of lenses or alteration to all the settings of the system between the different views, this makes it easier and encourages the photographer to use the camera more frequently. Whichever camera system is chosen, it will need to be calibrated by running a test film on a volunteer. Extra-, intra-oral and close-up views should be taken using a variety of settings to establish the optimal settings required to obtain high quality exposures.

Pearl: The camera to be used in a busy clinical situation should be kept easily accessible and capable of producing high quality images over and over again, with few or no camera adjustments required.

If conventional photography is to be used, the camera system recommended is: the Dental-Eye III, produced by Kyocera Yashica (Figure 4.1). The beauty of the Yashica Dental-Eye III is that, depending on the selected view, once the appropriate focal length has been set by moving the barrel to a predetermined position, only one further adjustment is required to the camera. This adjustment is to open up

Figure 4.1

Yashica Dental-Eye III camera.

the aperture by one full stop only for the occlusal mirror views (Figure 4.2). The reason for this is that the F stop chosen by the camera is determined by the distance of the camera to the subject. The 'subject' with the mirror views is the flat plane of the mirror, however, the light has to travel twice this distance and reflected light is rarely reflected 100%.

Figure 4.2

Dial for adjusting aperture: open one stop for occlusal mirror views. (J Sandler, A Murray. Recent developments in clinical photography. (*Br J Orthod* (1999) 26: 269–272. By permission of Oxford University Press.)

If digital photography is your choice, then the Fuji S2 Pro Finepix camera is a good option (Figure 4.3). With this digital camera the only adjustment that is required is to

Figure 4.3

Fuji S2 Pro Finepix camera plus a Nikon SB 29 Ring Flash.

change the F stop from 5.6 on the extra-oral views to F32 on the intra-oral views. In the current market, newer models of digital single lens reflex cameras are becoming available at reducing prices.

Pearl: The advantage of taking the intra-oral views at F32, whether you use a digital or conventional camera, is the enormous depth of field, which ensures that the maximum amount of the area of interest is in crisp focus (Figure 4.4).

Figure 4.4

Intra-oral view showing sharp images (depth of field) extending from the central incisors to the molar tubes. (J Sandler, A Murray. Manipulation of digital photographs. *J Orthod* (2002) 29: 189–194. By permission of Oxford University Press.)

OTHER CAMERA EQUIPMENT REQUIRED

Each orthodontist may take varying views. However, the basic minimum should include standardized extra-oral full face and profile views with the lips in relaxed pose, intra-oral front and two side views with the teeth in occlusion using good lip retraction.

Supplementary extra-oral photographs could include 45 degree lateral views and smiling views. For aesthetics and smile evaluation, a close-up view of the smile without the use of cheek retractors is useful. Remember, patients have never seen their teeth with their lips pulled to the side with retractors, they can relate more easily to a view showing their teeth smiling without retractors.

Pearl: The most important piece of equipment for securing high quality clinical views once the correct camera has been selected is the cheek retractors (Figure 4.5).

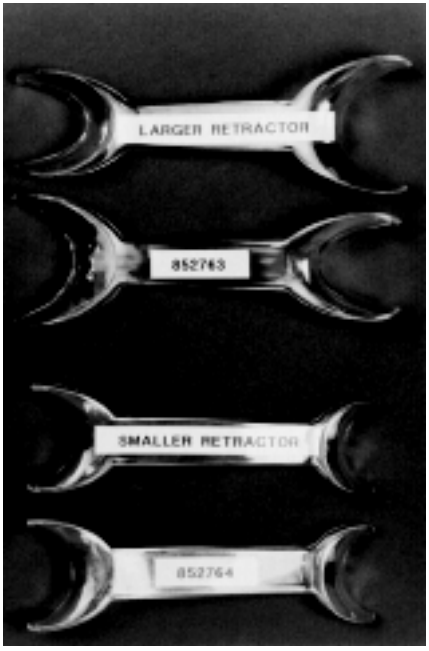


Figure 4.5

Range of double-ended cheek retractors. (By permission of *J Clin Orthod*.)

Figure 4.6

The extent to which the lips need to be retracted for front intra-oral views. (J Sandler, A Murray. Recent developments in clinical photography. *Br J Orthod* (1999) 26: 269–272. By permission of Oxford University Press.)

It is necessary to have two sizes of double-ended cheek retractors, for the front intra-oral view the large end of the larger retractor is appropriate in 95% of cases (Figure 4.6). The only cases that will not be able to tolerate the large end of the larger retractor are very small children or patients with markedly reduced lower facial height (Figure 4.7). These two groups of patients find it impossible to close in centric relation with the large end of the large retractors in place. It is extremely important to instruct the person doing the retraction to pull the retractors not only laterally but also forwards away from the patient to allow them to close up comfortably. Any attempt to pull the retractors backwards towards the person doing the retraction will mean that the patient cannot close on the retractors due to impingement of the alveolus on the edge of the plastic retractors. For those few exceptional patients, who cannot tolerate the large end of the larger retractor, use the large end of the smaller retractor for the front shot.

For buccal views, on the side of interest, the large retractor is turned to 180 degrees to utilize its smaller end maximizing the amount of horizontal retraction and cutting down on the amount of vertical retraction of the soft tissues. On the side that is not being photographed, the large end of the larger retractor is left in place (Figure 4.8). For the occlusal views the small end of the smaller retractor is used to pull the lips laterally, upwards away from the teeth and also outwards. Special lip retractors to hold the lip away for occlusal views are commercially

Figure 4.7

For small children reduce the size of the lip retractors.

Figure 4.8

For the best view of the right buccal region, use the small end of the retractor for maximum horizontal retraction while retaining the large end of the retractor on the left side for maximum vertical retraction. (By permission of *J Clin Orthod*.)

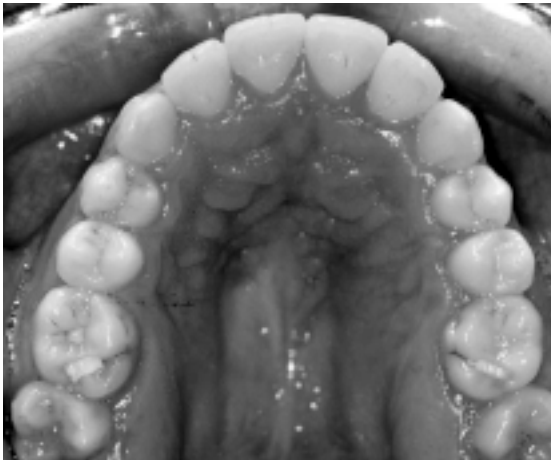


Figure 4.9

Example of a good occlusal photograph. The view should extend from the central incisors to the second molar teeth.

available and Pappel describes a technique for constructing your own retractors. An example of a good occlusal photograph is shown in Figure 4.9.[2]

Dental Mirrors

The next most important piece of equipment is the mirror chosen to record the dental views. Intra-oral photographic mouth mirrors are essential for occlusal views of the maxillary and mandibular arches and may also be used to improve views of the buccal occlusion. The mirror recommended for both maxillary and mandibular occlusal views is the long-handled 'mirror C' produced by Filtrop (Forestadent, UK). The advantage of this mirror is its size, which allows recording of the entire dental arch in almost every patient (Figure 4.10). Very occasionally, with small children or adults with tiny mouths, the smaller occlusal mirror is required, however, this would perhaps only be appropriate for fewer than 5% of patients. Another advantage of the long-handled mirror is that while setting up the shot the patient can hold the long handle. Then, just before the photographer takes the image, the handle can be grasped by the photographer, to allow him or her to

Figure 4.10

Warming a long-handled mouth mirror prior to placing it in the mouth.

Figure 4.11

Mouth mirror held by the patient. Just before taking the picture, the photographer should hold the mirror.

manipulate the mirror into the ideal position showing a perfect plan view of the teeth (Figure 4.11).

> **Pearl:** It is important to instruct patients to tilt the head back as far as possible when taking occlusal views and just before the photograph is taken ask them to 'open about twice as wide'.

This will ensure a true plan view in which the palatal surface of the upper incisors or the lingual surface of the lower incisors is recorded on the image. If the labial surface of the

incisor teeth can be seen then the patient has not opened the mouth sufficiently wide and further encouragement is required.

It must be remembered that the person doing the retraction has the most difficult job during orthodontic photography. They must be instructed carefully and given the information when the lips or soft tissues are impinging on the area of interest so that they may rectify this situation.

In certain patients, where it is not possible to obtain good buccal views of the occlusion, there are mirrors available which can be placed in the buccal vestibule. These act as cheek retractors and at the same time show a reflected view of the occlusion extending back as far as the first and in some cases the second molars.

Pearl: With all mirror shots, it is possible to reduce the problem of fogging by warming the mirror in hot water just prior to use in the mouth.

CONVENTIONAL 35 mm PHOTOGRAPHY

A feature of the Kyocera Yashica Dental-Eye III that has made it the most popular 35 mm camera for orthodontic photography is that it is significantly lighter than its predecessors and therefore can be held with ease with one hand. It is essential during orthodontic photography for high quality results, that the person doing the photography holds the retractor on the side of interest during buccal shots and holds the mirror during the occlusal shots. The reason for this is that the person holding the camera is the only one who knows exactly when the photograph will be taken. An additional 4–5 mm of retraction can be achieved by increasing retraction immediately before the photograph is taken. This allows the true relationship of the first molars and sometimes the second molars to be recorded without prolonged discomfort for the patients (Figure 4.12). The mirror position during the occlusal shots can also be adjusted at the last moment, or the patient can be asked to open momentarily that little bit wider to secure a high quality photograph.

Figure 4.12

Good retraction provides a view of the true relationship of the buccal teeth extending from the central incisors to the first molars.

The graticule on the viewfinder means that the inter-pupillary line, the Frankfort plane and the occlusal plane can all be lined up perfectly to achieve excellent symmetry. The sometimes amusing but frequently distracting photographs showing occlusal plane 'all over the place' is now a thing of the past for people who use the Dental-Eye III. Another very useful addition is the 2× multiplier which can be screwed into the end of the lens, thus allowing the excellent close-up shots to detail particular orthodontic techniques or perhaps record areas of particular interest (Figure 4.13).

There are many other single lens reflex cameras on the market, which may be a little more complex to use, but which can still produce excellent results.

DIGITAL PHOTOGRAPHY

As far as the digital camera is concerned it offers a number of advantages over conventional photography. Initially, when digital cameras came on the market the issue of mediocre quality was first and foremost. A conventional 35 mm slide is believed to hold the equivalent of 25 million pixels, whereas

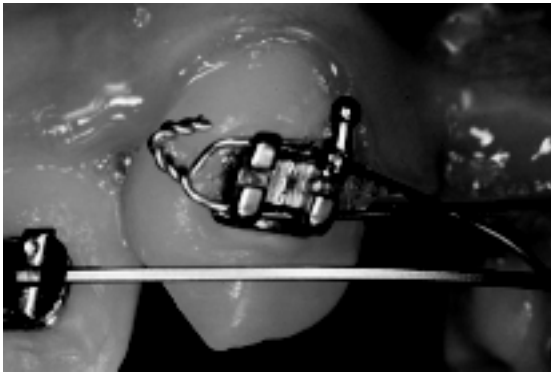


Figure 4.13

Magnified view provided by the addition of a 2× multiplier. (J Sandler, A Murray. Recent developments in clinical photography. *Br J Orthod* (1999) 26: 269–272. By permission of Oxford University Press.)

the original charged couple devices (CCDs) only recorded about 1 million pixels. Currently, many mega pixel cameras are available, and it is common to record 3 million pixels on an image. For most orthodontic uses this provides more than enough information to allow a high quality image to be recorded.

Pearl: A major advantage of the digital camera is the ability to view the image immediately.

This gives the photographer instant feedback as to whether the area of interest has been recorded and whether a high quality picture has been taken. The image can be discarded if not of sufficient quality and the instant feedback on the image enables the photographer to improve on the second attempt. With the particular system recommended the high quality Nikon flash is sufficiently powerful to allow photographs to be secured at very small apertures of F32. This ensures that the area of interest extending from the labial surface of the upper incisors almost to the buccal tubes on the molars will be in crisp focus. The Fuji S2 Pro Finepix is also a single lens reflex camera so the image in the viewfinder represents exactly the image, which will be secured by the CCD.

The manual focusing system is used with this camera, which means that crisp images can be obtained provided the eyesight of the photographer is satisfactory. This is in contrast to the autofocus systems available on most digital cameras, which have proved to be very frustrating to use. Cameras with autofocus invariably find it very difficult to focus on the intra-oral views. In addition, with the cheaper cameras the pictures are almost always taken at F8, which reduces the depth of field and consequently a smaller area is in sharp focus.

Other advantages of digital photography are that there should be no ageing of the images. Storage of the images is no longer a problem and the images are very easily retrieved, duplicated and transmitted around the world at the touch of a button on the computer. In addition, there are no film purchasing or processing costs, as is the case with conventional systems. We predict that digital photography will take over from conventional photography in the next ten years, at least as far as orthodontics is concerned.

FLASH LIGHTING

Flash lighting is an essential component of clinical photography. The two options available are the ring flash and the point flash. These are either an integral part of the camera or an additional item. The ring flash provides good lighting to almost any area of the mouth. However, it does eliminate shadows and certain intra-oral views appear flat and lose their sense of depth. By contrast with a point flash intra-oral views have a feeling of depth where the three-dimensional perspective of the teeth and surrounding tissues can be visually appreciated. If a point flash is used for the buccal shots, it is essential to avoid the flash throwing a shadow of the cheek over the buccal teeth. To avoid this problem, the flash should be positioned on the left of the camera (photographer's left) for the patient's left buccal view and on the right of the cameras for the patient's right buccal view. If the flash is fixed on one side, then the camera should be inverted (turned upside down) for the contralateral view.

It is possible to purchase a ring flash which is divided into four quadrants, each quadrant has its own covering screen which allows the operator to vary the lighting effect from that of a full ring source to a point source which in turn may be directed from any of the quadrants (Nikon).

IMPROVING IMAGE QUALITY

Use of an aspirator

If a few seconds are used to remove saliva from the field of view a much better quality of image will be obtained. Any clinical photographer should therefore ensure photographs are taken in a chair, which has an aspirator on hand. This will prevent the all too frequently seen photographs, which appear as if the patient has just had a 'liquid soap' mouthrinse (Figure 4.14).

Figure 4.14

Intra-oral view spoilt by the presence of excess saliva.

Timing of photographs

The photographs should be taken before any other clinical records are taken, particularly study models. Alginate in the embrasures between the teeth or smeared over the patient's face significantly detracts from the overall quality of image obtained (Figure 4.15). Also, patients occasionally find it slightly uncomfortable to have their lips retracted during the intra-oral photography and if the extra-oral photography is done before the intra-oral photography there is a better chance of getting a smile out of a patient!

Figure 4.15

Traces of alginate on the face detract from the quality of the facial photograph.

Tongue retraction

During intra-oral views if the tongue is retracted from the field of view a black background is obtained. This contrasts nicely with the white enamel of the teeth and therefore gives a better quality image than if the tongue is pressed up between the teeth (Figure 4.16). Patients who press their tongue up behind the teeth also tend to squeeze saliva between the

Figure 4.16

The tongue is retracted away from the teeth just prior to taking the photograph. (By permission of *J Clin Orthod*.)

teeth, which once again detracts from the quality of the image obtained.

Image reproducibility

Consistency in image size is important particularly when projecting start and finish views next to each other. It is therefore important, particularly with 35 mm photography, to use a constant magnification for intra-oral views, mirror views and extra-oral views. This is easily achieved using standard lens positions (Figure 4.17). An attempt should be made to get the patient to position the head routinely in one position; therefore the Frankfort plane should be horizontal for extra-oral views or an attempt made to photograph the patient in natural head position. This can be done by having a mirror on the surgery wall and asking the patient to look at the reflection of his or her own eyes in this mirror.

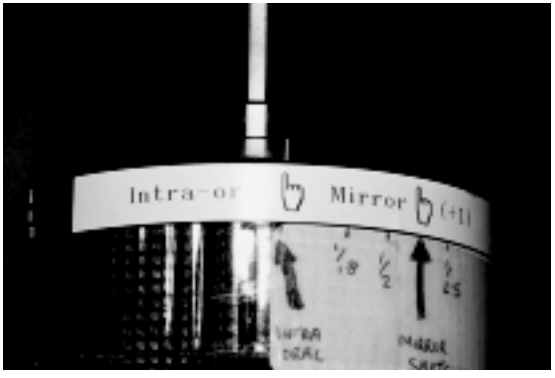


Figure 4.17

Mark the lens barrel to standardize the magnification for intra- and extra-oral views. (By permission of *J Clin Orthod*.)

File size of digital photographs

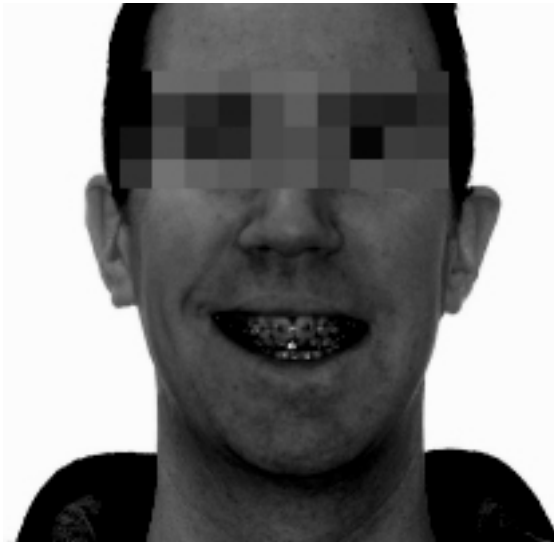
If the images are to be used merely to show a picture on the computer screen or to perhaps incorporate into a Powerpoint presentation, there is no point recording more pixels than the computer can actually display. There is little advantage recording many millions of pixels only to have to compress the image size into a Powerpoint slide. It is therefore necessary to experiment with a digital camera and record the smallest file size possible that will still provide a satisfactory output. The only reason for recording a very high number of pixels would be if the image were to be used in a subsequent publication in which case it is recommended that the image is stored as a Tiff file.[3] This uncompressed image will then allow the maximum quality image to be reproduced on high quality photographic paper when required.

Avoid noise in the photographs

A reasonably neutral background should be chosen, either a dark colour to reduce the amount of shadow or an illuminated screen behind the patient to completely eliminate shadowing. Any extraneous items within the background will only serve to distract the viewer and the patient should be moved to another area if appropriate (Figure 4.18a, b).

Never trust the last slide

Because of the way in which slides and prints are processed, there is a high likelihood that the last slide on the film will be overexposed. It will invariably be an important slide necessary for an examination, or presentation in the very near future. Once you have secured 36 images on a film it is probably worthwhile rewinding the film, as image 37 and certainly image 38 can never be relied on to not be spoilt during processing (Figure 4.19).



(a)

(b)

Figure 4.18

(a) Use a plain background for extra-oral views. (b) Extraneous items in the background detract from the quality of the photograph.

The final quality of your photographs is dependent on both the photographic technique and on the equipment. Critically evaluate the colour, the sharpness, the size, the view, the presence of shadows and the background. If the final product is not up to standard, then consult with either a colleague who knows the subject and is getting good results, or seek professional advice. This part of the clinical examination should run smoothly and can often be delegated. It is expedient to have a separate room apart from the surgery/operatory where photography can take place without disrupting the smooth running of the clinical work area.

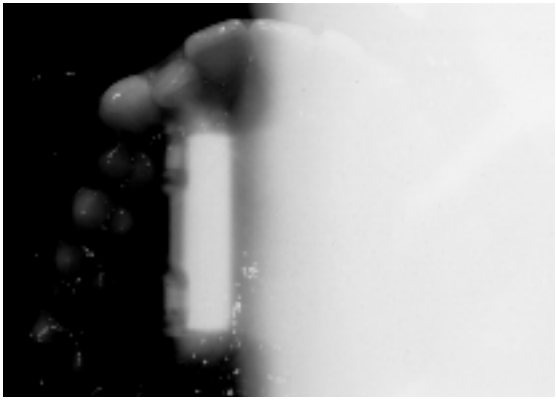


Figure 4.19

The last exposure on a film is often spoilt during processing.

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5 CASE DISCUSSION

The case discussion appointment is an extremely important session and I believe crucial to establishing the all-important correct relationship with the patient and, where applicable, the parent. It is your main opportunity to present yourself as the professional, an expert in your field who understands the patient's problems and is able to provide the relevant treatment. This session should not be rushed and it should be presented in the correct setting, with the correct decorum.

It is difficult to predict how long a case discussion appointment will last, some patients or parents have very little to say while others can keep asking questions and drag the discussion out for much longer than you expected.

Pearl: For this reason it is advisable to schedule the discussion appointment for the end of the day. If you start to run late at the end of the day, it is not too serious, there are no patients waiting, you do not get stressed and the patient does not get the feeling that they are being rushed.

PHYSICAL ENVIRONMENT

The case discussion with an adult patient or a child and parent should be held, if at all possible, in a consulting office away from the clinical surgical environment. The office plan should incorporate a desk or table allowing the patient to sit either opposite, or on the same side as the orthodontist, as an alternative, all participants sit at a round table. The idea is to make the arrangement as non-intimidating as possible for the patient. The room should be well lit either with artificial or natural light and the desk surface clean and uncluttered. Clutter on the desk will distract the attention of the patient. Close the door so that external noises and conversations do not distract from the case discussion and make sure no telephone calls are put through to you. Educational and promotional material, such as case photographs, charts, pamphlets and magazine articles, could be displayed on the walls of such an office. Depending on the system adopted by the practice, it is essential to have a viewing box and/or a computer screen easily accessible. The viewing box may be cut into the desktop.

Layout of Records

All the relevant records should be neatly set out on the desk prior to the patient being escorted into the office; do not start searching for records while the patient is sitting at the desk. The photographs should be laid out in front, closest to the patient, next in line place the study models; the radiographs should be clipped to the viewing box but the light should be off at this stage. If you are using digital records, make sure the relevant programs are up and running but the screen should be off until you are ready to discuss the relevant material on screen. The patient should not be distracted from your discussion, they need to concentrate on what you are saying and describing. Some practitioners will leave the patient alone for a few minutes before entering the discussion office. This gives the patient an opportunity to look at their records before the clinician begins the presentation.

CASE DISCUSSION DIALOGUE

At the outset, it is important to realize that in general, patients and/or parents have little or no clinical background, what you are going to explain to them is new and strange, therefore, it is essential to talk in terms that they can understand rather than confuse them with clinical or anatomical terms. However, it is important not to talk down to the patient. Today, many patients may carry out a prior search on the Internet and have a surprising amount of information on the subject.

When the patient sits at the desk his or her attention is immediately drawn to the photographs, this is something they can recognize and relate to and this is where you should start your discussion. Remind the patient of their original 'main complaint' and relate this to the relevant features portrayed in the photographs. Comment on the smile displayed on the extra-oral photographs, then move on to the intra-oral pictures, remember they have never seen their teeth with the lips retracted. Show them relevant features on the photographs, such as crowding, spacing, irregularities, chipped edges, and discoloration, and do not forget the soft tissues, such as swollen gums and possible areas of plaque accumulation.

Next, move on to the study models, if they wish, let them hold the models for a short time. When the patient or parent has finished examining the models, place them on the desk and start explaining the relevant features of the models in a logical sequence. Using a pointer or a pen, discuss the lower model first, identify the permanent teeth and the deciduous teeth, show them the spacing or crowding or rotations or whatever other condition exists. Then do the same for the upper model. Now, place the models in occlusion and point out the excessive protrusion or retrusion of the incisor teeth, the deep bite, show them where the lower incisors are impinging on the palate, show them the crossbite of the molar teeth, explaining all the time what the correct or normal situation should be.

From the study models move onto the radiographs; now switch on the viewing box or the computer screen, a panoramic (DPT) radiograph should be in position. Identify the lower and upper jaws; point out the deciduous teeth, unerupted teeth, and any other relevant features, such as obvious crowding or impactions. In the case of adult patients, take time to explain the possible loss of alveolar bone, and associated periodontal conditions. You should remember that it is difficult for a layperson to understand the concept of radiographs and to understand what they are seeing even when it is explained to them.

Next, clip up the lateral skull radiograph, this never fails to draw their attention and make some impression. With the tracing flipped up off the radiograph, orientate the patient by identifying the main anatomical features. Once again start by identifying something they can relate to, point out the soft tissue profile, the forehead, nose, lips and chin. Next, point out the upper and lower jaws, and the upper and lower incisors highlighting any marked overjet that may be present. That should be sufficient information regarding the actual radiograph, now flip the tracing on to the viewing box or place a sheet of white paper between the tracing and the radiograph and place it on the desk in front of the patient. Explain to them that this is a tracing of their skull radiograph and not a random freehand drawing. Orientate the patient to the tracing by identifying the same profile and major features as you did for the radiograph. Now, using an analysis of your choice, explain to them in very simple terms, how you determined that the lower jaw is behind or in front of the upper jaw, how far the upper and lower incisors are out of position and what effect this has on the position of the lips and relate this to the fullness or flatness of the lips. Depending on your perception of how much the patient or parent understands, you may increase or decrease the detail of your presentation.

Pearl: Do not forget to keep asking the patient or parent if they understand what you are describing and ask if they wish you to repeat or explain any particular feature again.

The same approach and pattern of presentation may be used for computer-based data. Instead of the physical material laid out on the desk, all the same material will be presented on the computer screen. Computer-based data allow for the presentation of animated graphics. There are programs available that show teeth and facial structures moving from the original malocclusion to the final predicted position.

Treatment Plan

Having presented the patient and/or the parent with all the relevant information, summarize the problem and start to explain how you propose to treat it. Start by explaining and showing, with the help of models, what type of appliances will be necessary to correct their problem. Have sample models with both stainless steel and porcelain fixed appliances. In certain cases, particularly with adult patients, you may wish to show examples of lingual or invisible appliances. Follow this by explaining your treatment plan, if for example, the case presents with dental crowding, show them on their study model that the only way you can accommodate the teeth is by either expanding the incisors forward into a wider arc of a circle, or moving the molars back or extracting certain teeth. If the case requires extractions, explain and justify your reasoning for extractions so that they can understand. Explain that the lips and the incisor teeth are already too far forward as you had shown them on the models and tracing, and the only way you can reduce the crowding and improve the profile is by extracting certain teeth. Conversely if the lips are too flat explain why you are reluctant to extract teeth. If you need to use headgear, explain its action, and show them what it looks like and when you expect them to wear the headgear (Chapter 9).

Where relevant, explain to the patient or parent the need to consult with another specialist, such as a periodontist or a maxillofacial surgeon, assure them that this will be done with the prior approval of their general dentist.

Complete you discussion of the treatment plan by giving an estimate of the duration of treatment stressing that this is only an estimate and treatment duration can vary greatly, explain that it is dependent on many factors not least of which is patient cooperation.

Retention

Having completed the treatment plan component of the discussion, lead into the concept of retention by asking the patient: 'What happens when I remove the appliances from your teeth? Your teeth will be straight and beautiful, but teeth are not embedded in concrete, they are in bone, and they will move, they tend to want to move back to where they were, so we need to hold them in the new position'. Now, you explain the importance of retention and how it relates to their particular case. In certain adult cases where you know the end result will be unstable, it is necessary to explain the concept and the reasons for permanent fixed retention. Some clinicians include the cost of retainers in the overall treatment fee; others charge separately for retainers, you will decide which system suits you.

> **Pearl:** Whatever system you choose, it is important that you tell the patient and/or parent at this discussion whether or not there will be a separate charge for retainers at the end of treatment.

Costs

Having completed your explanation of the existing problem and how you propose to treat the case, it is now time to disclose the cost of treatment. Irrespective of how you originally calculated your fees, or whether you base them on the type of malocclusion or on the type of appliance used, you will find that, generally, clinicians have a range of fees to cover most malocclusions presenting for treatment. The level of your fees is inevitably

influenced by two major factors, first, the fees generally charged by colleagues in the surrounding areas, and second, by market forces as they impact on the socio-economic status of your patient base.

Pearl: If you ignore these two major influencing factors when determining your fees, irrespective of which end of the scale you aim for, the economics of your practice will suffer.

Having previously calculated the fee for this particular case, you now tell the patient or parent exactly what the fee will be. Also, that this fee is payable by means of an initial payment at the start of treatment of usually a third or a quarter of the total, and the balance by means of a monthly payment extending over approximately 18 months or whatever you believe will be the duration of treatment.

Pearl: It is important to explain that the monthly payment (or whatever instalment plan you choose) is not related to a monthly visit, it is only a means of paying for the treatment costs, and if you see the patient two or three times within one month or possibly once in six weeks, this has no bearing on the monthly payments.

Each clinician, to suit his or her own philosophy, often varies this scheme, some charge quarterly, some use a bankers stop order, some use a coupon or a series of post-dated cheques. Whatever system you choose, make sure it is efficient and works with the minimum of complications. Most importantly, it maintains your cash flow commensurate with the rate at which you are proceeding with treatment. Do not fall into the trap of routinely finishing your cases and finding that the patient still owes a large amount of money. This can happen occasionally, however, if it happens often, then your monthly payments are too low and your cash flow will suffer.

Pearl: Make sure that the patient or parent sees you reading the fees from the card; they should feel that you have calculated the fee and not just sucked some figure out of your thumb.

Compliance

Having explained everything about the case, now you need to tell the patient what you expect from them as far as cooperation is concerned. You need to clarify and stress, in layman terms, what you require regarding changes in eating habits, oral hygiene, appliance care and appointment scheduling (Chapter 7).

Side Effects

How much should you tell the patient and parent about the possible side effects and complications of orthodontic treatment? This subject still continues to be hotly debated.

Pearl: There is no question that where there is clinical or radiological evidence of an existing condition or a predisposition to the further development of a condition, these must be pointed out and the possible consequences explained to the patient or parent.

Conditions that fall into this category are: existing temporo-mandibular joint symptoms, evidence of root resorption, loss of alveolar bone, gingival and periodontal pathology, existing apical pathology and anticipated adverse growth patterns in either the sagittal, vertical or coronal planes. Where impacted teeth are present and surgical exposure or removal is anticipated, it is important to explain the possible complications related to root resorption of adjacent teeth and the risk of occasional ankylosis.

In the majority of cases where there is no evidence of any abnormal conditions I do not believe the majority of orthodontists list all the

possible complications at the case discussion. However, it is prudent to have all the possible risk factors listed in a document, which can be included in the correspondence to the patient with a request that this should be read prior to signing the consent form (see Appendix A).

Closure

Most patients or parents will not have contributed very much to the discussion up to now, and it is at this stage that you now invite them to ask as many questions as they like and the discussion becomes a two-way dialogue. Once the questions have stopped and the patient understands what the case and the treatment is all about, you need to explain what the next procedures will be. Tell them you will be sending them a written report that will briefly summarize the salient points of the discussion, the costs will be detailed and you will include a consent form that needs to be signed and returned before commencement of treatment. Inform them that you will also be sending their dentist a report on the case. Explain the appointment scheduling you require for placing separators and fitting the appliance. If there are extractions to be done, inform them that their dentist will carry out this procedure as well as any other general dental work and they must arrange the necessary appointments prior to the fitting of appliances. Some patients will leave your office and immediately arrange the necessary appointments at the reception desk while others will prefer to go home to think over all you have told them, others will want to discuss the issues, particularly the financial issues, with their spouse or partner, while others will wish to receive your written report before taking a final decision.

Pearl: I believe that one should never try to pressurize or talk the patient or parent into making the next appointment.

The following questions now arise. Do you keep track of those cases that do not make an immediate appointment for fitting appliances? Do you follow them up with an enquiry after a few weeks? Or, do you adopt the attitude that if they want treatment they will contact you and if they do not want treatment there is no point in pursuing them? Your response to these questions will depend on your marketing and practice philosophy, I tend not to follow up on these cases, I believe that if the patient or parent is sufficiently motivated and is happy with my approach and my practice, they will proceed with treatment, but I do understand the thinking of those who are concerned and who do follow up on such cases.

CORRESPONDENCE

Pearl: It is essential to promptly follow the case discussion with the necessary correspondence. Both the patient and the referring dentist were informed that they would receive reports, the patient at the case discussion and the dentist in the original letter of acknowledgement.

I assume that most orthodontic practices have a word processing or some orthodontic management software package. The framework of letters for most case scenarios can be stored; using a Dictaphone or even a small tape recorder, pre-formatted paragraphs can be identified, and the information specific to a patient can be entered. How much detail you wish to provide in these reports, is a matter of personal preference. However, I believe that it is not necessary to provide too much detail. Most patients or parents will not understand clinical detail and most general dentists do not wish to wade through pages of orthodontic diagnostic and treatment detail. However, irrespective of your personal preferences, certain basic information must be conveyed to both parties.

Letter to the Patient/Parent (Appendix A)

- The letter confirms the discussion.
- Describe the skeletal pattern in layman terms: '. . . has an acceptable or protrusive

or retrusive lower jaw in relation to the upper jaw . . .'.
- The state of the dentition: mention conditions, such as crowding, spacing, protrusion, and any other relevant features.
- The proposed treatment plan, mentioning the type of orthodontic appliances, if necessary, the need or possible future need for extractions.
- Where relevant, the need to consult with another specialist.
- The approximate duration of active treatment.
- The importance of retention.
- The proposed costs including the method of payment.
- Other items, such as the need to continue visiting the general dentist, the need for cooperation.
- Currently, it is considered good practice to include, either as a separate enclosure or as part of the letter, a listing of the possible hazards and risks associated with orthodontic treatment.
- As confirmation of having read and understood your letter, a request for the patient or parent to sign and return an enclosed consent form.

Letter to the Referring Dentist

- Start this letter by thanking the dentist for his referral. (This is the second 'thank you'.)
- Briefly outline the essential clinical findings related to the skeletal, dental and soft tissue elements.
- List the features of your treatment plan.
- Your request for any procedures you wish the dentist to carry out including possible extractions and restorative work.
- Where necessary, inform the dentist of your intention or desire to refer the patient for a consultation with another specialist. You should be aware, either from past experience or by calling the dentist, of their attitude to further referral, some dentists prefer to do their own minor oral surgery or periodontal therapy.
- Confirmation that you would wish the dentist to continue to monitor the patient's general dental requirements throughout orthodontic treatment.

As mentioned previously, copies of all correspondence should be kept either as a hard copy or an electronic file.

There are a number of letters that form the correspondence inventory of an orthodontic practice; most are common to all practices with variations dependent on the type of practice, location and individual preferences of each clinician. L Jerrold and MB Romeo have compiled a manual covering virtually every type of letter you would need in the conventional running of your practice.[1] Several letters from the manual are presented in Appendix B. Examples of some letters used by Dr Kerr are presented in Appendix C.

RISK ASSESSMENT REGARDING ORTHODONTIC COMMUNICATIONS

Laurence Jerrold

Inter- and intra-office communications are a vital part of orthodontic practice and most practitioners often devote a good deal of attention to what these communiqués say.

Pearl: From a risk assessment perspective, while that may be important, what is often more critical is what is implied, as well as what is not said.

Exposure to risk, relative to orthodontic communications, occurs on a timeline that starts before the doctor–patient relationship is established, as a basis for establishing the relationship, during the relationship, and most certainly when terminating it. The next few pages will, it is hoped, provide today's orthodontist with some food for thought while making one's way around the smorgasbord of inter- and intra-office communications in clinical practice.

If we start at the beginning, when a patient first calls the office for an appointment, some practices, after thanking the patient for having

contacted them, will set up the initial consultation appointment and immediately mail a packet of material to the patient. One piece of information might be a brochure extolling the virtues of the doctor, staff and the office. This is a good marketing tool but may evoke some risk-management issues. A legal argument can be made that an office brochure is nothing more than an offer of one's services extended to the public for the purpose of soliciting them to accept these services based on the promises contained within the brochure. In other words if photographs, statements, innuendo, etc., regardless of the communication they appear in, form a material basis on which the patient accepts treatment, then it can be legally argued that liability may attach for breaching the expectations elucidated within the communication.

Consider the following statements, arguably able to be claimed as false and misleading, that were found in various office brochures collected over the years.

'Convenient flexible hours to suit your needs.'
'All insurance plans accepted for payment.'
'Available for emergencies 24 hours a day, 7 days a week.'
'Our treatment is quicker, less painful, and carries less risk.'
'We exceed all governmental rules and regulations regarding sterilization . . .'
'We promise to be prompt and respectful of your time.'

Consider also the following sentences derived from mission statements that once again can be construed to be promising far more than the doctor ever intended to deliver.

'We are dedicated to providing you with the highest quality of orthodontics available today.'
'Your total dental health is our highest concern and we will be in constant communication with your other health care providers during your treatment.'
'With the advances in technology that today's modern orthodontics has to offer, there is no reason that an ideal result cannot be achieved.'

Next, and this is no longer in the temporal context of pre-doctor–patient relationship, but is still within the timeframe of pre-treatment, consider the role that video imaging plays in creating a specific expectation on the part of the patient and whether or not this inducement of obtaining a specific result can create a promise on which a patient has a right to rely on. If this is so, then any result falling short of this promise may result in a breach of contract claim by the patient. This subjects the doctor to liability for the value of the contract; in other words, having to return the fee that the patient paid you for specific results that were not received as well as for any differences in fees charged by the subsequent treating practitioner whom the patient now hopes will be able to fulfil those lost expectations.

Finally, in another commonly encountered pre-treatment scenario, consider the promise made by the office's insurance coordinator, that a patient's insurance will cover the cost of treatment; a scenario most often encountered when providing services for temporo-mandibular dysfunction. If reimbursement is not forthcoming and the patient can successfully claim that he or she was induced to accept therapy based on this unfulfilled expectation, it is easy to ascribe liability for the breach of this promise to the doctor for the unanticipated financial loss suffered by the patient.

Let me now break down this issue into its legal elements. A statement (promise) is made in a communication. The doctor intends for the statement to be taken seriously and at face value. The patient, then relies on the statement, and accepts treatment from the doctor based on the expectation that the promise(s) will be fulfilled. As a result of relying on this promise, the patient suffers damages (the damages usually claimed are for additional financial expense, and/or increased treatment time resulting from having to go elsewhere to correct the breached promises that induced them to accept and undergo treatment with the first doctor). While the doctor may be afforded a chance to 'cure' (correct) the breach, at this point the doctor–patient relationship has often been strained to the point where it is often too uncomfortable for one of the parties to continue, given the personal service nature of orthodontic therapy.

Pearl: To sum up this area of exposure, in all of your communications, regardless of the form they take, make sure that they reflect precisely the 'promises' you intend to make; secure in the knowledge that you can indeed fulfil your part of the bargain and meet or exceed the patient's expectations based on these promises.

Another area of pre-patient contact exposure occurs when medical history forms are sent out prior to the patient's visit to be filled out by the patient at home. You review this when the patient arrives for their consultation appointment. While at first blush this may appear to be a time saver, there have already been a number of instances where the lack of verbal communication between doctor and patient has resulted in significant injury to a patient because medical history information was incorrectly transmitted to the form by the patient.

Pearl: The medical history should be obtained verbally, face to face, by the doctor and then reduced to writing, noting details of the conversation.

Another overlooked consideration occurs in communications sent by you to the referring dentist thanking him or her for referring the patient. Contained within this memo may be a statement outlining how you will work closely with him or her for the benefit of the patient, how responsibility for patient oversight will be shared, and so on. While there is no inherent problem with this, from a risk-management perspective, the only concern is that you are able to carry out the 'promises' you are making, particularly if the patient is aware of them (copied to the patient). Thus, this will create what might be construed as the patient becoming a third party beneficiary to the 'contract' made between you and the dentist to provide a certain and specific level of care to the patient.

The next point on our timeline is associated with the consultation visit. While an in-depth analysis on the issue of informed consent is beyond the scope of this section, there are some basic points and some tangential issues that need to be addressed. Relative to informed consent, regardless of the mechanism you use to transmit the 'material information required' thus enabling a patient to accept or reject the proposed treatment, this exchange of information must be documented. Most doctors use a pre-printed form that is either purchased from a proprietary source or one that is designed by the doctor. In either case, the same elements should be reflected in the document. It should contain a description of the patient's problem and the treatment plan recommended to correct it. It should also note any alternative plans and the general pros and cons associated with each. It should discuss the alternatives of no treatment and should ensure that the patient has had an opportunity to ask and have answered any questions pertaining to treatment. Finally, the cost of treatment, the time, any necessary secondary or follow-up treatment that may be necessary should be noted, and finally, the expected prognosis.

Pearl: Written documentation can take the form of a stock form, a personalized letter, a detailed chart entry, etc. Adequate content and documentation are the key issues.

Once this is completed, a synopsis letter is usually generated. This communiqué is often done twice, occasionally to the unfortunate chagrin of an orthodontist who is caught having painted the same picture using Rembrandt's strokes for one letter and aping Picasso's style in the other. The synopsis letter that is sent to the patient often paints a blue sky, noting that the patient's malocclusion is 'ABC' and that with good cooperation there is no reason not to expect 'XYZ' result. On the other hand, the synopsis letter that is sent to the dentist, notes that the patient's 'ABC' problem also carries with it concerns about the patient's periodontal support, the potential for root resorption, the need for post-treatment, etc. It is amazing how often the two letters seem to be about two different patients. If the case ever gets to trial, it is quite embarrassing to have to answer why the dentist was told one thing but that the same information was apparently withheld from the patient.

We often generate various referral letters or forms stemming from the consultation appointment, such as requests for periodontal evaluation and clearance, caries examination, extraction letters, medical clearance requests, etc. One area of risk exposure concerns sending out requests for clearance letters and then initiating treatment without obtaining the required clearance.

Pearl: It is crucial to keep copies of all interoffice communications and to track those outstanding necessitating either follow-up of their receipt and/or a specific response prior to beginning treatment.

Another area concerns financial communications. Usually referred to as the 'contract letter', this communiqué serves to commit to writing a patient's pecuniary responsibilities regarding treatment. Various countries and American states have specific laws that deal with consumer transactions. Usually, these statutes address such things as the interest rate charged, if any, and the amount of related finance charges, such as those for returned checks, late payments, and additional fees, as well as for such things as lost or excessive breakage of appliances. The general rule is, if a charge is not specified prior to the initiation of treatment it cannot be added on during treatment. Be extremely specific when drafting financial documents. This is also not a treatise on collection practices but be forewarned, abusive collection practices and harassments can occur, even inadvertently through the misuse of financial letters and forms as well as for unsavoury collection efforts practised on your behalf by collection agencies you hired.

Once the financial considerations of treatment have been dealt with one usually sends out or provides the patient with a letter thanking them for allowing you to move their teeth from point 'a' to point 'b'. Somewhere, either in this letter or in an accompanying memo, the patient's responsibilities are outlined. It is critical to follow the adage: 'Say what you mean or you will never mean what you say'. Be specific with what you want and do not want them to do, how often, and with whom. It should cover everything such as keeping appointments, following instructions, maintaining optimal home care, the need to periodically see their dentist, the responsibility of alerting you of any changes in their medical history, etc.

If you have progressed this far with the patient then a doctor–patient relationship has been formed. Invariably, there will be times, and patients, where for one reason or another you decide it is in your best interest to terminate the doctor–patient relationship. This is always best done in writing offering proof that you provided the patient with sufficient notice to seek substituted care, the reason you are taking this action, the need for the patient to continue with therapy and your unbridled willingness to provide them with help in seeking same and your availability to deal with any emergencies during the reasonable period of time you have allotted the patient to effect the transfer. You must also note that the patient's records will be available to them or any subsequent treating practitioner.

Assuming the patient is continuing to receive treatment in your practice, the next discussion on our timeline must centre itself around the most important of all documents, the patient's chart. What is important here is to realize that the purpose of the patient's dental record is to provide documentary evidence of:

- The evaluation and diagnosis of the patient's condition.
- The treatment plan chosen and the patient's informed consent to that effect.
- The treatment rendered including referrals and recommendations.
- The retention employed including post-treatment consultations.
- All communications with the patient, relevant third parties, and all other health care providers.
- In addition, the record provides data for continuing education, quality assurance, administrative functions, and billing.

Pearl: The key element supporting all risk-management efforts concerning the clinical chart is the concept of credibility.

There is a legal presumption at work here; if something was written it was said or done. The corollary is also true, if it was not written, it was not said or done. Acting on this assumption an administrative body, a jury, another doctor, whomever, can look at a patient's chart and recreate the clinical history and treatment, covering not only the 'what was done' but the 'who it was done by', the 'how it was done' and the 'why it was done' as well. Therefore, for credibility, chart entries must be done in ink, never pencil—the reason; ink cannot be erased and it can be date-tested if necessary. What about computer entries? No problem, as long as the software you use locks you out at 24:00 hours thus creating the indicia of credibility (believable impression) regarding being unable to access the chart sometime later to change an entry. You should also place the initials of the person who actually made the entry, if it wasn't you, next to it. Entries should be kept in chronological sequence and should never contain 'white outs' or 'black outs' that make certain words or lines unreadable. If they do, someone will always be wondering, what was the doctor trying to hide? A simple line through an erroneous entry accompanied by the word error will serve the same purpose but enhance credibility.

Pearl: All entries should be legible by anyone who needs to read them. This issue begs practitioners to refrain from using codes, hieroglyphics, or abbreviations known only to them and their staff.

One should keep records as if one were writing an audio- or videotape of the clinical session or the discussion with or about the patient. If our chart entries are not complete and credible, then the chances are likely that it is the patient who will be believed and not us if we are ever found to be at opposite sides of the legal bar.

Finally, one must remember that communication is an all-encompassing term. It includes laboratory prescription forms, insurance forms, letters to concurrent treating practitioners, relevant third parties, anyone and everyone with whom you may have contact pertaining to any aspect of the patient's treatment. All of these items must be maintained as part of the patient's record. Often, there will be statutory rules and regulations pertaining to just how long and in what format these records must be constructed and maintained but none the less, they are part and parcel of the great sea of inter- and intra-office communications.

Pearl: Remember, all of these communications are deemed to have been generated and completed at the behest of and under the doctor's direction. As such, you would be responsible for any omissions or errors contained therein even if incorrect information was placed in these documents by another's mistake or errors.

As is evident, communication is a two-edged sword. It can serve to protect your interests and those of the patient, but it can also wreak havoc if it is misused or data are completed incorrectly, whether intentionally or by accident. The smart money says to draft your own forms and letters, covering all points on our timeline, and then have them reviewed by a professional. In practice, make sure you know what is being sent out to whom and either proof-read it or trust others to make sure the information is correct.

As an aside, a great little idea is to form a focus group of present or past patients, bring them in over lunch, give them a small gift, ask them to review your office letters telling you what they think the letters say, how they would feel about receiving them, what they mean and what subliminal message they convey, etc.

Pearl: Always read your communications through the eyes of the person receiving the message.

REFERENCE

1. Jerrold L, Romeo MB. Orthodontic inter and intra office communication. A manual for risk management, practice management, patient management, and fiscal management. Personal document (1993). (This manual is available from Dr L Jerrold. See List of Contributors for the address.)

6 MARKETING AN ORTHODONTIC PRACTICE AND MANAGING A NEW PATIENT

Winston B Senior

Before describing a philosophy, which has facilitated the growth of a successful, all private orthodontic practice in a non-affluent area of Manchester, England, I believe it is relevant to present some of the general business principles I have learnt and applied. Much of what I have applied can be summed up in a statement made by Conrad Levinson in his book, *Guerrilla Marketing*.[1]

> 'Marketing is everything you do to promote your business, from the moment you conceive of it, to the point at which customers buy your product or service and begin to patronize your business on a regular basis. It is the name on the building. It is where you are located. It is how you answer the phone. It is the quality of the service you provide. It is how you conduct your consultations and it is who you are'.

Today's orthodontic graduates are taught high standards of therapy involving clinical care and diagnostics, as well as the theory and use of different mechanical techniques. These are core product skills vital to overall patient management.

Pearl: The management of a new patient calls for the clinician to use non-core product skills, the importance of which are seldom addressed at dental school.

The success or failure of a practice does not only depend on what happens in the practice. That is on *internal strategy* alone. The architecture, decor, staff and treatment are important but before these become relevant, the right type of patient needs to be attracted to beat a path to the front door of a private practice. This depends on *external strategy*; a discipline concerned with marketing activity outside the practice, either by professional associations (the American Association of Orthodontists is superb at this) or the practitioner himself.

Pearl: Marketing a practice can be regarded as a two-fold process comprised of external and internal strategies.

EXTERNAL STRATEGY

This should be directed both to potential patients in the general population and to professional colleagues considered as referral sources. It involves the application of non-clinical disciplines. A simple example of which is to stand back and try to view the practice building and garden objectively and ask yourself questions such as: Does it give a message of quality? Is parking adequate?

For a deeper understanding of non-core skills needed for the successful applications of external and internal strategies, one needs to turn to subjects researched and taught at business school, such as:

- *Segmentation*: Deciding which segment or section of the public you wish to treat.

- *Public relations*: Telling members of the public what you do and making them like you for doing it.
- *Marketing*: Presenting a favourable image of a product and making it desirable.

Segmentation

The principle of segmentation is graphically illustrated in Figure 6.1. Segmentation is particularly important to an external marketing strategy. It is important because no organization could possibly satisfy all sections of the population. Clearly, for a dentist seeking to provide private cosmetic dentistry, targeting older people in the lower socio-economic groups is unlikely to yield worthwhile results. A dentist wishing to practice a specific type of dentistry must identify the segment of society most likely to accept the type of treatment he or she has to offer and then plan an external strategy targeting the identified niche market. Likewise, patients seeking high-class cosmetic dentistry are unlikely to obtain satisfaction from every member of the dental fraternity. They must be alerted to the need to identify a segment of the dental profession likely to satisfy their needs.

Before considering how a dentist identifies a segment of society needing his particular specialist skills, it is worthwhile considering the factors that determine how a patient chooses a professional practice.

How a New Patient Chooses a Professional Practice

Three factors influencing this choice have been identified. These can be referred to as the 'Three Hierarchy of Needs':

1. *Accessibility*. How convenient is it to get to the practice? Is the practice near to home? Is there traffic or a parking problem? Are the office hours convenient?
2. *Affability*. Are there any adverse reports regarding the principal and/or staff in the practice?
3. *Ability*. Note that this lies third down the list. The reason given for the low status of *Ability* in the hierarchy is that, in the eyes of the man in the street, all professionals are perceived, unless otherwise proven, to be equal. They have a dress code in the case of dentist, technical equipment and uniformed staff. They all have a university qualification often seen as incomprehensible letters after their name. These are, understandably, taken as an acknowledgement that all dentists have attained, from a respectable authority, a 'state of the art' standard of ability, which is (assumed) to be frequently updated and will be used to their benefit without restriction of clinical freedom being placed by a third party health plan.

In most countries any qualified dentist is entitled to practice any branch of dentistry whether trained to speciality level or not. Consequently, the choosing of a dentist by the public to carry out a specialist service, such as

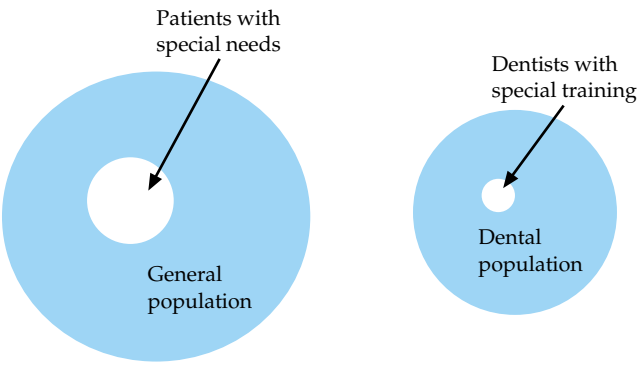

Figure 6.1

Segmentation. No dentist could deal with the whole population. They must attract a segment of society containing a specific type of patient. No patient with an orthodontic problem could obtain treatment from all members of the dental profession. They must seek out a segment of the profession trained to deal with their specific problem.

orthodontics, is more likely to be based on affability and accessibility rather than ability!

Pearl: A patient setting out to find a professional advisor does not know what he wants until he does not get it!

How a Specialist Orthodontist should Select and Attract his Patients

To identify and target a particular segment of the population, there are four fields that a clinician needs to evaluate. These have been described as:

1. Research
2. Activity
3. Communication
4. Evaluation.

Research

This section starts with the questions: 'What product is being marketed?' 'What socio-economic class of society would be likely to pay for the product?' 'What geographic area should be targeted?' It is essential for the clinician to consider these questions, research the subject and try to answer them before proceeding further.

Pearl: The question of the cost of the product is not a factor considered at this stage. When marketing a service to a chosen segment of society marketing the service by offering low fees can be counter-productive.

Theodore Levitt, head of marketing at Harvard Business School wrote in the *Harvard Business Review*, June 1981 an article entitled *'Marketing Tangible products and products Intangible'*.[2] Like most papers on marketing it highlights well-known but often not appreciated facts of life in a consumer society. He points out that there are two types of marketable products. Both have a visible and a non-visible component.

1. The Tangibles

These are those products that can be directly experienced; seen, touched, smelled or tasted as well as tested. Examples of these are refrigerators and cars, and in dentistry, orthodontic braces and dentures. These are commodities and the customer can compare and contrast these products before purchasing.

2. The Intangibles

These are such products as insurance, banking, education and health services. These cannot be compared or judged by the customer until the product is delivered and the results evaluated. Products such as these are more difficult for a potential purchaser, accustomed to purchasing commodities and not services, to appreciate. Consequently, a cost quotation for an intangible product, such as a comprehensive orthodontic service consisting of many invisible components, is more likely to be challenged.

Levitt points out that many individuals sell intangibles in the marketplace. The usefulness of the distinction between tangibles and intangibles becomes apparent when one considers the question of how the marketing of intangibles differs from the marketing of tangibles. The tangible product in orthodontics is easily identified by a patient, it is the appliance; it can be demonstrated photographically or on a model.

The full benefits and performance, that is, the intangible component of the appliance to correct dental irregularities unique to the patient, unlike the benefits and performance of a shiny new car or refrigerator, cannot be appreciated by the consumer until its effectiveness has been witnessed by the consumer (the patient). Therefore, before the product is put to use there is an element of intangibility.

Other intangible components of an orthodontist's service to the patient include technical training and retraining, time spent on treatment planning, record-keeping and the cost of laboratory bills. All of these are invisible to the patient but very necessary and expensive to the practice. Unless the patient appreciates these invisibles or intangibles, the fee quoted for orthodontic treatment, which

may seem to the patient to only involve the fitting of an orthodontic appliance, may be regarded with suspicion.

> **Pearl:** The intangible products are the largest and most expensive components of an orthodontic practice.

Following comprehensive research, strategies (both external and internal) have to be designed to make the patient aware that the provision of the orthodontist's tangible product, the appliance, constitutes only a small part of the service necessary to deliver a high standard of orthodontic care.

Activity

This involves planning and executing an approach based on answers to the research previously carried out. If, for example, research shows that the reputation of the district where the practice is situated is poor and likely to deteriorate, parking is difficult and it is unsafe to park or walk about during hours of darkness, it may be prudent, before capital is spent on expensive activities, to relocate.

When research has highlighted the segment of the population you wish to attract, a plan to satisfy the special needs of potential clients must be addressed. Examples of such actions would include special staff training on: 'How to make the client feel important'. Other actions might include a change in practice decor or determining where and how to direct advertising. If the practice is far away from the homes of the targeted population segment, external strategy in the form of improved or altered communication has to be designed to encourage referrals from practices far afield.

Communication

Telling people who you are, where you are, what you do and making them like you for doing it, is the communication component of public relations. This can be achieved through lecturing, writing articles in local newspapers, and advertising in *Yellow Pages* (a directory of local services) and/or a practice brochure. Which of these you select depends largely on your personality and your communication skills.

Lecturing to colleagues, parent/teacher groups, Rotary, etc. may be the vehicle of your choice. However, the results of such an approach need to be carefully evaluated. If this avenue is not effective, it may be due to poor lecturing technique. Lecturing does not suit everyone and everyone is not a born lecturer but training and observation of lecturing techniques can help.

Writing articles in local newspapers can be helpful and professionals can be employed for this. However, be aware that the wrong type of communication may result in the wrong type of person being attracted to a practice.

In the author's case, a practice brochure and *Yellow Pages* advertising have proved to be effective means of targeting the chosen segment. Other forms of advertising, such as a website and videotape promotion in medical centre waiting rooms, have not proved to be effective. *Yellow Pages* advertising is being used more widely. Although not always possible, a *Yellow Pages* advertisement should be sited in the top right-hand corner of a right-hand page. Advertising needs constant reinforcement to be effective.

> **Pearl:** Do not expect a great response to an advertisement in one publication of the *Yellow Pages*. Remember, although issued annually, many people keep an old copy of *Yellow Pages* for five years.

The author's brochure is designed to target a middle class segment of society interested in investing money and time to improve their appearance. It consists of two sides of an A4 sheet folded into three. This gives one outside column carrying the logo 'It's Never too Late to Create The Perfect Smile'. This logo is sited under a picture of a mature female. The logo is duplicated in the *Yellow Pages* advertisement. The other columns give a simple explanation of what the author's speciality is, how long the first visit will take and what will be done to assess the patient's particular needs. It is designed to highlight in simple language that:

- The practice is exclusively orthodontic.
- What the speciality of orthodontics is and what training is needed to become a specialist.
- The practice offers easy access and good parking.
- How a patient's specific needs are investigated.
- After consultation, full and comprehensive written reports will be sent to both the patient and their dentist.
- Treatment will be carried out in cooperation with the patient's dentist.

The message of both a *Yellow Pages* advertisement and a brochure should have a 3 second impact. Research has shown that unless this occurs, promotional literature is likely to be mentally or, in the case of a brochure, physically binned.

Pearl: A brochure should be designed to give a subliminal message that there is something more to treatment than fitting a brace. It should emphasize the benefits of the practice services to the patient and not, as many contemporary brochures do, lay too much emphasis on the qualifications and ability of the dentist. The patient will assume ability.

Evaluation

This endeavour, like the research, activity and communications steps, should be ongoing. The results of all the previously described external strategy steps can be continually evaluated by looking at the following parameters:

- How many patients are contacting the practice.
- How many are making consultation appointments.
- How many are having treatment.
- How many patients are satisfied with the tangible and intangible products received.
- How many patients would recommend their friends to the practice.

A post-treatment questionnaire given at the end of active treatment in a stamped addressed envelope is used in the author's practice.

The research, activity, communication and evaluation (RACE) process does not terminate with one evaluation. It has been described as a continuous spiral where each evaluation provides leads on to a further spiral of research highlighting what improvements are need to better the practice's external strategy. This process is shown graphically in Figure 6.2.

INTERNAL STRATEGY

Internal strategy is directed at: establishing and consolidating confidence in a new patient who enters the practice as a result of the *external strategy* outlined above. Internal strategy covers the following procedures:

- The first telephone contact
- Making the first appointment

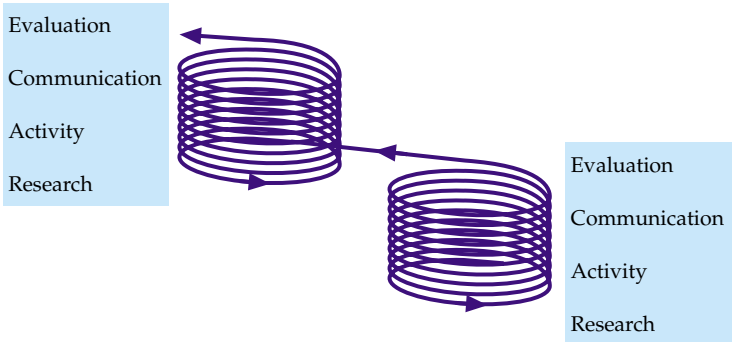

Figure 6.2

The RACE process does not terminate with one evaluation. It has been described as a continuous spiral where each evaluation provides leads into a further spiral of research highlighting what improvements are needed to better the practice's external strategy.

- The patient's first visit to the practice
- The first consultation
- The first examination
- Acceptance to proceed with comprehensive investigations
- Carrying out comprehensive investigations
- The second consultation
- Correspondence.

First telephone contact

The first contact with a practice will undoubtedly be by telephone. The way that this is handled can create a good or bad first impression. Affability should be apparent at the outset. Research has shown that more than 14 rings before a phone is answered engenders aggression. If the receptionist is busy she should answer the phone with a smile, give the name of the practice, her name and a reason why she must ask the caller to hold or be called back. Electronic messages about queuing and instructions to press keys for further information are certain to put off a potential client.

The use of a telephone referral information form is a useful adjunct and should always be left on the desk near the telephone. An example of a referral sheet to be completed at the time of the first phone call is shown in Figure 6.3.

The notes made at the time of the phone call give important signals. A patient phoning to ask the question: 'How much will it cost to have my teeth straightened?' is unlikely to come from a suitable population segment. A more enlightened question may be: 'How much does a course of orthodontic treatment cost?' A polite method of dealing with this is to explain that:

- There are many types of treatments each requiring a different series of braces.
- A full assessment to be carried out by the orthodontist is always necessary to ascertain what a patient's individual needs are.
- Only when the orthodontist has had the opportunity of assessing the patient's needs could the type of treatment, type of braces and the cost be outlined.

Pearl: To avoid misunderstandings, a patient should know before they attend for the first consultation what the maximum cost of the first and second consultation, records and reports are likely to be. This carries the message that a full diagnosis is needed before a treatment plan can be formulated.

Date of referral .....
Name of patient ..... Date of birth .....
Address .....
.....
Phone: Home ..... Business ..... Mobile ..... Fax .....

Self-referred: Y ..... N .....

Name of dentist .....

Has the patient been:
Given a quote of fees?
- Y ..... N .....
- Informed that payment is by cash or cheque? Y ..... N .....

Further notes of conversations

Figure 6.3

An example of a telephone referral form.

Making the first appointment

If the patient confirms they wish to make an appointment, a letter is sent the same day confirming the appointment. It also assures the patient that they will receive a courtesy telephone reminder of the appointment about 48 hours before the appointment. A practice brochure is enclosed that includes a map showing location, parking facilities and outlining what will happen at the first consultation.

Pearl: These procedures are designed to elevate the practice above others, which rarely offer such a personalized service.

Such non-affable remarks by a receptionist as: 'Make sure you are not late' or 'Don't forget your chequebook' should never be made. Patients have, on more than one occasion, reported such remarks as reasons for severing their contact with dental/medical practices.

The patient's first visit to the practice

From a patient's point of view, the first visit to an orthodontic practice may be likened to a customer unaware of the product they are being asked to purchase. Patients may have been shopping around various practices or browsing the Internet and be confused about the different types of treatments advertised, such as 'invisible' braces. The task of the orthodontic team should be to convince a patient that their practice is unique and to this end, the staff should be trained to advise and to delicately inform patients that:

- The practice is conversant with different techniques but not tied to a particular system of treatment.
- That there are braces, which may or may not have to be worn all the time or be conspicuous. The appliance design depends upon the orthodontist's analysis of the patient's problem.
- The provision of braces is only part of the service the practice is offering.

To reinforce and encourage the efforts of the staff, the physical environment of the reception area needs attention with regard to:

- Magazines should be few, up to date and of high quality. An abundance of reading material sends messages of long periods of waiting.
- If walls have to be adorned it should not be with posters.
- A drinking water dispenser emphasizes health/comfort concern.
- Most new patients attend early. Keeping them waiting gives a wrong first impression and on future occasions they may consider it reasonable to attend late. The greatest cause of discontent amongst clients whether on a telephone or in a queue, is to be kept waiting and not be told why. It has been suggested that the term 'waiting room' should be replaced with the term 'practice lounge'.
- The author does not recommend asking a new patient to fill in forms before seeing the orthodontist as he considers that a patient makes an appointment for a private consultation in order to have individual attention. Form filling is common in public institutions as a means of categorizing patients to save time.

Pearl: If a new patient is impressed with a high quality of care received at the first visit they are more likely to see the long-term benefit of choosing a practice which explains and is focused to their individual overall needs.

THE FIRST CONSULTATION

The patient and any accompanying person are invited into a private area, preferably a separate consulting office, where they may be seated in a relaxed atmosphere. Ideally, the consultation area should be out of sight of the treatment area at the time of a consultation. Whether the patient is seated in an office chair or a dental chair, try to avoid having the patient seated at a lower level than yourself, and do not peer down over a mask and half moon glasses, this can feel threatening for the patient.

A recommended way of starting the discussion is to ask the patient if there were any

difficulties in finding the practice and if so in offering to help for the future. Encourage the patient to talk about him- or herself by asking Why have they come, what is their problem and is there any relevant medical history?

Pearl: Patient's response to these questions can be surprising. The perception of the patient and perception of the clinician as to what is a problem may differ widely and it is always better to hear what the patient has to say before jumping to any conclusions as to why they are coming to the practice.

The patient should be assured that you are only going to examine them, make some notes and that no other procedures will take place. This sets a precedent in the patient's mind that they will be told what is going to happen to them and that consent will always be sought before anything is done.

The First Examination

Following the initial introduction and discussion, the patient is then asked to sit in the dental chair either in the consulting office or in the treatment area. The dentist can sit at the 12 o'clock position to the patient and drop the chair back. An extra-oral palpation of the submaxillary glands, investigation of temporomandibular joints and an intra-oral examination of the configuration of the dental arches both in and out of occlusion is all that is usually needed for the experienced clinical eye to form an opinion as to which direction a more detailed examination should take. The patient can at this point be given a hand mirror, and any accompanying person invited to come to the side of the dental chair; avoiding the use of dental jargon, the presenting problems and types of records needed to investigate those problems are simply described. A rapid assessment so carried out and a clear yet brief explanation of what has been assessed will be an assurance to the patient that the orthodontist is an experienced professional. If the patient appears unhappy at this point and sometimes they may say that they are worried because what has just been said seems to indicate that there are complicated problems, they can be reassured by informing them that: 'there is nothing unusual to be worried about and that there is nothing that can't be solved'. All that has been done so far is to focus on the reasons they have given for attending the practice. Emphasis on the individuality of occlusal patterns can be made by describing how everybody has a different dental history, that all faces are different (a fact that is universally accepted), and that this variation is in keeping with the arrangement of an individual's teeth.

Following this pattern of examination and presentation it becomes apparent and logical for the patient to understand and accept that what is now needed is a full set of records and an opportunity to study them. Explain that once you have the records, you will then carefully plan the proposed treatment and present it to them at a second consultation.

Pearl: Do not, at the first visit, outline in any form whatsoever, a definitive treatment plan. Do not suggest what will have to be extracted, worn, or how much it will cost because whatever is said may be misunderstood and subsequently regretted. Be aware that an average patient only retains 10% of what a medical practitioner tells them. The message should be simply: 'There are different ways of treating each patient's problems'.

At the conclusion of the first consultation seek acceptance to proceed with a comprehensive investigation. The patient is asked if they wish to take the matter further and have a full set of records taken so that their individual needs can be assessed and an ideal treatment plan formulated. The type of records including the number and type of radiographs, photographs and study models required should be described.

Comment

The evaluation of a new patient should be completed in two visits, each lasting no longer than 30 minutes. These are referred to as the *first* and *second consultations*. The reason for managing the new patient in two visits is that the first impression formed by both the patient and the clinician is a two-way process. The orthodontist needs time between the first and second consultation to assess the needs of the patient and the patient needs the time and opportunity to assess and reflect on the orthodontist. To arrive at a diagnosis and work out a detailed treatment plan requires evaluation of the study models, radiographs, cephalometric tracings, photographs and written records. The findings are presented to the patient at the *second consultation*.

The second consultation is necessary for explaining to the patient their specific treatment requirements, costs and any other items pertinent to their treatment.

Pearl: In a state-funded system, it is rare that adequate time is spent with a patient during the first and second consultation. Using a first and second consultation strategy will contrast with a patient's previous experiences leaving a lasting impression of the benefits of this difference.

A fee for the two consultations can never reflect the true cost of both of them. This service includes the time spent with the patient, the preparation of study models, photographs, tracings and preparation of reports, etc. and is part of the invisible intangibles referred to earlier in the chapter.

Pearl: It is suggested that the orthodontist's fee for the two consultations should be quoted at 50% of the fee that it normally charged per hour for active treatment.

If the first and second consultations are conducted as recommended, the patient will conclude that what has been charged is exceptional value and will be more ready to accept the fee quoted for the active treatment. In other words, the first and second consultation should be regarded in commercial terms as 'loss leaders'.

Pearl: It is wise to have the patient pay at least 50% of the total cost of the consultations before leaving the practice for the first time. Reluctance to pay is a bad omen for payment of future accounts.

CARRYING OUT A COMPREHENSIVE INVESTIGATION

While orthodontic records are generally standard, there are individual variations among orthodontists. In this section I will only discuss the items that may differ from those described in Chapters 3 and 4.

All non-invasive procedures are carried out first; taking impressions is uncomfortable for some patients so this procedure is carried out last.

Radiographs (Chapter 3)

While some clinicians take the lateral skull radiograph with the teeth in occlusion and the lips at rest, I believe that this radiograph should be taken with teeth in centric occlusion and the lips sealed, no matter how difficult this may be for the patient. Ideally, this radiograph should be checked before the patient is dismissed, as centric occlusion can often be difficult to achieve when the patient strains to achieve a lip seal.

Photographs (Chapter 4)

Similarly, the extra-oral profile and full-face photographs should be taken in a centric relationship with the lips sealed. This can often be difficult for the patient to achieve, however, it allows for muscle strain to be evaluated. It is important that the quality of the photographs should be as high as possible. Excellent prints are always appreciated. Poor prints create doubts in the mind of a new patient about the excellence of practice equipment. The author prefers to use coloured photographic prints taken with a non-automatic single lens reflex

(SLR) camera mounted on to a 102 mm fixed focus lens.

Study models (Chapter 3)

Two sets of study models are ordered from the laboratory. One set will be given to the patient at the second consultation in a special box.

Clinical examination (Chapter 3)

A systematic examination is carried out in the form of a logical sequence of facts recorded on a Dictaphone at the chairside. The examination starts with medical history and ends with a description of dental abnormalities. By speaking aloud into the Dictaphone at the chairside the patient is made aware that a structured and holistic view of his needs are being considered.

Provisional Recommendations

Following the clinical examination, provisional recommendations are dictated and typed on a separate sheet. This records the orthodontist's impressions of the patient as well as the possible treatment options. This forms a useful memory aid when preparing the second consultation. An example of my examination and treatment report template is presented in Appendix D.

Once the comprehensive investigations have been completed, the patient is encouraged to book an appointment for the second consultation. They should be told that the case discussion will last about 25 minutes and will be used for a chat covering a full description of the problems as well as details and a logical explanation of why a particular type of treatment has been chosen to fulfil their personal needs. It should be emphasized that it is *not* to start treatment. Tell the patient that after the second consultation they will receive a set of plaster models of their own teeth and a letter confirming the details of the proposed treatment as well as the fee and payment plan. This will enable them to decide in their own time whether to go ahead or not.

THE SECOND CONSULTATION (Chapter 5)

The structure of the second consultation or case discussion has been developed to reinforce the message of the first consultation and make the patient aware of behind-the-scenes services, the invisible components of the practice sometimes not appreciated by the patient. The consultation should be carried out in quiet surroundings. As in the first consultation every effort should be made to see the patient on time. The records should be laid out on the desk and the seating arranged so that no physical barrier is placed between the patient, accompanying persons, and the orthodontist.

It is recommended that the orthodontist familiarizes him/herself with details of the case, by researching all records a few hours before the appointment, in the same way as a conscientious barrister would before appearing in court.

Pearl: When the patient attends for the second consultation, have a member of the staff seat the patient in the consultation area for a few minutes before the orthodontist arrives. This gives the patient time to familiarize him/herself with the surroundings and to see the records laid out on the desk. This will make the patient aware that a considerable amount of time has been spent with the records and planning treatment.

The orthodontist then asks the patient to sit briefly in the dental chair assuring them that no more records are required but that he would just like to check the models against the patient's bite. This is a useful tip as it allows the orthodontist, armed with knowledge recorded at the first consultation and knowledge of the static records to clinically check such factors as bites of accommodation and asymmetry. The patient is then asked to take back their seat in front of the orthodontist or at the deskside.

The personality of each individual orthodontist will dictate the manner, language and nuances of a case discussion; I have found the following sequence to be effective.

Orthodontist: 'I will divide this consultation into three parts and with these records, I'll be able to show you: First, what exists in terms of teeth, etc.; second, what your problems are; third, what should be done about these problems and approximately how long the treatment will take.'

Starting with the orthopantomograph (OPT) or dental panoramic tomogram (DPT) on which the teeth have been previously numbered in accordance with Palmer's Notation, demonstrate that this is a flat representation of the left/right curve of the face. A pencil should be used as a pointer to attract the patient's eye to the salient features, such as missing teeth, overcrowding etc.

With a pencil, mark on the study cast the upper and lower centre lines and the teeth according to Palmer's Notation. Patients usually comprehend Palmer's Notation very well. Because patients are given one set of marked study models to take home it is possible to refer to the numbered teeth in the letter that will be sent to them confirming the recommendations (see Appendix D).

With the aid of the models and radiographs explain the problems of overcrowding and overjet/overbite.

Refer to the cephalograph as a silhouette of the profile and describe it in conjunction with the extra-oral photograph of the patient's profile and the lateral view of the models. These records, together with the en face extra-oral photograph, can be used to explain asymmetry and any disharmony between the lengths of the upper to lower jaws. In other words, a description of the architecture of the face. This fascinates most patients. As currently all medical data are assumed to be measurable, show the patient the cephalometric tracing and analysis. If facilities are available, produce a second tracing in the form of a visual treatment objective (VTO) which can show dental changes as well as changes in soft tissue profile which will occur as a result of orthodontic treatment.

Outline of Treatment

I always try to divide the treatment plan into phases and present these both at the consultation and in the contents of subsequent correspondence.

Phase I: Any extractions and the wearing of non-visible appliances such as removable appliances, palatal arches and/or buccal sectional appliances.

Phase II: The wearing of fixed appliances to align and correct the relationship of the upper and lower teeth.

Phase III: The retention phase, using either fixed or removable retainers.

Pearl: Bearing in mind that orthodontics is, to the patient, an intangible product, it is useful to have a practice album showing before and after results of treatment carried out in the practice. This helps to make what has just been described to a patient more tangible.

CORRESPONDENCE

The final step in the management of a new adult patient is the follow-up letter. The patient should be assured that this will be received within one week and will confirm the treatment plan, the type of appliances to be worn and when, how much the treatment will cost and how long it is estimated to take.

The purpose of this follow-up letter is that it solves the problem of the patient only being able to recall 10% of what they were told at the consultation. It is always advisable to overestimate the duration of treatment, when treatment takes less time it is cheaper for the patient and consequently the fee for visits during Phase III (retention) will be more readily accepted. Furthermore, if you are using an open-ended payment plan, a patient who does not cooperate or fails appointments can gently, without offence, be advised that treatment is falling behind schedule and consequently becoming more expensive. In other words, the total cost of treatment can be reduced by the patient's compliance with instructions.

The final paragraph asking the patient: 'to make another appointment if they find the arrangements acceptable', avoids going through the bureaucratic process of drawing up and getting the two parties to sign a contract. If the patient phones to make another appointment, I believe they have agreed to the clinical and financial obligations laid out in the letter.

A letter is also sent to the referring dentist together with the clinical report completed after the second consultation (see Appendix D).

Copies of all correspondence are always kept in the patient's file and can be referred to during treatment.

MY PHILOSOPHY OF ORTHODONTIC PRACTICE

Renton Tindall

My efforts to develop a busy orthodontic practice have always been centred on marketing and education and I have also endeavoured to provide a service and treatment that are perceived by patients as value for money.

Marketing and Education

For me, this involves selling myself to every patient with whom I come into contact with a very positive, friendly and accommodating approach. My objective is to make every patient my friend and to develop a relationship that is expected from a good friendship (i.e. respect, honesty and reliability).

> **Pearl:** I always shake hands with every patient and meet and greet each one by name.

Children must be made to feel that they are the most important individuals, not the parents, after all they are the ones who need to cooperate with the treatment.

Successful orthodontic treatment is a team effort involving the orthodontist, staff and the patient. Forming a friendship goes a long way towards establishing the cooperation required. It is therefore absolutely imperative for each member of staff to be an extension of the orthodontist in this approach. Every one must have exactly the same attitude and form a happy, enthusiastic informed orthodontic team. Communication at all levels is therefore absolutely essential and I have regular staff meetings to reaffirm policies and approaches.

It is essential to establish a very high level of communication among the orthodontic team, the patients and the referring dentists.

> **Pearl:** I never stop explaining, while I am working, and make sure that the patient fully understands what is going on especially with the use of a mirror. 'I inform before I perform'.

This is part of the education process. I encourage parents, brothers, sisters, friends, etc. to accompany the patient into the surgery in order for them to be exposed to the process of being educated in orthodontics. They are all potential patients.

I never carry out in a single visit a records/treatment plan and discussion. I prefer to arrange a subsequent half hour to formally present the treatment plan, which gives me another opportunity to impress the patients with my orthodontic knowledge. Again, I encourage patients to bring wives, partners, brothers, and sisters along who will also have the opportunity to become more educated in orthodontics.

A good marketing/education ploy is a large notice board that has examples of before and after treatment photos as well as another area with only the smiling photo of the most recently de-banded patients of the past six weeks placed and constantly updated. I find that new patients who may notice someone they know will be more inclined to accept treatment.

System of Correspondence

All referring dentists are supplied with preprinted referral pads in order to facilitate a

referral. They are also supplied with a promotional brochure, which explains the general philosophy of the practice, the fee structure, a map and a brief CV with a photograph. On receipt of the referral, a letter is immediately dispatched addressed to the patient (whatever age) inviting them to attend a free-of-charge consultation appointment. At the consultation appointment, a personalized fees letter is provided outlining the various costs, payment plans, and includes photographs of the different types of fixed appliances. If the patient decides to proceed with the records then a fee is levied, which includes the subsequent treatment plan discussion appointment. If the patient then accepts treatment, the records fee is deducted from the treatment fee.

A brief letter of thanks is sent to the referring dentist with the promise of a full report once a full investigation with records has been carried out. This report is designed to be concise and in point form, and will include copies of digital photographs and radiographs when extractions are required. The patient receives a similar report in layman terms and the appropriate fee is clearly laid out. I do not include any negative comments in the letter, such as fees for failed appointments, breakages or interest on late payments. I do not believe in charging for any of these but prefer to counsel the patients positively about paying, keeping appointments and breakages without the threat of a fine. However, before embarking on treatment, patients are asked to sign a 'consent to treatment' form, which does point out a few problems and risks that could arise during orthodontic treatment.

Any cooperation problems that arise during treatment, such as poor oral hygiene, breakages and poor elastic/headgear wear, is discussed and the patient re-motivated. I always follow up such a conversation with a personal letter to the patient reaffirming the concerns we have.

I used to supply every patient with a treatment manual, which had information regarding all aspects of orthodontic treatment. I now prefer to supply single page information sheets, which specifically apply to the procedure that has just been carried out. These are all computer-generated and easily reprinted on demand. I find this to be far more effective and also cheaper than having manuals written and printed, which are often mislaid by the patient and then need to be resupplied.

I rarely communicate with the referring dentist during treatment unless I have concerns about oral hygiene control or need further extractions. At the completion of active treatment I send a letter advising the dentist that active treatment has been completed, retention commenced, and that I would like them to see their patient for teeth cleaning and fluoride treatment.

Patients will receive a leaflet about the retention programme. I monitor retention for one year and then provide another information leaflet at the end advising them how to continue with retention themselves.

Treatment Philosophy

I try to remain focused throughout the treatment on the patient's primary concerns, especially with adults. I also try not to enforce my concerns regarding both functional and aesthetic issues without being absolutely certain that the patient is happy and fully understands my advice.

I do not believe that it is imperative that every malocclusion needs to be treated to result in a Class I occlusion. I will give every patient the opportunity to achieve the ideal result. However, in my experience not every patient is capable of achieving that result and often I have to accept a Class II occlusion. I am very conscious of facial-lip support and will accept an overjet rather than over-retract upper anterior teeth. The option of surgery is then always available and the philosophy of permanent part-time retention will maintain the final result.

I generally see patients for adjustments at six to eight week intervals; this varies with each individual patient and their level of care.

I offer a range of fixed and removable appliances, I do try and accommodate all the patients' needs but more actively try and encourage all patients to have the self-ligating metal fixed appliance system.

I almost exclusively use the upper Hawley retainer and either a lower fixed canine to canine or spring retainer. This, I feel, gives me more control during retention and allows more vertical settling-in of the occlusion.

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7 PSYCHOLOGY FOR PATIENT COMPLIANCE

Kees Booij

From experience in the medical field, we know that a relatively high percentage of patients do not follow instructions, whether it be the taking of medicines or the carrying out of certain exercises. The same phenomenon applies to the compliance of orthodontic patients. This is in contrast to what one would expect from youngsters and even adults who actively seek our advice and treatment. Cooperation with complete discipline, on which our work is absolutely dependent, is not something automatic. We should actively introduce our patients to their task and to our expectations.

Pearl: We need to explain the Why? and How? at the case discussion before we start, make patients aware of the close partnership that must exist throughout the period of treatment and retention.

At this stage, it is necessary to stress that compliance from the patient also depends to a large degree on us, it is incumbent on us, to build up, to control, to cultivate and to maintain this cooperation for an extended period of time. Unfortunately, we know from experience that we need to remain vigilant and at times suspicious because even our best patients can deceive us. Do not trust or assume that they will do what you ask of them. Despite all our years in practice, certain patients may still delude us.

There is a striking difference between orthodontics and other fields of dentistry. In general dentistry, after an extraction or the placing of a restoration, the work is generally completed.

Pearl: In orthodontics, fitting the appliance is only the start of the process, orthodontics is a continuing story and the mutual long-term interrelationship should be realized and maintained to optimize the chances of attaining our treatment goals.

To nurture this interrelationship, we should be very careful not to accuse patients falsely of failing to comply with our instructions. False accusation has a long and negative memory.

EVALUATING BODY LANGUAGE AND PATIENT ATTITUDES

It makes sense to find out what the new patient knows about orthodontics. They have often been exposed to either siblings or friends who have had or are currently receiving orthodontic treatment. Try to establish if they already have some negative preconceived opinions. It is advantageous to be aware of such opinions at an early stage so that the subject could be more tactfully handled. Patients often have negative opinions on the wearing of headgears, elastics, and the use of functional appliances. It really is our business to detect and to foresee possible difficulties and to act accordingly. Judge the burden

that each patient will be able to carry and make sure your treatment plan and the consequences of non-compliance are well understood.

Pearl: Understanding and evaluating body language is very useful. A patient exhibiting an absence of interest, unease, impatience, nervousness, playing with the taps and buttons of the chair while you are talking, are all silent warnings, make a note on the card.

If you have some doubt about the patient's ability to comply, it may be expedient to adopt a flexible approach and avoid irreversible options, such as extractions, until you are sure of attaining adequate compliance. In some cases it is not always possible to start off with the ideal treatment plan, under certain circumstances, it may be necessary to water down our goals. As treatment progresses and cooperation improves, it may be possible to readjust to a more ideal treatment plan. To quote Milton Sims: 'stay out of trouble', an important general rule to be remembered.

Further opportunities for evaluating patient attitudes present themselves early on. Taking the initial impressions (taken by yourself) provides you with a considerable amount of information about the patient's attitude towards you and your treatment. Is there a willingness to undergo some inconvenience; is there hesitation, obstruction, reluctance or aversion? Remember that we need their active participation in a pleasant, unrestrained atmosphere for a long time. Irritation between patient and orthodontist can work both ways, try to be tolerant. Exhibiting a vomiting reflex when having an impression taken is normal, but assess how the patient behaves, is there panic or self control, what is the body language? Talking to the patient at the first consultation and at the case discussion, gives you a chance to let them talk. Is he or she answering the questions or is mother answering for the patient? Listen to the speech and evaluate any tongue habits. Look at the hands, even in the absence of openbite tendencies there may be a thumb or finger habit. Compare the hands, even the slightest spot on the skin, not only on the thumbs but also on the fingers, can reveal a whole story. Persistent habits lower the threshold for cooperation.

Pearl: If you notice such habits without having asked for any specific information, both the patient and the parent will understand and acknowledge that they are dealing with an individual who is an authority and who knows his or her subject.

Do not be deceived by both the mother and child downplaying the habit or remarking: 'he hardly does it anymore'. Marks on the fingers or thumbs are evidence.

Perhaps I have overstressed the negative aspects of poor cooperation, but I believe it is important for the clinician to build up experience in this field. Once you have seen what a really cooperative patient can attain in a reasonably short period of time, particularly with regard to headgear and functional appliance therapy, you will be better placed to judge and evaluate those whose compliance is suspect.

Do not fall into the trap of praising a patient before carefully evaluating their progress. Often they know what you want to see—'Sunday-bites' are notorious. If you praise before checking the bite carefully, they may feel justified in continuing with their poor level of elastic or headgear wear.

It is essential that before criticizing a patient, you need to be sure that the fault for poor progress is not iatrogenic and does not reside in the appliance.

CLINICAL CLUES TO PATIENT COMPLIANCE

Remove the archwire yourself; if an assistant removes the archwire before you see the patient, you may lose some information. Active archwires should be passive when removed. If not, then the timespan between the visits may have been too short. Some patients react faster than others—wait longer, do not intensify the activity, and give the appliance a chance to work; with sliding arches check for any binding. It is interesting

to notice, following a long holiday, how much progress has taken place; the teeth have had a chance of moving without interference. For me this is a lesson to keep my hands off.

Pearl: Changing the forces while the archwire is still active slows down the rate of movement, the periodontium has to readjust to the new force values and that takes time.

To help in evaluating the possible causes of slow progress, it may be advisable to make a new set of study models that allows you to examine the occlusion from the lingual; look for occlusal interferences that may be hindering tooth movement. As stressed earlier, only after having checked everything, are you entitled to accuse the other party in the partnership. Keep the discussion pleasant; explain to the patient that he or she is misleading him/herself, and that is not very smart. Try to reach a mutual solution for improvement in co-operation. A personal letter addressed to the patient can be of great help in such a case (see Appendix E). The letter should be designed to avoid the risk of a false accusation of non-compliance. If you believe a patient is not cooperating, use a tactful approach even if you are sure of yourself. Making a mistake by accusing a patient unjustly may ruin a potentially good relationship forever. My advice: The letter should not convey an attitude of authoritarianism. This concept has served me well over many years.

In certain cases, some patients are too clumsy to fit rubber bands, make it a habit to let them place the elastics themselves in the surgery, the ease or difficulty with which they carry out the procedure, gives you a hint of the level of cooperation. If, despite your efforts, nothing happens after ample time, then there must be a problem. Show your sympathy, good cooperation does not last forever and remember that puberty has its problems.

Pearl: Remember that at times we may be asking too much from certain patients. Lack of cooperation may in certain cases be related to problems at school, or at home, a family illness, a sore throat, or a blocked nose.

One of the traps that a young clinician may fall into is to believe that he or she is better than his or her older colleagues, and to expect that he or she will have more success where others failed. Beware of patients who come to your newly opened office with a history of previous treatment, where another orthodontist may have done his or her best. Do not believe everything the patient says, try to get the other side of the story and there is usually a good reason why the original orthodontist either stopped treatment prematurely or dismissed the patient.

Set aside your pride; we all hope to have a reasonable amount of psychological acumen and experience but always ask yourself: 'Am I good enough to master the difficulties that certain patients present'? We have to work on establishing mutual understanding, but if it starts to fade it is very difficult to regain.

Pearl: Know your customers, make friends, and be honest about the inconvenience you are inflicting on them.

PATIENT COMPLIANCE WITH FIXED APPLIANCES

Certain patients and parents are often under the misapprehension that fixed appliances do not require patient cooperation. Often, the parent will express a desire for fixed appliances as opposed to removable appliances because, to quote some mothers: 'If it is fixed to his teeth, he will not lose or break it, I know that if he can take it out of his mouth, he will lose his plate'. The mother's understanding of her son is clear, unfortunately, her understanding of orthodontics is poor and once under treatment her son's noncompliance becomes evident in his forgetfulness to wear elastics, headgear and to generally care for his appliances.

In an attempt to cater for such a group of patients, orthodontists have developed a group of non-compliant appliances, such as the Herbst appliance, bonded functional appliances, bonded Hyrax rapid expansion appliances, quad helix expansion appliance,

palatal bars, lingual arches and the fixed pendulum appliance. Despite these types of appliances, in most cases it is still necessary at some stage to fit conventional fixed appliances incorporating bonded brackets and/or bands.

Pearl: With patients who always seem to have 'bad luck' and repeatedly loosen their brackets, my policy is to replace fractured brackets with fixed bands.

PARENTAL INFLUENCE

Before starting treatment, it is essential that patients and parents should be well informed at a case discussion about the consequences of orthodontic intervention (Chapter 5). The parents must be informed of the prognosis for treatment, type of appliances, the anticipated duration of treatment as well as the cost of treatment. They should be made aware of the possible need for the extraction of both deciduous and/or permanent teeth prior to or during orthodontic treatment. It is also important to warn them of the need for retention following orthodontic treatment.

Explain to the parents that their task is to support their child but still show a positive attitude towards our work. If they fall short in this aspect of parental care, then we have a problem. If they show too much pity or if the child is a victim of a divorce situation, cooperation may be further compromised. When a mother asks at the banding appointment: 'Does my child have to wear that thing?' then you are off to bad start. It may be wise for you to stop and explain once more to the parent that you need their support and that positive comments will be more helpful.

At the outset, it is important to ask if the husband/father/partner agrees to orthodontic treatment for the child, positive all-round family support is essential. If there is a difference of opinion between parents especially under divorce circumstances, we may once again be faced with a cooperation issue.

In the majority of cases we find good parental involvement and support. However, we do find a few parents who want to know every little detail of what is happening and at the other end of the spectrum we have parents who show no interest at all. This latter group are not aware of the problems we face treating their children and if treatment does not go according to plan, they may remark 'Doesn't the appliance do the job?' This attitude and any accompanying remarks should be noted in the patient's file.

Pearl: Irrespective of the parent's attitude, it is incumbent on us to report to the parents any signs of declining cooperation and to note the facts on the patient's file.

It is not often that I find it necessary to write the non-cooperation letter (see Appendix E), but I have found the effect of this letter to be quite dramatic. Certainly, the parents wanted to know from the saboteur what the message was, the victim had to confess and in many cases life improved.

Another policy is to send the patient home without an appointment pointing out that they should return when they are prepared to do their share. Once again the parents must be informed.

We all develop our own way of handling compliance issues, however, if you are suspicious of poor cooperation before starting treatment, it is advisable to send a letter to the parents expressing your fears and recommending that the patient seeks treatment elsewhere. Remember: 'You can lead a horse to water but you cannot make him drink'.

ADULT PATIENTS AND THEIR MOTIVATION FOR TREATMENT

Adult patients are generally more compliant than children. There are some adult patients who seek extra care, they live by their mirror and they can be very demanding (Chapter 6). Generally, orthodontic treatment of adult patients can be very rewarding.

Pearl: It is important to realize that the older patient has gone through a lot of 'soul searching' before crossing your threshold. They expect and should be given our full attention. Take ample time to establish their complaint, their past history and the reasons for seeking treatment at this stage of their life.

As a consequence of a generalized reduction in dental caries, many older dentitions are well preserved. Certainly, in the eyes of the orthodontist there is always something that could be considered for improvement yet it would be unwise to try to 'normalize' every irregularity. Very often, older patients foster the illusion that simple intervention can meet with their desires. Usually, they focus on one or more teeth and they have the impression that the situation is becoming worse. They have no real idea of how long the condition has existed and are often under the illusion that it has progressed over the last few months. To ease the patient's mind, in cases where you believe treatment is not warranted, it may be an idea to document the current condition with study models and compare the situation in six to twelve months time. It usually then becomes clear that very little has changed.

Unfortunately, a few patients are overfixated on what we would consider to be a minor problem and it is difficult to convince them otherwise. We then have to explain to them in all honesty that the remedy may be worse than the disease, a simple and clear message, but for some hardly acceptable. The energetic, dashing, modern orthodontist may be inclined to start adventurous treatment. However, always ask yourself if the lifespan of the dentition will be enhanced or reduced by your treatment.

Pearl: We should not always believe that we are so much better than nature.

Often in the older patient, the problem is centred on one or two displaced teeth. While this may appear as a simple problem, always remember to try and establish the aetiology of the problem. Whether the aetiology is of skeletal, dental or soft tissue origin, it has probably existed for many years and is currently in a state of functional equilibrium and exhibits the so-called 'wrinkles of the older dentition'.

Pearl: Our task as orthodontists is to achieve an alternative, balanced, stable new arrangement.

If the patient has undergone a previous episode of orthodontic treatment, you need to assess very carefully whether a similar approach at this stage will have any better chance of success. In these cases, the chances of root resorption are increased.

It seems such an easy solution to straighten the teeth and to retain them with fixed bonded retainers. However, we still do not know that if after having forced the teeth into an aesthetically acceptable but functionally unstable position, bonded retainers are without ill effects in the long term.

Pearl: It is important to explain to the adult patient the limitations that their age imposes on the orthodontic treatment required to solve their particular problem.

Encouraging Patient Compliance

Victor Lalieu

We have an 'Orthodontic Grand Prix' incentive programme for our patients, every good 'deed' gets rewarded with a stamp, once they have raced around the track, the patient is rewarded with a fairly nice prize.

All proceeds from donations received from patients in 'purchasing' oral hygiene products go to supporting our World Vision Charity Child in Zambia. Our Christmas Charity Competition in which I match our patients' contributions, the proceeds of which are donated to a children's charity.

Empathetic Approach to Patient Compliance

Effie Patrikios

A few minutes spent with the chairside assistant prior to the orthodontist seeing the patient helps to set the mood. An interest in patients' activities and interests and, more importantly, adverse events provides a background which is helpful. They may at times, of course, be very unwilling participants in the 'wonderful world of braces' but patience and tolerance on the part of the orthodontist and the team will help to achieve a positive outcome. Certain parameters and guidelines need to be set early on. I recall the case of a teenager (from a single parent family) who had run away from home during her orthodontic treatment. During this time she was exposed to difficult circumstances. She returned to her mother and to her orthodontic treatment. This treatment took twice as long but at the end she turned to her orthodontist and said: 'Doctor, we have been to hell and back twice together haven't we? Thank you!'.

Pearl: Encouragement and motivation to achieve, even though faced with exceptional circumstances, will assist in more ways than simply the orthodontic outcome.

Whether your attitude and professional deliverance of your service gives encouragement to a teenager to select dentistry/orthodontics as their chosen career; whether you share in the dreams of a girl whose aim it is to be the first woman prime minister of Australia; whether you share in the excitement of two brothers who love to participate in rodeos; or whether you share in assisting a young man to set up his own gardening business you have played an important role.

Relationship Between Patient, Parent and Clinician

Colin Wallis

Should you allow parents to remain in the treatment room while you are attending to their child? This is a question asked by nearly all clinicians at some stage in their career. Some orthodontists will encourage parents to remain in the room while others will discourage them, there is no hard and fast rule, it is an issue of personal preference that warrants further discussion.

Before a patient reaches adolescence, a parent can offer valuable reassurance and is likely to have a positive effect on compliance. However, the majority of orthodontic patients will have at least some of their treatment during adolescence and the presence of a parent may need to be reassessed.

As a child approaches puberty their relationship with their parents tends to change. Adolescence is an essential period of adjustment between childhood, which is characterized by dependence on authority figures, and adulthood, which demands self-sufficiency and the assertion of individual values.[1] The transition commonly incorporates an emotional separation from the parent and may surface in the orthodontic environment as a tension between the desired values of the patient and those of authority figures. Further tension may arise out of differing views on health benefit. While adults tend to place a high value on health, adolescents generally consider themselves to be resistant to poor health.

Pearl: Peer pressure and sexual maturity are additional factors that create a desire to be attractive.

A visible orthodontic appliance is a clear marker of unattractiveness and inevitably challenges this developing self-image.

The unfortunate coincidence of adolescence and orthodontic treatment places an additional burden on the orthodontist. As well as

the problems of managing complex appliances and severe malocclusions during a phase of rapid physical change, it is necessary to negotiate this challenging period of psycho-social development. As compliance is a key to success, the negativity that may arise must be channelled and redirected in a positive way and the orthodontist has a unique opportunity to respond to these issues.

The developing ability of an adolescent to make rational evaluations will, one hopes, direct the patient to agree to treatment at an appropriate time. In a world seemingly dominated by authority figures, the orthodontist can assist this process by seeing the patient alone and asking if they wish to be treated or at least think about whether they wish to be treated. Previous decisions regarding their health and welfare have been made for them and many are surprised or overwhelmed by this radical shift of responsibility. The responsibility should now be extended into the treatment itself, the orthodontist becoming less of an authority figure and enabling the patient to acquire independence and individuality. Small choices taken by patients, such as colours of appliances and modules, can enhance feelings of individuality. Furthermore, the orthodontist frequently has an advantage over parents and schoolteachers in the opportunity to develop a relationship with the patient on an adult level.

Pearl: This particular relationship is more readily developed without the inhibiting and distracting influence of a parent at the chairside.

According to Freeman: 'recent research examining non-compliance has clearly shown that it is the conflict between parent and adolescent that influences the success of continuing orthodontic treatment'.[2] While compliance may be improved by the exclusion of a parent from the treatment area, other issues relating to professional conduct and the law need to be considered.

Parents universally desire optimal health care for their children, therefore, rather than being made to feel excluded from this responsibility, it is necessary for the orthodontist to explain to the parent that this arrangement can carry advantages. In particular, parents should find some comfort in the knowledge that the orthodontist is assuming responsibility for this aspect of their child's care. It is understood that at the outset the diagnosis and treatment plan were explained in detail and parents assured that they will be kept informed of any significant problems or changes to treatment.

Pearl: Parents must have access to information from either the orthodontist directly or an appropriate member of the practice team if there are any concerns at any stage during treatment.

Orthodontic procedures are generally painless but may be accompanied by some anxiety. Although some younger patients benefit from the security of a parent close by, Kent and Blinkhorn have observed that: 'in many cases ... some parents exhibited behaviour that would tend to increase the child's anxiety'.[3] The ground rules should be established before treatment commences and cooperation sought in terms of flexibility over appointment times and the need for continuing parental support throughout treatment. In the vast majority of cases, parents welcome this shift of responsibility and generally recognize that orthodontic management requires a high level of concentration and the presence of any relative or friend of the patient in the treatment area can create at least some level of distraction.

Health and safety, and also public liability insurance issues may arise if children (siblings and friends) are not closely supervised in the surgery while the orthodontist and nurse are busy treating a patient.

When it is clear that the needs of the patients and parents have been met, it is necessary to ensure that the orthodontist is also protecting his or her own interests.

- First, it should be understood from a legal viewpoint that when a minor is discharged into their care, they are acting in loco parentis. While treating a patient the orthodontist is responsible for all aspects of their care and welfare.

- Second, patients have usually been referred by their general practitioner who has: 'assumed a duty of care which necessitates a willingness to refer . . . if the task in hand is beyond the dentist's own skills'.[4] The same duty of care applies if the orthodontist requires assistance from other specialties, and it is essential to keep the parent as well as the referring practitioner informed with regard to all aspects of the patient's care.
- Third, in the case of a minor, it is necessary to obtain a valid consent form signed by the parent or guardian prior to commencement of treatment and to ensure that a chaperone (apart from the parent) is always present in the surgery.[5]

Pearl: In the event of any misunderstanding by a parent relating to the provision of care of a minor, the voice of authority is quite clear.[6] The orthodontist may always defend or justify his or her position if he or she is seen to be acting in the best interests of the patient.

I prefer not to have parents in the treatment area, whether you choose to practise orthodontics with the parents there or not, remains a personal decision. However, it is as well to retain a degree of flexibility and remember that there will be occasions when it will be advisable to vary your rule.

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III Clinical treatment

8 FIXED APPLIANCES

STAINLESS STEEL BANDS

Despite the advent of direct bonding, conventional bands are still widely used for second bicuspid, first and second molar teeth. Brackets bonded to second bicuspid teeth particularly in the mandibular arch, have a high failure rate. While a number of orthodontists currently bond all teeth including second molars, the reliability of well-banded molars still provides the clinician with a comfort zone knowing that all molar attachments are well secured throughout treatment.

If you choose to use conventional bands for molar teeth that are in tight contact with adjacent teeth, then it is essential to place interproximal separators at least one week prior to the banding appointment. Schedule a short five minute appointment for placing separators followed by a long appointment for bonding and banding. The long appointment can vary from one to two hours depending on your personal preferences as to how many teeth you intend to bond and the rate at which you choose to work.

Pearl: Schedule sufficient time for fitting fixed appliances. Treatment can be either compromised or enhanced at the outset by the calibre of the strap-up placed on the teeth. This was well described by Dr Swain: 'Banding as an investment in efficient treatment: the full service strap-up versus band brinkmanship'.[1]

Separators

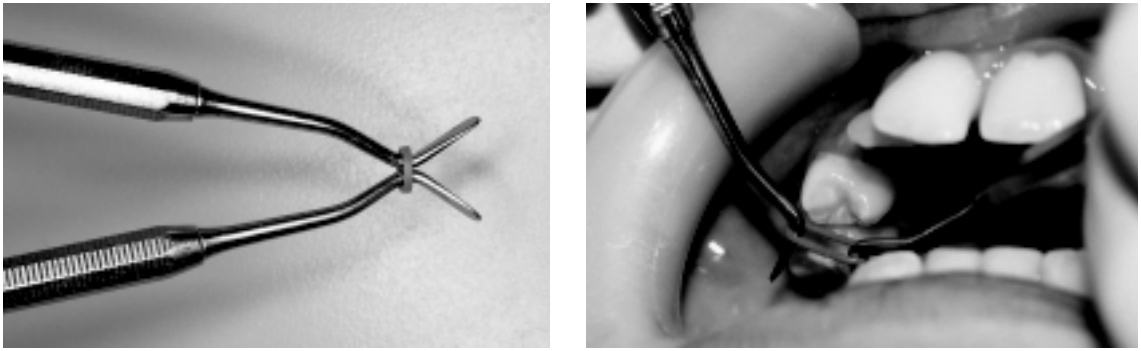
All separators work by applying pressure around the contact points and squeezing the proximal tooth surfaces apart. One of the early forms of separation was achieved by slipping a piece of brass wire (0.7 mm, 0.028 inches) under the contact point from buccal to lingual, then back over the contact point and twisting the two ends tightly on the buccal aspect. Commercially available separating springs and separating elastomeric rings have currently superseded this technique.

Separator Placement

Robert Katz

When using the proprietary separator pliers, the separator is located 10–15 cm (4–6 inches) away from the operator's fingers. This results in loss of control and frequent slippage. If two flat plastic instruments are used with the separator placed between the blades, one has greater control with no slippage and less potential for damage to the gums and soft tissues. It is also significantly cheaper to use this method as a separator pliers costs significantly more than two flat plastic instruments (Figure 8.1a, b).

Pearl: Warn your patients that while the teeth are not sensitive immediately after placing separators, they generally become sensitive by the next day. This sensitivity is more marked in adult patients.



(a) (b)

Figure 8.1

(a) Elastomeric separator held with two flat plastic instruments. (b) Placing an elastomeric separator stretched between two flat plastic instruments.

Separators should be left in place for at least one week; this allows sufficient time for adequate tooth separation and for the tooth sensitivity to abate. If the teeth are still very sensitive at the banding appointment, it will not be possible to seat the band with adequate pressure and there is a danger of selecting a band, which may be one size too large. The pain threshold varies with each patient; adult patients are particularly sensitive to tooth separation so it may be advisable to extend the period of tooth separation for one or two extra days.

Pearl: Do not try to fit or cement a band with the teeth in tight contact. While it may be possible to force a band through the contact point, you cannot judge the correct fit of the band in the presence of a tight contact.

Band selection

Seamless stainless steel bands are currently the standard; it would be an extremely rare occasion that would necessitate the intra-oral construction of a pinch band. Seamless bands are purchased as either plain or with pre-welded attachments of your choice. Manufacturers are now etching the inner surface of bands to increase their mechanical adhesion to the cementing medium. Before deciding on which brand of bands to use, examine the shape, contour, accuracy of fit to the tooth anatomy, hardness of the band material, range of sizes, availability of easily accessible stock, speed of delivery and cost. Next, you need to decide whether you prefer to use plain bands or bands with pre-welded buccal and lingual attachments. Plain bands, once seated, allow the clinician to mark accurately, using a marking gauge, where the bracket or tube needs to be spot-welded. It is necessary to maintain a stock of plain bands as well as a stock of weldable attachments. Pre-welded bands must be seated to a position on the tooth, which allows the buccal tube or bracket to be at the correct height as required by your chosen technique. In certain instances, where the anatomy of the crown is unusual; the accuracy of bracket or tube height may be compromised. It is essential to establish the prescription of attachments you require to be pre-welded to the bands. Your supplier should record this prescription or you may need to repeat the prescription when reordering your stock.

All molar and pre-molar bands should have lingual buttons, cleats or hooks. Lingual cleats are the most comfortable for the patient. As Brainerd Swain explained, investment in a good and comprehensive strap-up pays dividends during treatment.[1] The convenience of having lingual attachments available increases

the versatility of the direction of force application to be used as and when needed during treatment.

Pearl: Malaligned and rotated teeth, buccal and lingual crossbites, tipped teeth and partially erupted teeth can all be more efficiently moved with the assistance of lingually directed forces generated either by elastomeric threads, chains or Class I, II, or III intra-oral elastics.

Fitting bands

Get into the habit of always fitting and cementing bands in the same sequence. It is common practice to start with the lower left molar, work around to the lower right and similarly in the maxillary arch start with the upper left and move around to the upper right. To save clinical time, prior to the banding appointment, auxiliary staff may preselect bands using the patient's study models. In some countries, jurisdiction allows oral hygienists and orthodontic auxiliaries to select and fit bands on patients.

Seat the band using finger pressure, the band should move through the contact points almost to the level of the buccal gingival margin and should feel firm. Next, use an amalgam plugger or a band pusher to further seat the band and then final seating should be done using a bite stick. With a bite stick it is possible to use a heavy bite force generated by the patient to seat the band to its final level. The buccal gingival edge of the band should just move into the buccal gingival crevice. Try to avoid leaving a thin section of exposed enamel between the edge of the band and the soft tissue gingival margin; this is a potential site for plaque accumulation and enamel decalcification. For optimal final seating of the band, the patient should close with the metal post of the bite stick resting on the disto-buccal margin of the lower band and disto-palatal margin of the maxillary band.

Pearl: A band will not seat fully to its correct position if it is too small or the contact points are still too tight.

To check where the fault lies, try a larger band, if the contact points are sufficiently open the band will seat down to the gingival margin with finger pressure alone. If the contact points are too tight, even a large band will not seat correctly. If it is possible to rock the band in a bucco-lingual plane, then the band is too loose or not seated sufficiently.

Bicuspid bands need to be seated with care using finger pressure followed by an amalgam plugger applying seating pressure to the mesial and distal margins of the band. Final seating should be achieved with the metal post of a bite stick resting on the buccal occlusal edge of the *band*. Beware of applying pressure to the occlusal edge of the *bracket*, it is possible that the bracket can be distorted or even sheared off the band.

Pearl: The development of a degree of lateral openbite as the case comes close to completion is the result of inadequate seating of bicuspid bands.

On the other hand, seating a bicuspid band too far gingivally will result in extrusion of the tooth, which in turn will produce cuspal interference and disturb the occlusion.

Once all the bands have been selected and accurately fitted, they should be carefully removed using a universal scaler, be careful not to distort the band during this process. Once again, if the contact points are too tight the band will be distorted when removing it from the tooth. The bands should be placed on a tray with demarcated wells for each band or a tray that has vertical posts for each band (Figure 8.2). The bands are now thoroughly

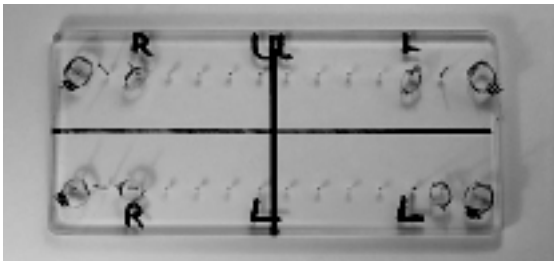


Figure 8.2

Rigid plastic band rack with stainless steel posts. The rack together with the bands can be immersed in water.

washed and dried to remove all traces of saliva and blood.

Altering band shape and dimension

Pearl: For maximum retention of the band on a tooth, it is essential to have a tight, well-fitting band. Do not depend on the cement to retain a loose fitting band; it will become loose during treatment.

Occasionally, due to unusual tooth anatomy, one size band is a little too loose and the next size down is just too tight. Furthermore, there are times when a band becomes dislodged during treatment and you can feel that it is just a little too loose. Under these circumstances you need to be able to improve the fit and slightly reduce the size of a band. There are three techniques to improve the fit of a band:

1. Grip 1 mm (0.04 inches) of the cervical edge of the band with the tips of Adams' pliers (Ash 64) and bend the band margin inwards about 45 degrees, move the pliers in small increments around the cervical circumference of the band bending the margin inwards with each bite of the pliers. This will have the effect of producing a small cervical collar on the band, which in turn enhances retention on the tooth (Figure 8.3).
2. Cut a piece of stainless steel band tape, and spot-weld it to the inner surface of the lingual wall of the band. Make sure the patch of band material does not extend on to the inter-proximal areas of the band. This procedure both strengthens the wall of the band and slightly reduces its internal circumference. Once again, improving the fit of a slightly loose band.
3. When trying to band very small molar teeth, where the smallest molar band is still too large and the largest bicuspid band is still too small, it becomes necessary to further reduce the size of the molar band. Cut the lingual wall of the band with a crown and collar scissors; overlap the two cut ends by an amount you estimate will correct the size and place one tack weld. Try the band on the tooth, if the size needs to be altered further, break the tack weld; re-overlap with the correction and re-tack weld, then re-try on the tooth. Once the correct size has been achieved, weld the overlap securely and smooth the edges with a mounted stone.

Figure 8.3

Using Adams pliers (Ash 64) to create a cervical collar for increasing band retention.

Preparation for cementation

Pearl: All buccal tubes, brackets and lingual attachments should have their lumen closed with soft red wax.

The attachment can be drawn along a piece of soft red wax or dipped into a well of semi-molten wax. Allowing cement to enter and block the lumen of an attachment causes unnecessary problems during treatment.

Sealing Tubes and Brackets

Mathew Power

The lumen of tubes and brackets may also be closed with toothpaste. When the patient rinses, the taste of the toothpaste is pleasing, fresh and counteracts the taste of the cementing media.

A piece of masking tape for each band is cut approximately 3 cm (1–1.5 inches) long. One end is folded on itself to allow the operator to hold the tape without it sticking to the gloves, the occlusal edge of the band is stuck to the masking tape using finger pressure and the assembled tape and bands are laid out on the work surface in the sequence to be cemented (Figure 8.4).

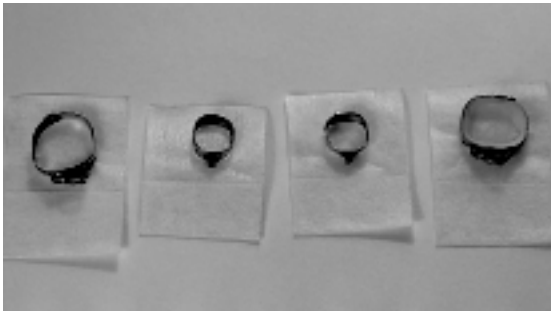


Figure 8.4

Bands placed on adhesive masking tape facilitates transfer between assistant and orthodontist and transfer from the orthodontist to the patient's mouth and relevant tooth.

While the bands are being prepared by the assistant, the clinician will have washed, isolated and dried the relevant teeth. As with the selection sequence, bands should be cemented starting with the lower left molar. Currently, the cement of choice for bands is the group of glass ionomer cements, the hybrid resin reinforced glass ionomer light-cured cements are also advocated as a cementing medium.[2–4] The cement is mixed on a cold glass slab to creamy consistency and placed on the inner surface of the bands to cover the entire metal surface.

Pearl: It is essential to ensure that the assistant does not underfill the band, voids left between the band and the tooth surface are potential sites for enamel decalcification. Rather overfill than underfill.

Pick up the folded end of the masking tape, carry the band to the tooth and seat the band applying pressure on the tape. This procedure forces the cement to fill all voids between the band and tooth surface, it also forces excess cement into the occlusal grooves and fissures of the tooth without getting too much cement on to the operator's gloves. Before moving on to the next tooth, take a cotton wool roll and wipe the excess cement off the occlusal margins and surface of the band and tooth.

On the assumption that the tooth is caries-free, leave some residual cement in the occlusal fissures, this can act as a fissure sealant and the slow fluoride release from the cement increases caries resistance in these areas. The degree of residual cement should not interfere with the occlusion to any significant extent. At this stage, leave the excess cement around the gingival margins and proceed to the next tooth following the same sequence. Once the cement has started to harden, the excess around the gingival margins can be easily removed with a universal scaler. It is important to ensure that all excess cement around the gingival margins has been removed, particularly in the area between the buccal tubes and the gingival margins. If excess cement is left to harden on the occlusal surface, it becomes extremely difficult to remove. Gilmore uses a wet disposable toothbrush to remove any excess unset cement.[5]

BRACKETS

Brackets are only a means of transmitting a force, from whatever source and direction, to the crown of the tooth, nothing more and nothing less. Irrespective of the bracket used, your treatment plan and its execution should be based on sound physiological and physical principles that govern orthodontic treatment. Treat with circumspection claims that expanding an arch with one type of bracket is more stable than expansion achieved with a different bracket; ask yourself if teeth can differentiate between the different brackets that generate an expansion force? However, dependent on the design of a bracket, different tooth movements can be produced by different brackets, as an example, some brackets allow tooth tipping while other brackets allow only bodily movement.

The design and composition of orthodontic brackets continues to be modified and refined at a rapid pace. Within the two major groups of ceramic and stainless steel brackets there are numerous designs and variations in prescriptions of torque and tip. As the clinician who will be using the bracket, you should carefully evaluate the brackets commercially available and choose a bracket that suits your treatment philosophy. Become familiar with the bracket and with time become expert at managing and handling the bracket. It is tempting to keep changing as new brackets come on to the market, but do not be taken in too easily by commercial advertising and do not always believe the blurbs. Having a large inventory of different brackets is expensive and inefficient.

Apart from considerations based on your treatment philosophy governing torque and tip, there are certain principles you need to consider when selecting brackets.

- Evaluate the design of the bracket.
- Look at the size of both the base and the arch-retaining components.
- Examine the shape and the fit of the base on the tooth surface.
- Evaluate the retentive characteristics of the base (mesh or undercuts).
- The position of the archwire retaining component in relation to the bracket base is of particular concern for bicuspid brackets where, in many cases, the archwire slot needs to be close to the gingival margin.
- Check the strength, protrusion and accessibility of the tie wings.

Vertical slot

Having a vertical slot greatly enhances your treatment options, and once you have become accustomed to utilizing this facility, you will ensure that you always use a bracket with a vertical slot. The vertical slot allows you to incorporate many auxiliaries, which can act in all three planes of space (Chapter 9). When a tooth is displaced to the extent that it is not always possible to place a conventional ligature wire or elastomeric tie, it is much easier to thread a ligature wire through the vertical slot and move the tooth into a more favourable position for the subsequent placement of a conventional tie. In the case of partially erupted teeth when it is not possible to place a conventional tie due to the proximity of the gingival margin, once again it is simpler to tie the tooth to the arch with a ligature wire threaded through the vertical slot. If it is not possible to thread the ligature wire through the vertical slot, due to the gingiva or adjacent tooth blocking access to the slot, a ligature should be first threaded through the vertical slot before bonding the bracket.

The vertical slot allows you to place a power pin (TP Orthodontics Inc, USA) for the attachment of an elastomeric chain, thread or intra-oral elastic. In some cases, the elastomeric thread can be threaded directly through the vertical slot or through a loop, formed with ligature wire threaded through the vertical slot.

While the vertical slot is standard in the Begg and Tip-Edge brackets, it is only available in certain standard and prescription edgewise brackets. Selecting edgewise brackets that incorporate a vertical slot has the potential to increase the overall efficiency of your appliance. Binder shows how standard or prescription twin brackets can allow the placement of auxiliary springs by making use of the central gap (vertical slot) between the mesial and distal tie wings.[6]

Pearl: The incorporation of a vertical slot in the bracket is a feature often neglected yet it is an extremely useful adjunct and greatly enhances the versatility of your appliance.

PRACTICAL TIPS FOR SELF-LIGATING BRACKETS

Nigel WT Harridine

With the emergence of robust, reliable bracket types, self-ligating brackets are rapidly gaining in popularity. The chief advantages of these brackets come from the combination of low friction and secure full archwire engagement. Several studies have supported the view that

these advantages result in significant reduction in treatment duration and appointments required. In addition, the greatly improved ability to align crowded teeth without extraction space, encourages the prescription of fewer extractions if the operator chooses. The brackets in common use are the Damon2—a bracket with a passive slide—and Speed, In-Ovation R and Time brackets—which all have flexible, potentially active clips that invade the bracket slot. These brackets vary in design and relative merits, but have many practical considerations in common. These tips apply to all self-ligating bracket types.

Locating the Archwire Fully in the Slot

With self-ligating brackets it is much more important to fully engage the wire before clip closure rather than attempt to close the clip and simultaneously engage the wire, as is the case with conventional ligation. Partial ligation is not possible with a self-ligating bracket—the wire is either fully engaged or the clip/slide will not close. This is a major source of their enhanced performance and on changing to self-ligation, a clinician will realize how frequently their archwires have previously failed to be fully engaged because of the deficiencies of conventional ligation. There are three reasons why an archwire does not seat fully in the slot:

1. There is something in the slot preventing the archwire seating.
2. The archwire is not sufficiently deflected (but can be) to seat fully in the slot.
3. The archwire is too rigid to be deflected to seat fully in the slot.

Plaque or food debris in the slot can be sufficient to prevent the archwire seating fully in the slot. With the need to fully engage the wire, this is a more significant consideration than with conventional ligation.

Pearl: One practice worth considering is to give patients a disposable pre-pasted toothbrush (e.g. Plak Smacker Pre-Pasted Disposable) after the removal of the archwires to clean their teeth before the new archwire is placed.

This emphasizes the importance of good oral hygiene and also ensures that the slots are brushed clean. An alternative tip would be to blow out the slots and tubes with a 3-in-1 syringe and achieve the same effect. Occasionally, some calcified material will be found in the slot and this needs to be removed by the orthodontist.

With full engagement being essential, if the wire is too rigid, then a wire of reduced dimension or reduced modulus of elasticity should clearly be used. If the wire is not too rigid, but needs active assistance to be engaged prior to clip/slide closure, a variety of instruments are available.

Aids to archwire engagement with self-ligating brackets

- If the wire is passive labio-lingually, this consideration does not apply.
- If slight assistance is required, the readily available finger will suffice. However, if archwire engagement and clip/slide closure is difficult for a particular tooth, several practical tools and techniques are worth knowing.
- Sometimes, a flexible wire can be easily engaged in a Damon bracket by catching the wire behind one corner of a half-closed slide and then fully closing the slide with finger pressure on the less engaged side.
- The wire can be placed and held into the slot base with a variety of simple tools, such as an amalgam plugger, ligature tucker, or Mitchell's trimmer. However, these only push on one side of the bracket and may fail to fully engage the wire across the whole width of the slot.
- The Cool Tool is a specific tool, which is rather akin to a torquing key (Figure 8.5). Dwight Damon has developed this instrument for engagement of wires, via balanced pressure on both sides of the bracket. The Engage-R tool (Figure 8.6) has recently been developed; it resembles a double ligature tucker and works in the same way (GAC International Inc, USA). These specific tools work very well and can reassure the clinician that slide closure is not being attempted over an incompletely seated wire. They can also assist with cheek/lip retraction during slide closure and such a

Figure 8.5

The Cool Tool for full archwire engagement to permit slide/clip closure. Each arm of the working end of the tool has a notch to locate the tool on the archwire.

Figure 8.6

The In-Ovation engage R tool for use with the wire engagement end of the tool.

tool is firmly recommended as a routine part of slide closure on teeth where the wire requires lingual pressure for full engagement. With thermally active wires, it is theoretically easier to insert a wire in some awkward teeth if the Cool Tool is kept in the freezer (as its name suggests). It is questionable how effective or desirable this cooling strategy is.

- Whereas engagement of an irregular tooth with an elastomeric ligature can involve considerable pulling on the tooth, with a self-ligating bracket, a pushing force is required. Reduction of a pulling force on the tooth when placing an elastomeric is difficult, but it is easy to reduce the net push on the tooth when engaging a wire in a self-ligating bracket—use a labio-lingual '*squeeze technique*'. As you push from the labial (e.g. with a Cool Tool), also push the tooth from the lingual/palatal with a thumb of the same hand. The net force on the tooth is greatly reduced and the wire is fully engaged more easily and comfortably. The Engage-R tool is too long to fit in the palm and so does not lend itself to the squeeze technique.
- If the tooth is very rotated and one end of the slot is too close to the adjacent tooth for an instrument to be used to seat the wire, dental floss or a ligature wire looped over the archwire can be used to pull the wire lingually/palatally and fully engage the wire on that side.

Pearl: Another useful manoeuvre on a very rotated or displaced tooth with any self-ligating bracket, is to first close the clip or slide and then thread the aligning wire through the closed bracket before engaging the other brackets (i.e. to first convert it to a 'molar' tube!).

Closing the clip or slide

- Once the wire is fully engaged, In-Ovation brackets and Speed brackets can be closed with a finger. Care must be taken in the lower arch that these brackets are not inadvertently closed by finger pressure before the wire is inserted.
- Damon2 brackets can easily be closed with ordinary light-wire or bird beak pliers.
- Damon also has specific pliers, which resemble a modified distal end cutter. This has narrow serrated 'beaks' and works well.
- Another specific tool for Damon2 brackets is the double-ended tweezers, which combines a locating tool similar to the Cool Tool and a tweezers action to close the slide (Figure 8.7). The tweezers must be squeezed close to the bracket to easily provide the required force and control. It must also be placed fairly precisely at a right angle to the bracket, so a diagonal approach to a posterior tooth is not possible. It has not proved widely popular, but some clinicians firmly prefer it to other instruments.

Figure 8.7

The double-ended Damon opening and closing tool.

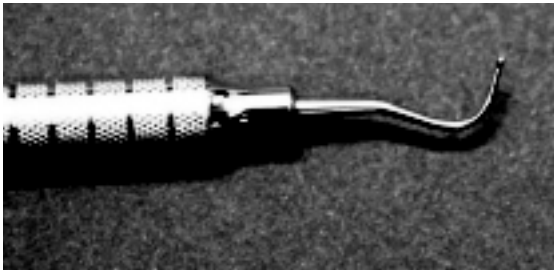


Figure 8.8

Engage-R tool for use with the In-Ovation bracket. Showing the wire-engagement-end of the tool.

Tips if the clips or slides are hard to close

- Ensure the wire is fully engaged.
- If there is real suspicion that there is something jammed in the clip or slide mechanism, remove the archwire and try to close the bracket with no archwire in place. This is rare.

Opening clips/slides

- In-Ovation brackets are opened by pushing in an occlusal direction on the tail of the clip behind the bracket. Specific instruments are provided for this, which resemble a ball-ended probe, but a Mitchell's trimmer works well (Figure 8.8).
- Time and Speed brackets are opened with a probe or other fairly sharp instrument, such as a Mitchell's trimmer, using the labial hole in the clip. Speed brackets can also be opened in the same way as In-Ovation.
- Damon2 brackets can be opened with ordinary pliers. Specific Damon pliers, which were mentioned above and resemble modified distal end cutters, are slightly easier to use for opening the slides than non-specific pliers. They are recommended for the beginner, particularly for the lower arch. *Both types of pliers work better if there is a slight downward rotation to the opening movement*.
- Very specific and extremely effective pliers for Damon2 brackets are Kasso D2 pliers (Plydentco Inc, USA) (Figure 8.9). Importantly, no downward rotation is required when using these pliers to open slides. One pair of these pliers is very useful to have to hand for all first-time users since they make any awkward slide (such as some lower second pre-molars) very easy to open. The disadvantage of these pliers is the need to have a stock of a specific pliers.

Tips if the clips or slides are hard to open Most clips and slides open easily. The following tips will provide the answer when a bracket proves awkward to open.

In-Ovation brackets

Excess adhesive around the periphery of the bracket can hinder or prevent clip opening.

> **Pearl:** A very important tip is to avoid getting composite resin near the tail during bracket placement.

This problem is more difficult and more important to avoid in the lower arch where the tail is not visible from the operator's position.

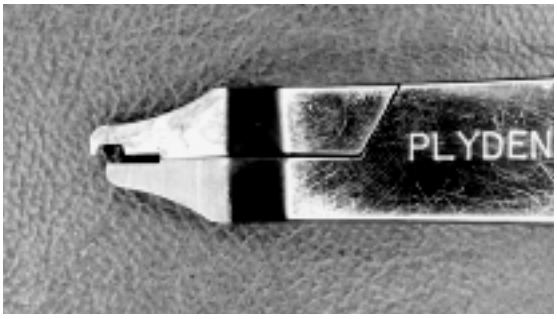


Figure 8.9

The Kesso D2 tool.

- Keep the opening instrument closer to a right angle to the tooth surface rather than parallel to the tooth surface. This prevents the instrument passing labial or lingual to the tail of the slide. Again, this is more important in the lower arch where the technique requires working by feel, the tails being invisible to the operator.

Damon brackets

The following remarks are more relevant for the lower pre-molars:

- Use a greater downward rotation of the pliers.
- Have a second opening move with the pliers. This usually works well.
- Place the lower beak of the pliers on the tie-wing rather than in the middle of the slide. This enables greater clearance between the pliers and the slide, the pliers being slightly diagonally placed across the bracket.
- Remove the archwire with the slide half closed. The slide can then be fully opened by twisting a flat plastic in the slot. This usually applies to lower pre-molars.
- Remove and replace the archwire with the slide fully closed (applies to pre-molars), treating it like a molar tube.
- Use the Kasso D2 pliers, which easily open any awkward brackets.

Prevention of Wire Pokes

Low friction increases wire displacement. Ironically, the problems of wire displacement resulting from low friction are perhaps the most convincing and immediate clinical evidence that the low friction found in laboratory studies is readily apparent in vivo. Even with very irregular teeth, the very low friction with self-ligating brackets enables aligning archwires to slip through the brackets and an archwire end to protrude. This is clearly a potential nuisance. Steps to prevent this can include:

- Using tiebacks with flexible wires over extraction sites to lessen the effects of occlusal forces on unprotected spans of archwire—particularly across lower extraction sites.
- Thorough turning in the ends of flexible archwires is favoured by some. Annealing the wire assists this, but this softening reduces the resistance to wire displacement. An interesting innovation in this respect is the Bendistal plier described by Khouri.[7] This is designed to place an effective distal end bend in a super-elastic wire without the need for over-bending which can be difficult and uncomfortable and also risks the loss of a bonded molar tube.
- Selective locking of individual brackets to the archwire with elastomerics can be helpful in those designs, which have a full conventional tie-wing assembly.
- Small V-shaped notches in the midline of flexible wires also limit the scope for wire swivelling. These are commercially available or can be bent into nickel-titanium wires with triple beak pliers. Pre-notched wires are more expensive. Sometimes, the notches are too large in the lower arch for the available inter-bracket span. Conversely, a small notch permits too much travel between the upper central incisors. This means stocking two types of notched wires for the two arches, which is a nuisance. Also, some notches can creep into the adjacent bracket and cause irregularity of that tooth. Finally, the notches are in the midline, and irregularity of the central incisors may dictate that this is not the site of choice. For all these reasons, I do not recommend this particular method.
- Small sections of stainless steel tube can be crimped on to the archwire. This is quick, easy, versatile and recommended for round archwires. You need to cut a supply of short lengths of stainless steel tube 0.5 mm (0.020 inches) internal diameter tubing is a good size for smaller diameter wires. With larger wires, 0.7 mm (0.028 inches) tubing is required, but a crimp-on hook may be a better option since it is harder to crimp tubing securely on to the flat surface of a rectangular wire.

Pearl: With all methods involving crimping on rectangular wires, one tip is to use a light squeeze from Mauns cutters to increase the bite of the crimp. This can help with recalcitrant crimp-on hooks used for other purposes.

- The neatest solution is probably the commercially available crimp-on split tube (3M Unitek). These can be squeezed on to almost all wires, require no fabrication, and are unobtrusive and effective. However, cost is a factor. Unitek wires are inconveniently supplied in a continuous strip, which means an extra step in making the stop available and hinders cross-infection control.
- A button of flowable composite (Kerr Revolution 2, Kerr Dental Products, USA) can be bonded to the archwire. *It is important that the archwire is dry*. A thicker composite can be used and then moulded with a sponge-tip dipped in a bond enhancer such as Ortho-Solo.
- It is recommended that the stop not be placed on a significantly active part of the archwire. This would diminish the range of action of the wire where it is most needed. If this is not a factor, the lower stops can be conveniently placed in the midline and the upper stop between pre-molars. If a stop is placed next to an upper central incisor, two stops are frequently required to adequately restrict the travel.

Changing Treatment Mechanics

It is useful to briefly list some of the ways that treatment can be changed to take advantage of the combination of low friction and full, secure bracket engagement. Use an archwire sequence that plays to the strengths of self-ligation.

Archwire sequencing is a little different with self-ligating brackets principally because of their full control between bracket and archwire and the need for full engagement of each wire. It is important to give each archwire time to work out fully, so treatment intervals of 10 weeks are suggested. For patients with very irregular teeth, it may be necessary to continue the initial archwire for more than one visit. The emphasis is on light forces and giving the archwires the time to fully express their potential aligning capacity.

The primary recommended archwire sequence is as follows:

- 0.356 mm (0.014 inch) nickel-titanium super-elastic of medium stiffness. This wire gives very low friction and permits excellent unravelling of irregular teeth as they elbow past each other. It is possible to start with a thicker but softer wire [e.g. 0.5×0.5 mm (0.020×0.020 inch) nickel-titanium of a nominal 100 gm or light force]. This thicker wire will put approximately the same force on the teeth with a potentially larger range of action coming from the larger diameter. However, for markedly irregular teeth, this must be balanced against the greater binding arising from the slots being more filled by wire. This balance is an area of interest as clinicians gain more experience with these brackets and wires.
- 0.356×0.635 mm (0.014×0.025 inch) or 0.406×0.635 mm (0.016×0.025 inch) nickel-titanium super-elastic wire. The 0.635 mm (0.025 inch) labio-lingual dimension is a big factor in ensuring easy engagement of the subsequent stainless steel wire. The smaller of these two wires is generally preferred as providing a lower, more gentle force. Sometimes, 0.457×0.635 mm (0.018×0.025 inch) wire is a good intermediate step before the next working wire.
- 0.483×0.635 mm (0.019×0.025 inch) stainless steel wire.
- 0.546×0.635 mm (0.21×0.025 inch) beta-titanium wire as a means of fully expressing torque.

Use more traction on lighter wires

The increased effectiveness of light forces and the decreased loss of control combine to enable more mesio-distal tooth movement to be sensible on lighter, more flexible wires. Compressed coil springs to move teeth apart can appropriately be placed from the first visit in many instances.

Employ longer appointment intervals

The ability to ensure full and secure wire engagement of modern, low modulus wires makes an extension of the interval between appointments a logical step: 8- to 12-week intervals are usually appropriate.

Separate movement of individual teeth

The control of rotation during traction on an individual tooth makes this option much more attractive when required. Controlled movement along the archwire of individual teeth can conserve anchorage in a variety of situations, without a penalty in loss of tooth control or disproportionate lengthening of the treatment (e.g. when correcting centre-line discrepancies).

Parallel processing

These mechanical features make it sensible in some malocclusions to separately retract canines to a Class I relationship whilst reducing the overbite. By the time the overbite reduction permits upper incisor retraction, the canines are already Class I, but in good rotational control, and the case is further advanced with anchorage conserved.

Squeezing teeth into alignment

Crowded teeth align much more rapidly. If the clinician wishes to align crowded teeth without making space with extractions, these brackets greatly facilitate the alignment.

Summary

Currently available self-ligating brackets offer the very valuable combination of extremely low friction and secure full bracket engagement. These developments offer the possibility of a significant reduction in average treatment times and also in anchorage requirements, particularly in cases requiring large tooth movements. There is a learning curve with these brackets and it is hoped that the tips in this chapter help the newer user of self-ligation to get more quickly into their comfort zone when using these appliances. Also, it is hoped that the tips suggesting changes in emphasis of biomechanical strategies help to deliver the full potential of these brackets.

BONDING PROCEDURE

Since the development of the acid-etch technique by Buonocore in 1955,[8] followed by the development of the Bis Gma resins by Bowen in 1963,[9] there have been numerous developments and refinements in both the technique and materials available for bonding orthodontic brackets to enamel, these have been extensively reported in the literature. However, despite all the improvements that have taken place over the last forty-odd years, bonding brackets to enamel still remains a very technique-sensitive procedure.

Apart from the large family of conventional light and chemically cured resin bonding materials, resin modified glass ionomer cements are also used for bonding brackets.[10]

Recently, the advent of a moisture-insensitive primer and bonding material has introduced a variation, which facilitates the clinical procedure. However, the reliability and bond strength achieved with this technique over the full duration of clinical treatment has yet to be established. It is possible that as further research data come to light this group of moisture insensitive primer and bonding materials may replace the current bonding resins.

Pearl: The key features for successful bonding to enamel are, good isolation and maintaining a dry field. If either of these is compromised, the bond strength will be reduced and the bracket will fail.

Isolation

There are many ways and aids to assist in isolation. Lip retractors of various shapes and sizes are available from most dental

companies; they are an essential requirement and no bonding procedure should be attempted without lip retractors in place. Cotton wool rolls and dri-angles (Parotid shields) may be used in conjunction with lip retractors to further assist in isolating either individual teeth or quadrants.

Controlling the position of the tongue during the bonding procedure is critical to maintaining a dry field. There are a number of plastic tongue guards incorporating bite blocks, which lie between the maxillary and mandibular molars. These auxiliaries come in different sizes and they serve a dual purpose, not only do they keep the tongue under control, but they also give the patient something to bite on thus stabilizing the mandible and making it much easier for the clinician to work on the mandibular teeth. A tongue restraining or guarding device such as the Tongue Away (TP Orthodontics Inc, USA) is very useful in preventing the tongue pushing saliva forward every time the patient swallows.

Full Mouth Isolation

John Hickham

I devised a dry field system that does not require cotton wool rolls, absorbent angles or drugs to be effective when used by a single operator.[11,12] The system has a unique ability to retract the soft tissues, produce an unobstructed view of all the teeth and prevent the tongue from contaminating the prepared tooth surfaces (Great Lakes Orthodontics, USA).

Once the dentition is isolated then start the standard procedure of pumice, wash, dry, etch, wash and dry thoroughly. With the direct bonding technique it is generally possible, as a single procedure, to isolate, prepare and dry all the teeth extending from second bicuspid to second bicuspid in both the maxillary and mandibular arches. If you intend bonding molar teeth, the maxillary and mandibular molars on left and right sides should be done as two separate procedures.

Pearl: When cleaning the tooth surface with pumice, use a rubber cup rather than a bristle brush. With a rubber cup it is possible to get very close to the gingival margin without traumatizing the soft tissue.

Preparing the surface close to the gingival margin is often necessary, particularly on bicuspid and molar teeth. If you use a bristle brush cup, the bristles can easily scratch the gingival margin and start gingival bleeding and seepage particularly if there is some gingival inflammation. Once there is marginal bleeding or seepage, the integrity of the bond will be compromised, you either have to wait for the bleeding to stop or you end up placing the bracket closer to the occlusal aspect than the case requires.

The final drying stage should not be rushed, each tooth must be well dried, check carefully to see that there is no saliva being pushed by the tongue through the interdental spaces and that the surface is dry right down to the gingival margins where necessary. The air-line should be free of moisture or oil, if in doubt use a hair drier with an adapted nozzle (Great Lakes Orthodontics, USA). As an alternative you can make your own using a conventional hair drier with an adapted inverted funnel attached to the front nozzle of the drier (beware of over-heating the drier).

Irrespective of which adhesive system you choose to use, make sure that the adhesive is 'well buttered' into the stainless steel mesh or the retentive surfaces of the ceramic brackets.

Start bonding from the lower left and move around to the lower right then follow on from the upper left to the upper right. If you bond the incisor teeth first, then as you move distally to bond the posterior teeth, particularly on the left, there is a danger that your fingers or instruments may displace or disturb the anterior brackets just prior to their setting.

Pearl: The mandibular arch is always at greater risk of moisture contamination and should be bonded prior to the maxillary arch.

Take time to accurately check the position of the bracket on each tooth. It is helpful to have the study models at hand, small deviations in

tip and rotations are not always clearly visible intra-orally at the time of bonding, they are more clearly noticeable on the models. When placing brackets on the teeth, it is helpful to view the bracket not only from the side, but also from the occlusal aspect.[13]

In an attempt to increase the resistance of the labial enamel to decalcification, Bowman recommends that immediately following the bonding procedure, while the teeth are still isolated and dry, a fluoride varnish is applied to the labial exposed etched enamel surrounding the bonded bracket.[14]

Bonding Brackets and Tubes

Luc Dermut

When bonding brackets, push the bracket firmly against the tooth surface. There should be enough bonding material to create excess around the bracket margin. Remove all excess before curing the material. This procedure saves time when debonding (less material to remove) and contributes to better oral hygiene.

When bonding buccal tubes, parotid shields are useful to control the flow of saliva from the parotid gland. The patient's head should be tilted to the other side so that saliva flows away from the tooth being bonded.

Single Arch Bonding

Ronald Melville

If only the mandibular arch is to be bonded, do not stick rigidly to conventional bracket height placement. Brackets should be kept out of the occlusion and archwires modified accordingly in order to maintain the relationship with the maxillary teeth if the original intention is not to change this relationship.

Pearl: When placing brackets always match the bracket height with the opposite side (e.g. if the maxillary right canine is being bonded, compare its height to the bracket previously placed on the left canine).

It is quite easy to have bracket heights running up or down from one side to the other if this is not checked, particularly if 'eyeballing' is used to place brackets. This type of error can result in changes to the cant of the occlusal plane when viewed from the front.

If only a few brackets are being placed to align a single tooth (e.g. placing brackets from mandibular canine to canine, to align an incisor), always contract the sectional archwire to prevent the canines from moving buccally.

Always telephone patients or parents a day or two after appliances have been fitted and enquire how they are getting on. Patients greatly appreciate this type of concern.

Molar Attachments

Attachments to molar teeth, such as buccal tubes or lingual buttons, may be either spot-welded to stainless steel bands or bonded directly to the enamel surface, the latter procedure is increasing in popularity. I still prefer, where possible, to use buccal tubes and lingual attachments pre-welded to stainless steel bands.

The prescription for the buccal tube will depend on your philosophy and the system you use. You have the choice of using single, double or triple tubes, whichever you choose, it is essential to select the correct torque, distal offset and tube height.

Irrespective of whether your treatment plan requires the use of headgear or not, it is advisable to use double as opposed to single buccal tubes on maxillary molars.

Pearl: Having that extra auxiliary tube increases the versatility of your appliance and provides you with the flexibility of incorporating many auxiliaries at any stage during treatment (Chapter 9).

ARCHWIRES

Orthodontists today have at their disposal a multitude of wire sizes, shapes and metals.

There is no doubt that the new flexible nickel-titanium based wires must be considered as one of the major milestones in the continuing advancement and development of orthodontic materials. These new generation wires are available as standard nickel-titanium, superelastic nickel-titanium (i.e. changes its state from austenitic to martensitic), heat-activated nickel-titanium and copper-nickel-titanium wires. The degree of flexibility of these wires provides the clinician with the means of engaging an archwire into severely displaced teeth and yet still delivering a light continuous force over an extended period of time; a feat not possible with conventional stainless steel archwires.

Both stainless steel and nickel-titanium based wires are commercially available in preformed format varying in sizes and arch shapes. However, for those clinicians who wish to bend and form their arches either from straight lengths or spools, nickel-titanium poses a problem. Conventional stainless steel wire can be formed using a turret or contouring pliers; neither of which can be used with nickel titanium wire.

Contouring Nickel-Titanium Wire

To form a nickel-titanium arch from a spool or straight length, measure the arch length required either on a study model or directly in the mouth, add 2 cm and cut off the measured length of wire from the spool.

> **Pearl:** Hold each end with an artery forceps or any convenient pliers and pull the length of wire backwards and forwards over a round peg 3–4 mm (0.12–0.16 inches) in diameter.

Any round peg may be suitable; I have used the copper post of an annealing jack on a spot-welder as well as the spout of a triplex air water syringe. The degree of arch curvature obtained will depend on the tension applied at the two ends of the wire, the diameter of the peg and the frequency of drawing the wire over the peg (Figure 8.10a, b). Pulling the wire over the curved 'beak' of contouring

(a)

(b)

Figure 8.10

(a) Contouring nickel-titanium wire by drawing a straight length over the nozzle of a triplex syringe or any round tube or peg. (b) Contoured nickel-titanium arch superimposed on a model.

pliers or some other instrument, such as the blade of a flexible stainless steel cement spatula, can also curve straight lengths of nickel-titanium wire.[15] The arch should then be fitted into the buccal tubes, and cut to the correct length with 2 mm (0.08 inch) excess at either end.

The distal ends must be annealed using either an annealing jack, a flame from a soldering torch or a cigarette lighter. If necessary, the buccal sections of the arch may be straightened by counter-curving the wire through the finger and thumb. Once the arch has been tied in, the annealed distal ends should be tucked in to prevent the arch from sliding out of the molar tube. The same technique can be used to place an increased or reverse Curve of Spee.

Straight stainless steel wires may be contoured with either a turret, contouring pliers or pulled over a post as above, however, the diameter of the peg or post must be much greater (1.5–2.0 cm, 0.6–0.81 inch) than that used for nickel-titanium wires.

Measuring Arch Length

Direct technique

This involves measurement directly in the mouth; the archwire is slipped into the buccal tube and one side and the length is estimated for the other side. It is usual to overestimate and then cut off the distal extensions. The disadvantage of this technique is the risk of irritation to the mucosa and gingiva distal to the terminal tooth. The archwire can be marked with a wax pencil where required for specific bends and offsets.

Indirect technique

The commonest method is to form and measure the archwire along the circumference of the dental arch on the patient's study models. A more accurate and more detailed technique has been described by Ribeiro.[16] She used a disposable plastic ruler held along the circumference of the dentition. Measurements are made from the midline to points where archwire adjustments are required. The data are then recorded on a paper Brader archform sheet with a millimetre scale. The archwire is superimposed over the selected archform and the relevant marks are transferred to the archwire using a wax pencil. Baccelli uses a thin strip of carding wax;[17] this is placed in the mouth along the circumference of the dentition, the wax is pressed on to the brackets and tubes, removed from the mouth and flattened. The archwire is placed over the wax strip and cut to the required length; the midline and the position of any bends are marked on the wire using a wax pencil.

The development of thermo-sensitive wires has added a further dimension to the armamentarium of archwire materials available.

Stabilizing Nickel-Titanium and Light Stainless Steel Arches

Apart from tucking in the annealed distal ends, there are other aids for preventing nickel titanium arches from sliding around the arch circumference.

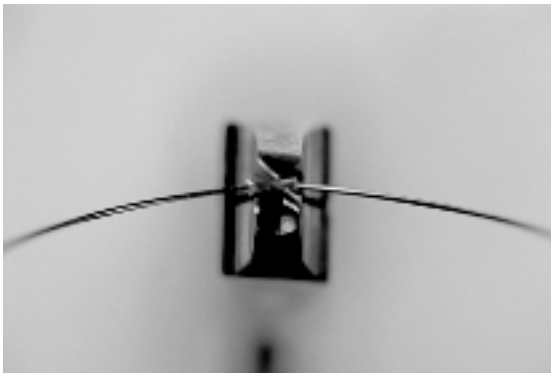
- A dimple or a notch can be placed in the arch using commercially available pliers (Figure 8.11a).
- Using a cutting disc, pre-cut and keep in stock, a number of 1–3 mm (0.04–0.12 inch) lengths of stainless steel tubing, internal diameter of 0.635 mm (0.025 inch). The archwire may be threaded through a small piece of stainless steel tubing, which is then crimped on to the archwire using crimping pliers.

Pearl: These aids are usually placed in the midline as are the dimples on pre-formed arches. However, if the central incisors are displaced, the tooth alignment is more efficient if the inter-dental arch section is straight and not dimpled.

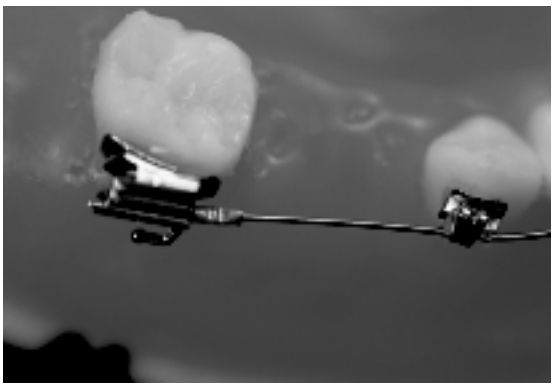
In such cases, the dimple or steel tubing can be placed between any other teeth that are in good alignment. Which teeth are involved is irrelevant, as long as the

mechanism prevents the wire sliding (Figure 8.11b).
- It is also possible to crimp a short piece of stainless steel tubing on to the archwire just mesial to the left and right molar tubes. This will prevent the arch from sliding around (Figure 8.11c).
- Crimp on the archwire short (1.25 mm, 0.05 inch) lengths of (0.457 mm, 0.018 inch) diameter stainless steel tubing (American Orthodontics, USA) this stop fits between the wings of a twin central incisor bracket.[18]

(a)



(b)



(c)

Figure 8.11

(a) Pliers used to place a notch (dimple) in a nickel-titanium archwire. (b) Pliers used to crimp a stainless steel tube stop in the midline of a nickel-titanium archwire. (c) Crimped stainless steel tube stops placed mesial to the first molars of a nickel-titanium archwire.

Lip Protection

Glen W Cooper

When a bracket de-bonds or a tooth is too rotated or crowded to bond and the archwire may produce lip trauma particularly in the lower labial segment, this section of wire should be threaded through latex tubular sleeve. The latex sleeve should be cut 1–2 mm (0.04–0.08 inches) longer than the available inter-bracket distance and compressed slightly on tying the wire to the brackets. This not only acts as a lip protector, but also has a limited expansion action similar to a compressed coil spring.

Strengthening a Span of Unsupported Archwire

P Jonathan Sandler

In extraction cases or when the pre-molars have not been bonded, there is a long span of unsupported or untied buccal archwire. In view of the flexibility of nickel-titanium or light stainless steel archwires, they may be sufficiently distorted or displaced during chewing to allow the distal section to slip out of the buccal tubes. The lower arch is particularly susceptible to this problem. To increase the rigidity and stability of these archwires,

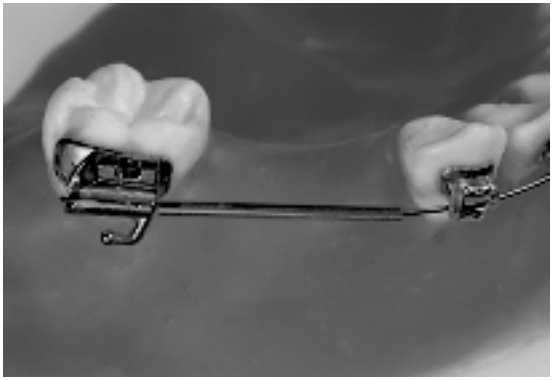


Figure 8.12

Stainless steel tubing reinforcing the buccal sections of a nickel-titanium archwire.

the buccal sections of the archwire are threaded into measured lengths of stainless steel tubing extending from the canine to the molar. The rigidity and stability given to these sections of the archwire by the stainless steel tubing prevents the wire from slipping out of the buccal molar tubes. Stainless steel tubing of 0.9 mm (0.036 inch) internal diameter may be pre-cut in lengths of 6, 8, 10, 12 and 14 mm (0.24, 0.32, 0.40, 0.48, 0.56 inch) (Figure 8.12).

In mutilated dentitions, involving the loss of teeth and in cases where over-erupted teeth impinge on to the buccal archwire of the opposing arch, the buccal segment of the archwire should be stepped down or up, away from the occlusal plane into the buccal sulcus and the horizontal section of wire may be reinforced with stainless steel tubing as described above (Figure 8.13). This archwire design cannot be formed in nickel-titanium wire.

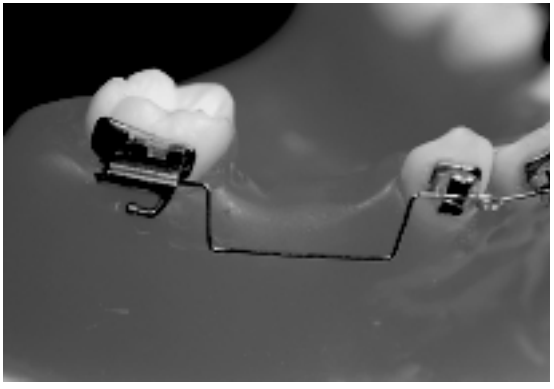


Figure 8.13

Buccal step-down bend in a stainless steel archwire to avoid occlusal impingement.

Archwire Size

Glen W Cooper

Following dental alignment with nickel-titanium archwires and prior to placing stainless steel archwires, the study models are measured against a template for archwire size using the lower model that best fits the template. I use a Euroarch guide (Precision Orthodontics, UK). The template size is recorded on the patient's notes and all further archwire changes are maintained at that size.

Reinforcing elastomeric thread

In cases where it is necessary to attach elastic thread and access is difficult such as with impacted or rotated teeth, a 0.254 mm (0.010 inch) ligature wire is threaded through 0.635 mm (0.025 inch) E-Z tie tubing. This makes the elastic thread more rigid and it can be formed into a hook shape and threaded through attachments. Once the elastic thread is in position, the ligature wire is pulled out of the elastic tubing and tied as required.

Sharps disposal

All cut wire-ends, old archwires, de-bonded brackets and bands are placed in a container (I use a disposable plastic cup in a cup holder) that rests next to the instrument tray on the work surface or bracket table. This container is emptied into the 'sharps' container at the end of each session. This reduces the risk of injury to the assistant, particularly when cleaning the instrument tray, and keeps the tray tidy during treatment. The assistant also knows that any wires, brackets or bands left on the tray are for sterilization and not for disposal.

Selection of Coloured Elastomeric Ties

Robert A Katz

The use of elastomeric ties is commonplace in current fixed appliance therapy. Coloured elastomeric ties appeal to younger patients and the variety of colours available requires the patient to make a choice. To assist in this process, we have devised the following chart:

> Construct a mini-grid using a spreadsheet program with the colours you stock evenly spaced out; print the sheet. We only stock about 10 colours at any one time. Cut some (6–8) elastomeric ties and stick them to the sheet in their relevant block. Back the sheet on to cardboard and place it in a self-seal plastic bag which should be changed periodically. We give these out to the patients or leave them in the waiting room area so they can choose a colour while waiting. This encourages patient participation and saves a lot of time (Figure 8.14).

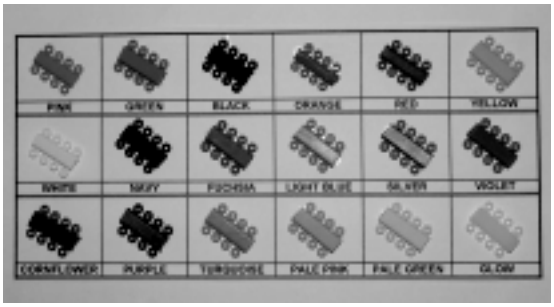


Figure 8.14

A selection of coloured elastomeric modules.

INTRA-ORAL ELASTICS

The use of intra-oral elastics is an essential element in the treatment of different malocclusions. Your appliances should provide the facility to use intra-oral elastics to generate forces in any direction you require. These elastics can be used for the movement of the entire dental arch or individual teeth in all three planes of space.

Apart from the variations in force direction, there are variations in force levels that need to be carefully selected and monitored. It is important to appreciate and differentiate between the force levels required for regular edgewise appliance systems, and light-wire systems, such as the Tip-Edge technique. With the edgewise appliance, a high percentage of the force generated by the elastic is lost in overcoming the friction between the archwire and the bracket. In a light-wire free crown-tipping appliance, most of the elastic force is utilized for tooth movement as opposed to overcoming friction. Consequently, the force values used are lighter (42–56 g, 1.5–2 ounces) per side for retracting six anterior teeth than those used in conjunction with the edgewise appliance.

When selecting elastics it is important to determine which tooth movements are required and evaluate the role of friction within the appliance system.

> **Pearl:** Excessively heavy elastic forces can produce undesirable side effects, such as alteration in the cant of the occlusal plane, mobility and sensitivity of individual teeth, extrusion of teeth and possibly a degree of root resorption.

For efficient tooth movement, elastics need to be worn 24 hours a day; intermittent wear of elastics is not conducive to smooth continuous tooth movement. Once a goal has been achieved, such as a reduction in overjet, then wearing elastics at night only will hold the teeth in the present position rather than move them further.

The force level of elastics reduces as the elastics degenerate in the oral environment; they need to be changed daily or every second day to maintain a reasonably constant force level.

Placing elastics correctly requires a degree of manual dexterity, which some patients struggle to find. Patients should be instructed carefully in placing and removing elastics. It is essential that the patient can place the elastics before they leave the practice. If a patient arrives for their routine appointment without the elastics in place, you can assume that there

are many other occasions when they leave the elastics off.

Pearl: The patient, and where applicable the parents, need to be instructed in the importance of elastic wear to the treatment progress.

Elastics Wear

Matie Grobler

If the patient needs to remove the elastics to eat and brush his or her teeth, the elastics should be placed on a finger so that he or she remembers to replace them straight after eating or brushing teeth.

Compliance with Elastics Wear

Luc Dermut

If you believe that a patient is not wearing intra-maxillary elastics, but he or she says they do, place an elastomeric tie on the one side but do not tell them. If at the next visit, that side has improved more than the other side, then you will have some evidence with which to confront the patient.

Non-compliance Appliances

Since the revival of the Herbst appliance by Pancherz in 1979,[19] this type of appliance has become more widely used. Currently, there are many variations of non-compliance appliances commercially available for the correction of Class II and III dental relationships, a description of these appliances falls outside the scope of this book.

The recent introduction of implants as a means of securing stationary skeletal anchorage may also fall under the umbrella of non-compliance appliances. Both the conventional osseo-integrated implants designed as permanent tooth replacements and the more recent temporary mini-screw implants designed to be removed after a few months, provide stationary skeletal anchorage.[20–23] This field of mechano-therapy is comparatively new in orthodontics but will undoubtedly become more widely accepted and used particularly as an adjunct to conventional appliances in adult orthodontics.

ORAL HYGIENE

Maintaining good oral hygiene throughout treatment is a continuing issue in orthodontics. Some patients need to be told and instructed only once and they manage to maintain excellent oral hygiene, their appliances are always clean and shining, the gingival margins are pink, firm and healthy. By contrast, there are the group of patients who, no matter how often you instruct and how often you admonish, still have plaque on their appliances and teeth; their gums are swollen, inflamed and bleed easily. Fortunately, this latter group are in the minority; most patients, with supervision and reminding, manage to maintain a reasonable standard of oral hygiene.

The importance of maintaining good oral hygiene throughout orthodontic treatment is first explained and stressed at the case discussion. It is then incumbent on the clinician or the ancillary staff to instruct the patient, usually at the banding appointment and then to monitor the standard at each appointment. There is extensive literature on the risks of poor oral hygiene as well as the techniques and aids available to promote and maintain a healthy oral environment.

At the banding appointment we give our patients an oral hygiene pack containing the following: conventional toothbrush, travelling toothbrush, toothpaste, fluoride mouthrinse, disclosing tablets, super floss, mouth mirror, protective wax and literature. The patient is instructed on brushing and flossing techniques and told to carry the travelling

toothbrush at all times. They are informed that when at school or out socially it is not necessary to carry toothpaste, using the brush and water is adequate. As evidence of carrying the toothbrush with them, they must have it with them at every appointment and they must brush in the surgery before any treatment is started. If they do not bring a brush to their appointment, they are expected to purchase a new one at the reception desk. This regime applies to both children and adults. In adult malocclusions where large interdental spaces are present, the use of interdental brushes can assist in the maintenance of good oral hygiene.

Pearl: If oral hygiene is assessed to be inadequate at any stage during treatment, it is essential that this is noted on the treatment card and both patient and parent informed.

At first, a verbal discussion should take place but then if the problem persists, a letter should be written to the parent informing them of the problem and pointing out the risks and reminding them of their original commitment to full cooperation. Some clinicians would copy such a letter to the referring dentist.

At the start of treatment, we request that each patient obtains a lighted magnifying mirror. This can be a 'make-up mirror' for a girl or a 'shaving mirror' for a boy. The important point is not the name used, but the fact that there are lights at the level of the mirror and the image is magnified for the patient. This allows patients to see past the incisors and clean more carefully around the posterior teeth and appliances. In reality, we instruct our patients to brush using their normal mirror and to use the magnifying mirror as a check. They must do the 'magnified check' twice a day.

Prior to going to bed, each patient must use an oral fluoride rinse to further help protect the teeth.

All patients are on minimal four month recall appointments for prophylaxis, further decreasing the potential risks of undiagnosed decalcification or caries.

Certainly not every patient follows the hygiene recommendations. However, we 'grade' the patient at each appointment and thus are able to assess when care is inadequate and communicate our concerns with the patient, parents and family dentist. The result is that we rarely see serious gingival problems and almost never have concerns with decalcification and/or caries in our practice.

Oral Hygiene Maintenance

Lee W Graber

One of the major concerns for patients in fixed appliances is the response of soft and hard tissues to retained plaque. We are well aware that often patients are at risk for increased caries with or without appliances. The placement of attachments to the teeth just makes the problem worse. As a result of concerns for tissue hypertrophy, decalcification and caries, we have adopted the following protocol in our office. The results have been excellent, with local dental colleagues who provide general dental and prophylaxis service reporting our patients to be the best they see.

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9 ORTHODONTIC AUXILIARIES

A major component of contemporary orthodontic mechano-therapy is based on the principles of prescription appliances where tip, torque and rotation are incorporated into the brackets with archwires kept simple, requiring the minimum of bending.

Pearl: Unfortunately, nature is not as uniform as are our appliances, malocclusions are not all the same and a competent orthodontist still needs to know how to bend wires, modify arches and draw on components and auxiliaries that fall outside the realm of standard straight wire appliances.

As mentioned earlier (Chapter 8), irrespective of which philosophy you follow, the versatility of your appliance can be greatly enhanced by using brackets that incorporate a vertical slot. A number of the auxiliaries described in this chapter are designed to be used in conjunction with brackets incorporating a vertical slot; however, some auxiliaries can be modified to facilitate usage with conventional brackets.

DISTAL MOVEMENT OF FIRST OR SECOND MOLARS

That molars can be moved distally is unquestioned. However, whether it is always desirable to move molars distally is sometimes debatable and is dependent on the treatment philosophy of each clinician.

Many appliances have been designed for the distal movement of molars. This section presents a few of these auxiliaries designed as adjuncts to conventional fixed appliances.

Sliding Jig

There are occasions when a malocclusion presents with a unilateral cusp-to-cusp Class II molar relationship. The use of unilateral Class II elastics to an inter-maxillary hook, usually placed between the lateral incisor and canine tooth, may be effective for a very limited amount of unilateral correction of the canine and pre-molar teeth, but not for correction of the molar relationship.

Pearl: It is more efficient to direct the distal force generated by a Class II elastic directly against the molar tooth using a sliding jig. This auxiliary may be used either on the first or second molar tooth.

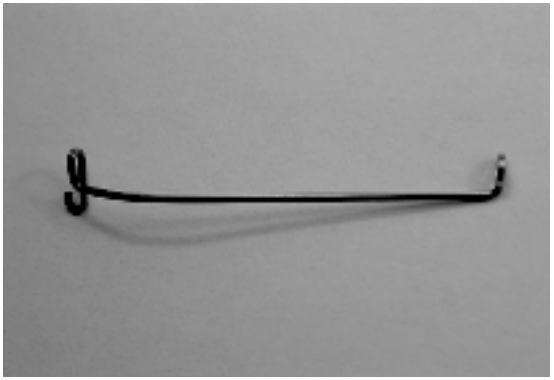
The auxiliary should be constructed using a relatively stiff wire, such as 0.457 × 0.635 mm (0.018 × 0.025 inch) or round 0.508 mm (0.020 inch). The design will vary depending on the molar buccal attachment.

Banded or bonded single buccal tube/ edgewise bracket

In cases where the buccal tube is less than 0.914 mm (0.036 inch) in diameter or where an edgewise bracket is being used instead of a buccal tube.

Construction (Figure 9.1a b)

- Bend an eyelet with a vertical post approximately 3 mm (0.12 inch) in height.
- Bend the horizontal arm at right angles to the plane of the eyelet.
- Place the eyelet hard up against the mesial of the molar tube or bracket with the horizontal arm extending mesially.
- Mark the horizontal arm at least 3 mm (0.12 inch) mesial to the canine bracket or as



(a)

(b)

Figure 9.1

(a) Sliding jig with eyelet. (b) Sliding jig with eyelet; the main archwire is threaded through the eyelet and the distal force is transmitted directly to the buccal tube on the second molar.

close to the distal of the lateral bracket as possible, remove from the mouth.
- At this point, bend the wire up at right angles to the horizontal section in the same direction (gingival) and plane as the vertical post of the eyelet.
- At a height of 3 mm (0.12 inch) bend the wire (towards the dental arch as opposed to the cheek) a full 180° to create a U-loop in the same plane as the eyelet with the long arm now extending incisally.
- Measure approximately 4 mm (0.16 inch) on this descending arm then bend a mesially facing hook.

Placement
- Slip the distal end of the main archwire out of the buccal tube.
- Thread the distal end of the archwire through the eyelet of the sliding jig.
- Replace the distal end of the archwire into the buccal tube.
- From the gingival, slip the anterior hook of the sliding jig over the archwire in an incisal direction. In a few cases it may be necessary to temporarily untie the lateral and canine brackets for this procedure.
- Once the anterior hook is in place, use a Howe or Weingart pliers to squeeze closed the gingival U-loop. This should prevent the hook from slipping up gingivally.
- The patient should now be able to attach a Class II elastic to the incisally and anteriorly facing hook.
- Check that the hook does not impinge on the cheek or gingiva.

Banded or bonded double and/or triple buccal tubes

Construction (Figure 9.2a b)
- Bend a 3 mm (0.12 inch) vertical offset in an occlusal direction.
- Place the distal end into one of the tubes not holding the main arch.
- Slide the vertical offset up against the mesial of the buccal tube.
- Mark and construct the anterior section as described above.

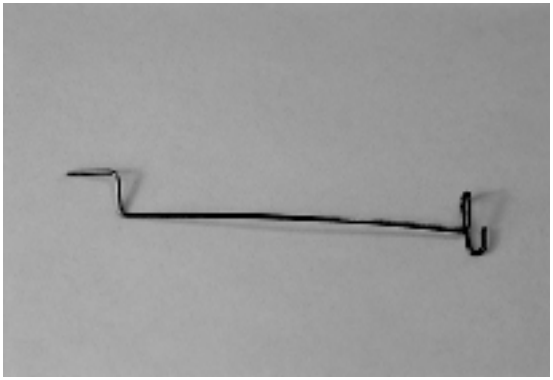
Placement

With this design it is not necessary to disengage the distal end of the main arch.
- Slide the distal end of the auxiliary into the free buccal tube.
- Slip the anterior section into place as described above.
- Make sure the distal extension of the jig is long enough to prevent the jig from sliding out of the molar tube.

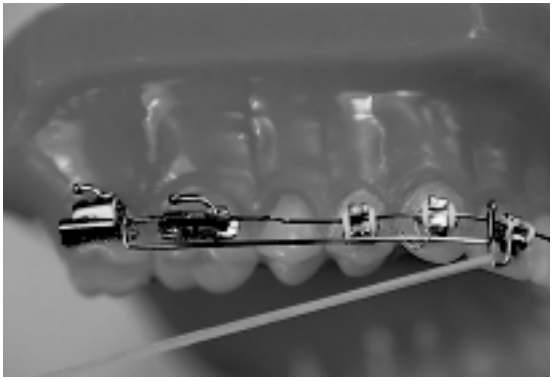
Banded or bonded single round buccal tube

The internal diameter of the buccal tube is 0.914 mm (0.036 inch) or greater.

The design and fitting is the same as for the double buccal tube (Figure 9.2). However, the



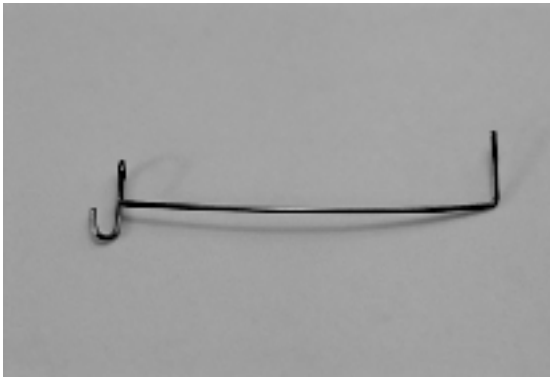
(a)



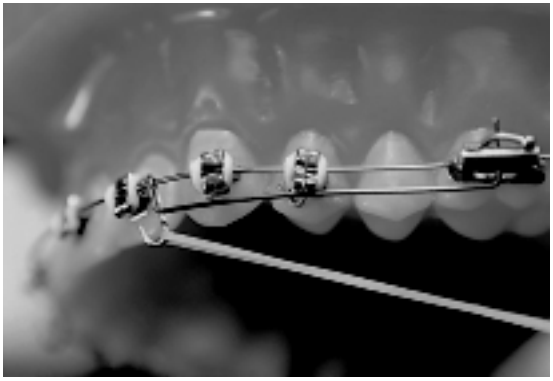
(b)

Figure 9.2

(a) Sliding jig with vertical offset. (b) Sliding jig with vertical offset; the vertical offset allows the horizontal arm to slide into the accessory buccal tube and the distal force is transmitted directly to the second molar.



(a)



(b)

Figure 9.3

(a) Sliding jig with vertical post. (b) Sliding jig with vertical post; the post slides into the vertical slot of the buccal tube or any other buccal attachment incorporating a vertical slot (twin bracket).

sliding jig wire size must not be greater than 0.508 mm (0.020 inch) in order to fit into the tube together with a 0.406 mm (0.016 inch) main archwire. The combined size of the sliding jig and the main archwire cannot exceed 0.914 mm (0.036 inch).

Banded or bonded buccal tube with a vertical slot

Construction (Figure 9.3a, b)

- The wire size of the jig must match the size of the vertical slot of 0.457 mm (0.018 inch).
- Bend a 3 mm (0.12 inch) vertical post at right angles to the main section.
- Slip the post into the vertical slot.
- Mark and construct the anterior section as described above.

Placement

- If the gingival margin of the band or tube is hard up against the gingival soft tissues or if there is gingival inflammation or hypertrophy, this design is unsuitable. However, provided there is adequate space between the gingival edge of the buccal tube and the soft tissue gingival margin, then from the

occlusal aspect insert the vertical post of the sliding jig into the vertical slot of the buccal tube.
- With a 'bird beak' pliers grip the end of the post protruding through the vertical slot of the buccal and bend it horizontally.
- Slip the anterior section into place as described above.

Advantages of the sliding jig
- It can be easily constructed at the chairside.
- It can be added to the current fixed appliance without having to remove or modify any component of the existing appliance.

Disadvantage of the sliding jig
- It requires the use of Class II elastics, which are in turn, dependent on patient compliance and anchorage considerations.

Removable Appliance

An upper removable appliance can be used in conjunction with conventional fixed appliances to assist in the distal movement of one or both maxillary molars. In the presence of a fixed labial archwire, it is possible to retain the removable appliance with ball clasps placed between the pre-molars. The retention can be further enhanced by the incorporation of an anterior bite plane. A palatal finger spring 0.66 or 0.711 mm (0.026 or 0.028 inch) active against the mesial surface of a molar will be effective in achieving the required distal movement.

The disadvantages of such an appliance are:

- The need to take an impression over an existing fixed appliance.
- In the presence of a tight contact it is essential for the finger spring to act first in a gingival direction in order to break through the contact point before it can be activated in a distal direction. In certain cases, the retention generated by the ball clasps will be insufficient to overcome the displacing effect of vertical activation of the finger spring.
- It needs to be constructed in a laboratory.
- The appliance may be uncomfortable.

Extra-oral Traction

The use of headgear for the distal movement of maxillary molar teeth has probably been the most frequently used adjunct to fixed appliance therapy over the last fifty years. Headgear was originally described by pioneers such as Farrar, Goddard and Kingsley and further modified by Angle in 1888.[1] The use of cervical headgear increased in the1950s following the work of Kloehn.[2] It is still widely used today, however, there is a perception that when possible, clinicians today may be seeking and using other alternative options.

Headgear (Rampton Headgear)

Demetri Patrikios

The main reason for using an extra-oral appliance, such as a headgear, is an attempt to find an area (a source of anchorage) from where we can exert a force to move teeth or prevent their movement, while the anchorage area itself does not undergo any adverse effect. Intra-orally there is no area that can provide a comparable stable source of anchorage. In certain cases, implants may possibly be an answer in the future, but currently, they are not used widely in routine orthodontics.

The main thrust of this section is the Rampton headgear which I will describe in some detail. I will point out the advantages of the Rampton and thus wish only to very briefly mention the other common headgears used and why I rarely use them.

Cervical headgear

This relies mainly on the posterior neck area as a stable base. The problems encountered here are:

- The neck is flexible and therefore not as stable as one would like. By bending the neck in various ways the patient can change the force applied. To reduce the force children commonly increase the spinal lordosis when sleeping. This also leads to neck and muscle ache.

- The length of the outer bow of the facebow can be dangerous as it can easily hook on to articles of clothing. Also, patients find it difficult to lie on their sides when sleeping, not to mention the changes in force distribution that occur with movement of the head while sleeping.
- The direction of pull leads to the upper first molar crowns tipping distally with the apices of the roots moving mesially. If these teeth are left with this inclination at the end of treatment, despite the crowns appearing to be in a Class I relationship with their lower counterparts, a cusp-to-cusp situation will develop as the upper molars upright during and after retention.
- In addition to the above, the upper first molars are also subject to extrusion under the influence of this type of headgear. In most Class II cases it is not desirable to increase the mandibular plane angle as this drives the chin point down and back increasing the lower face height. Naturally, there are some cases such as Class II division 2 malocclusions where we would like this to happen but these are in the minority.

Straight-pull headgear

This is similar to the Rampton headgear; however, I have found that the straps used are too narrow and too soft so that the force delivered is not as accurate or as constant as one would like it to be. Part of the headcap component fits around the neck, which is uncomfortable for the patient. Furthermore, the outer bow is generally still too long.

High-pull headgear

Two versions of this form of headgear are generally used.

- *Incorporating J-hooks*. This is generally used to depress maxillary anterior teeth, the J-hooks engage hooks soldered to the anterior part of the archwire. The risk of root resorption here is increased and pulling upwards on the anterior portion of the arch while the archwire is tied in to all the posterior teeth does not seem mechanically correct. I can envisage the posterior maxillary teeth having an eruptive force applied to them as the anterior teeth are depressed.
- *Incorporating a facebow*. The idea is good, but by using a facebow I feel it is difficult to avoid either mesial or distal crown tipping of the maxillary first molars. If you carefully examine the attitude and movement of the facebow under this type of high-pull force, you will soon appreciate the attributes and consequences of the force you are delivering to the maxillary molars. Again, I believe the facebow is too long.

Rampton Headgear

This headgear is one of the most useful extra-oral appliances I have used in my career as an orthodontist. In fact, it almost became the only extra-oral appliance I relied on to enhance maxillary anchorage, distalize maxillary molars, distalize whole buccal segments or even the entire maxillary arch. It is probably not as well known as, for example, the Kloehn-type cervical headgear and I only know of one company that markets it commercially (Oscar Inc, USA).

What is it about the Rampton headgear that makes it, in my opinion, so superior to other headgear appliances? Let me list the advantages:

- The sources of anchorage are the occipital and superior cranial areas of the head. These are 'immovable' and provide a solid anchor from where to deliver the force required and where the anchorage is harmlessly dissipated. That is, there is 'money in the bank' in this area.
- The material I used to make the 'headcap' portion of the headgear is wider and stronger than the average available straight pull-type headgears and hence provides increased stability and anchorage. Although the headcap component is available commercially (Oscar Inc, USA) I find the in-house custom-made version provides the necessary greater stability I seek. (I will be happy to provide details and directions for custom fabrication of the headcap component.)

- The outer bow of the facebow is much shorter than the usual facebows available and can be bent to closely follow the curvature of the cheeks (without touching them). This markedly reduces the chance of something hooking on to the facebow and injuring the patient. Also, when worn during sleeping, the patient can lie comfortably on their back or on either side without disturbing the appliance. The hook on the outerbow is adjusted to end at a point just mesial to the headgear molar tube (in the vertical plane). Under elastic traction this hook will come to be at the same level as the mesial opening of the molar headgear tube (Figure 9.4a, b).

(a)

(b)

Figure 9.4

(a) The Rampton headgear showing the soldered joint lying passively between the lips. (b) The outer bow is short and the hooks lie parallel with the cheeks.

Pearl: The outer bow hook is bent to lie parallel to the face (instead of horizontal as is usual with all facebows) so that it does not interfere or hook onto the pillow when the patient is sleeping. Also, while the patient is active during the day, the hook is not sufficiently prominent to hook on to extraneous objects, such as items of clothing, etc.

- Patients who have worn a cervical traction headgear and later a Rampton headgear have all expressed their preference for the latter, certainly from a comfort point of view, thus increasing the likelihood of compliance. In cases that require headgear therapy, I believe that it is incumbent on the orthodontist to do all he or she can to motivate patients to wear the headgear. All too often, the operator gives up and blames the patient for not wearing the appliance. I think we ought to look at ourselves more closely and develop techniques to improve rapport between our patients and ourselves. This requires knowledge and understanding of the psychology of teenagers and the ethnic and social environment in which they find themselves. In most cases, a sympathetic, understanding operator will eventually be able to gain the confidence and cooperation of patients under his or her care. It is quite amazing how teeth move once cooperation is established!

Pearl: The direction of force delivery must be well controlled.

In my view this is the critical factor in successful headgear wear. In most instances we require the maxillary first permanent molars to move distally while maintaining an upright position. Therefore, the force applied must be directed through the centre of resistance of the molar in question. Inappropriate direction of force delivery will result in mesial or distal tipping of the tooth crown, and concomitant undesirable root movement of the molars.

It is very difficult to determine the exact position of the centre of resistance of a given tooth. In respect of the maxillary first permanent molar, convention has it that the centre of

resistance is about where the bifurcation of the buccal roots occurs. When using the Rampton headgear, I have found it quite easy to arrange the outer bow and the boot hook on the headcap (as fitted in the custom-made version) in such a way as to have the distal force vector of the elastic traction passing through the centre of resistance. A practical method to achieve this configuration is as follows:

- Place the headcap on the patient (there is no boot hook on it at this stage).
- Fit the facebow in the usual way with the outer bow finishing just mesial to the corresponding headgear tube.
- Place headgear elastics on the facebow (e.g. Panther elastics supplied by Ormco, USA).
- Stand behind the patient, insert your index fingers into the elastics on both sides and pull distally, simulating the direction of pull that will be exerted by the headgear when fitted. At this stage the outer bow should be at the same vertical level as the inner bow. The anterior soldered joint of the facebow should rest passively between the lips so that upper or lower lips are not displaced vertically. By pulling on the elastic as above, the anterior portion of the facebow will either:
  - *bend upwards*—this indicates that the direction of pull you are applying is too high and will lead to mesial crown tipping with distal root tipping of the maxillary molar.
  - *or bend downwards*—this indicates that the direction of pull is too low and will lead to distal crown tipping with mesial root tipping.
  - *or*—by varying the direction of pull so that the anterior portion of the facebow tips neither up nor down but remains neatly between the lips (i.e. a 'neutral' position), the correct direction of pull will be determined and hence the position of where to attach the elastic to the headcap (boot hook as fitted in the custom made version) will have been determined.
- During treatment, this direction of pull must be checked at each visit. Variations can be made by adjusting the outer or inner bow accordingly, always looking for the 'neutral' position of the facebow as described. Sometimes, it may be necessary to change the position of the boot hook in order to vary the direction of the applied force.
- By placing two boot hooks on each side and stretching the elastic over both and hooking up to the outer bow, the elastic forms a triangle. The resultant force direction can be determined by bisecting the angle formed by the elastic at the outer bow hook. If the force vector passes through the centre of resistance of the molars, these teeth can be driven both distally and intruded in an upright position with no tipping. This facility is extremely useful in treating moderate anterior openbite malocclusions of skeletal origin.
- When the headgear is finally fitted, it should be snug and comfortable. Twelve hours wear (over a 24 hour period) should be sufficient to move the maxillary first permanent molars distally. Of course, the time needs to be adjusted according to the response of the individual patient to the applied force. If entire buccal segments are to be moved distally on sectional arches (from canines to second molars), 18 to 20 hours wear is required. The force required may be calculated on the basis of 71 g (2.5 ounces) per tooth involved.

Pearl: It is, of course, the wearing time that is the most important factor as opposed to the force applied.

A note on safety

Currently, there is the tendency to incorporate break-away elements between the facebow and cervical strap as a safety measure. This feature is designed to disengage the facebow if it is intentionally or accidentally pulled forward. Such an incident would be a rare occurrence and the break-away would not necessarily prevent any accidents. The length of the outer bow and how far it is situated away from the cheeks presents a real problem as almost anything can get accidentally

hooked on the outer bow. Where the outer bow ends, the hook is usually bent horizontally (as opposed to vertically with the Rampton facebow), almost inviting something to get hooked on to it, not to mention the problems of the pillow when the patient is sleeping on his or her side.

If the patient or parent reports that the facebow becomes disengaged during the night, it is important to ascertain if the patient is actively removing the facebow or if the break-away module is faulty.

I am much happier with the smaller Rampton facebow which fits close to the face and is positively held by strong rubber elastics to a strong well-fitting headcap and where the hooks on the outer bow are bent parallel to the facial skin rather than at right angles to it. The whole appliance fits so well that it is snug and comfortable and very difficult to displace.

For those orthodontists who feel that they must use a break-away mechanism, this can easily be incorporated on to the headcap. Instead of the boot hook, a loop of strapping could be attached at the desired angle. This loop may be stitched in place or simply attached by means of an eyelet set in place with a boot hook setter. The headcap, with loops incorporated for the break-away mechanism, is commercially available (Oscar Inc, USA). Unfortunately, these loops are not always exactly where you want them to be in terms of the direction of force applied and delivered. Hence, it is more reliable if one attaches them oneself.

Another protection mechanism is the plastic safety strap made by Masel (USA). This strap is simply placed around the neck and hooked on to the outer bow on both sides. This prevents the headgear from being accidentally removed.

Unfortunately, both the above mechanisms require the hooks on the outer bow to be bent out horizontally, thus increasing the chance that they can catch on something. It is all a question of what the orthodontist feels is the safest option. The patient and parents should be given to understand that they must accept the responsibility of ensuring the appliance is worn correctly and looked after with care.

General comments

At this stage I believe it is relevant to list some important points that experience has taught me over the years:

1. It is important to ensure that the parents, especially the mother, are in full agreement with you concerning the patient's wearing of the headgear. Some mothers get upset to see their child wearing a headgear. In these cases you have failed before you start because the mother's concerns are passed on to the patient (even though mother attempts to hide her feelings; children are adept in their ability to pick up on this) and the headgear will simply not be worn to prescription.

> **Pearl:** Hence, convince the mother first (in private if necessary) before any treatment starts. In fact, I tell them at the very first visit that there is a high probability that a headgear will be required during treatment.

2. When discussing the diagnosis and treatment plan, mention all the appliances to be used including the headgear. This often raises the question of whether there is a technique to avoid using the headgear. This would mean using Class II elastics or a Herbst appliance or altering extraction patterns. I personally do not like to deviate from a chosen mechanical procedure that has been worked out to give the optimal result with regard to the soft tissue profile and final occlusion. In addition, the above-mentioned alternatives have disadvantages of their own which may be undesirable. When pushed on the above points, I have often asked the parents whether the same arguments are used when a car is serviced. Do we insist that the motor mechanic is to use only certain selected tools? What about a surgeon? Do we stipulate what instruments he will be using to achieve a desired result?
3. Since we have the responsibility of providing the best result possible for the patient, it is a poor defence to say afterwards: 'You could have got a better result if only they allowed you to use a headgear'. In this

situation, I offer to refer the patient elsewhere if I could not choose the appliances I wanted to use in a particular case. Most simply agreed and stayed with me.

4. However young a patient may be, I always spent adequate time explaining why we need to use a headgear in their particular case. I stress the '*we*' in such a way as to make the patient understand that they and I are in this *together as a team*. I provide the appliance and guidance, they provide the effort and dedication and we both achieve a result. I get paid for it and they get to have their teeth in the best possible position for the rest of their lives. This is between you and the patient, and a special rapport should be established. They must regard you as a friend, easily approachable, and not the autocratic, aloof doctor (Chapter 7).
5. I make vigorous attempts to explain the mechanics involved, such as the matter of stable anchorage to move the teeth efficiently. A quick drawing or moving objects on a counter top does wonders for understanding the problems involved and creates an interest the patients like to follow. Again, the time involved reaps great dividends and is worth the effort.
6. I go through the wearing times very carefully and make sure the patient understands what 12 hours out of 24 hours really means. I check with them what they do during school hours, after school hours, homework time and TV watching, I work out when and how they can achieve their goal, starting with just two hours on the first day and building this up to the desirable numbers of wear hours. A chart is given to the patient for recording the wearing time. The most suitable is a firm card approximately half an A4 page size with divisions to clearly record dates and wearing times. The chart should also include motivating sentences that are short and to the point and remind the patient what *we* have already discussed and what *we* are trying to achieve.
7. Place the headgear, elastics and time chart in a special case that is then given to the patient. I use a bright soft plastic pencil case, which can still be used for other odds and ends after the headgear phase is completed. Exhort the patient to always keep the headgear, elastics and time chart in the case and to bring it to every visit without fail.
8. At each visit, the rapport with the patient must be renewed. Check the headgear, its direction of pull (as previously described) and adjust as necessary. Check the time chart and comment as necessary. Show the patient what has been achieved, show your pleasure and reinforce the commitment to achieving the desired tooth movements.

If any reader wishes to contact me in regard to this appliance or for detailed instructions on the fabrication of the headcap, I will be happy to provide the relevant information (see List of Contributors for address).

Length of Outer Bow Arms in Headgear Therapy

Luc Dermut

Translation of upper first molars by headgear therapy can be achieved by having the force application going through the centre of resistance of the first molar (trifurcation area). The length of the outer bow arms determines whether pure translation or tipping of the molars will occur.

To find the sagittal position (length of the outer bow) of the centre of resistance the following procedure may be adopted. By exerting a downward vertical force (with two fingers) on the outer bow arms starting from the connection between the inner and outer bow arms, the soldered joint will descend (Figure 9.5a, b). By moving both fingers distally, at a certain point, the soldered joint will remain at the same vertical position as before exerting the force (Figure 9.5c). This is the sagittal level of the point of force application. By moving the fingers more distally, the soldered joint will move in the opposite direction (upwards) (Figure 9.5d).

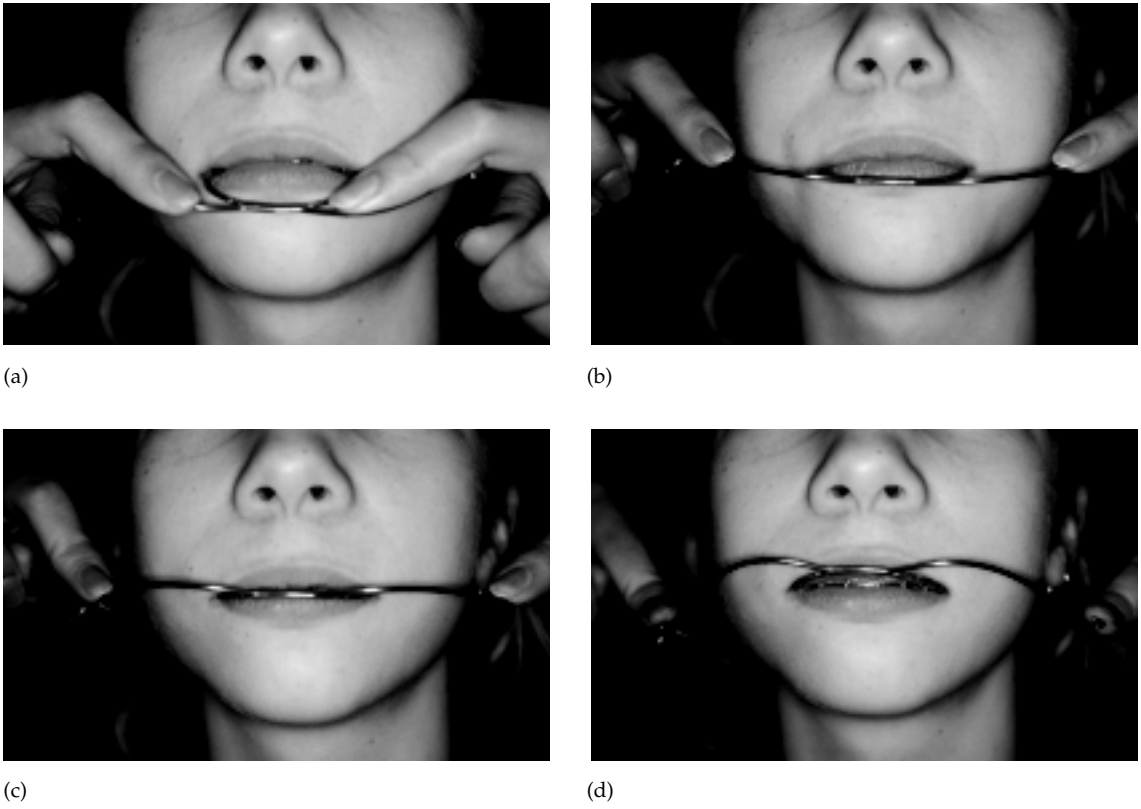


Figure 9.5

Technique for determining the length of the outer bow so that the distal force is directed through the centre of resistance of the maxillary molar. (a) Using two fingers, press down on the outer face bow near the soldered joint. (b) Slide the fingers distally and continue pressing down. (c) When the soldered joint reaches a neutral position between the upper and lower lips, the position of the fingers on the outer facebow determines the correct length of the bow. (d) Further distal movement of the fingers will move the soldered joint up onto the upper lip.

This procedure will assist the orthodontist to adapt the length of the outer bow arms to obtain the desired molar movement.

Headgear Safety—A Simple Solution

Tom Weinberger

As far back as 1975, the American Association of Orthodontists (AAO) issued a warning about the potential dangers of extra-oral appliances (EOAs).[3] Since then a number of surveys,[4–7] and many case reports,[5,8] have confirmed that the use of EOAs does present a finite risk of damage which cannot be ignored. The potential for injury to the patient can be divided into two categories:

1. The first category concerns the accidental removal of the inner headgear bow from the tubes on the molar bands or, if a removable appliance is being used, removal from the tubes soldered to clasps. This is usually the result of a force applied from the outside by someone or something pulling the bow forward either as a prank

or as the result of the outer wire bow getting caught up in an article of clothing. The elastic force of the neck strap or headcap pulls the wire bow backwards with considerable force and the exposed inner bow ends can cause penetrating injuries to the mouth, pharynx or, if the inner bow has come completely out of the mouth, to the face or eyes. The site of the injury is determined by the direction of the external force, low-pull or high-pull, and the distance that the inner bow disengages from the tubes.

A number of safety devices have been designed to prevent such accidents from occurring. The most common, and effective, is the snap-away module attached to the neck strap or headcap. This disconnects when the force applied exceeds a pre-set limit, thereby nullifying any backward force on the inner bow and preventing penetrating injuries. The use of such modules must now be considered to be standard practice when EOAs are applied and failure to do so may be regarded as professional negligence even when no injury ensues. The break-away force limit of the module must be high enough to allow clinically meaningful forces to be applied to the teeth but not so high that it fails to disconnect before the inner bow leaves the molar tubes.

Pearl: The length of the inner bow wire, which is inserted into the molar tubes, is also significant, it should not be too short or disengagement from the tubes may occur before the modules disconnect.

2. The second danger of EOA injury occurs when the wire bow comes out, or is taken out by the patient during the night. The exposed ends of the inner bow may now lie on the pillow and may scratch the patient's face or eye during movement. Any contact between the inner bow, which is contaminated by oral bacteria, and the eye is likely to cause a severe reaction, in excess of the physical damage caused by the scratch itself. This almost inevitably leads to blindness in the affected eye with the possibility of sympathetic ophthalmitis damaging the second eye unless immediate and effective treatment is carried out. The disconnection of the EOA at night may occur even when a break-away safety neck strap or headcap is used.

Pearl: It is vital for the orthodontist to ask the patient whether the EOA is removed at night and to make the appropriate note in the patient's records.

To minimize the dangers of such an event occurring, the inner wire bow must be secured to the molar tubes in such a way that it is unlikely to come out at night even if the neck strap or headcap is disconnected. In 1996, Trayfoot described the use of small orthodontic elastics to secure the inner bow to the clasps of a removable appliance for use with headgear,[9] and in 1997, Samuels described a locking device, which prevents detachment of the inner bow.[10] Re-curved facebows, which do not have sharp ends, and non-elastic neck bow straps, which prevent accidental dislodgment of the inner bow, have been designed and may offer some security. The catches, straps and re-curved facebows are effective but complicated to use as well as being expensive.

For a number of years I have been using a simple and very effective safety device, which has eliminated the risk of accidental dislodgment of the inner EOA bow either during the day or at night. I solder a 0.7 mm (0.028 inch) stainless steel wire to the anterior part of the inner bow on each side and bend it forward as a low profile hook (Figure 9.6).

Pearl: Connecting a small 4.762 mm (3/16 inch) orthodontic elastic between this hook and the hook on the molar tube will secure the inner bow in the molar tubes even in the event that the neck strap or head cap is removed (Figure 9.7).

Alternatively, it is possible to buy facebows with canine hooks that face distally, and very gently to rotate the hooks through 180 degrees

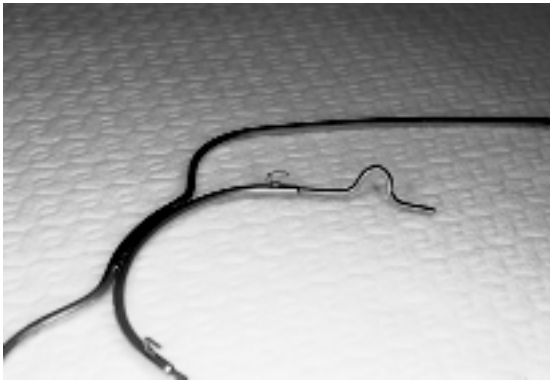


Figure 9.6

Modification to enhance headgear safety. Hooks soldered to the inner bow and bent mesially.

Figure 9.7

Headgear fitted with intra-oral elastics to hold the inner bow in position.

until they face forward. The importance of full-time use of the safety elastics should be explained to the patient and parents without scaring them too much. Since starting to use this simple safety device the incidence of night-time EOA disengagement has fallen to nil. Like all such devices it only works when the patient uses it as instructed and this is, of course, its major drawback. Despite the comment in the *British Orthodontic Society News* that: 'small facebow retaining elastics are difficult for the patient to use',[11] my experience has been quite the opposite. With the exception of a very small number of patients with marked manual dexterity problems, the idea and the use of these elastics is quickly assimilated.

The orthodontic specialty may have to accept that the use of any form of extra-oral appliance carries with it a risk, but with the correct use of both extra-oral and intra-oral safety devices, this risk can be kept at an acceptably low level.

I have in the past been required to prepare an expert opinion for a plaintiff who lost an eye. Seeing a 15-year-old girl suffer such a loss made me determined to make every effort to teach, practise and advocate measures that contribute to the reduction in the incidence of such accidents.

Headgear Compliance

Matie Grobler

Never give a neck pad with a cervical traction appliance until the patient complains that the elastic neck band hurts or irritates the skin around the neck and that they cannot wear the appliance. Given the neck pad they now have no reason for not wearing it. Less than 5% ever need the neck pad.

LATERAL MOLAR EXPANSION

The desirability or the final stability of lateral molar expansion is dependent on establishing the correct diagnosis, treatment plan and appliance selection. There are many well-documented conventional fixed and removable expansion appliances, some will tip the teeth, some will move them bodily and some will contribute to a limited degree of skeletal base expansion. Certain interesting useful variations are described in this section.

Overlay Arch (Figure 9.8)

The overlay or 'piggy back' arch is a useful adjunct for this procedure. This auxiliary requires double buccal tubes on the maxillary molars either bonded or preferably welded to conventional bands. The expanding arch is constructed from 0.914 mm (0.036 inch) stainless steel wire. Using the patient's maxillary study model, the wire is bent to conform approximately to the dental arch, and estimated to just touch the labial surface of the fixed brackets on the incisor teeth. Insert the arch into the headgear tubes and place a mark on the expanding arch at the mesial opening of the tubes. Remove the auxiliary from the mouth, bend a lingual molar offset, and cut the distal extensions so that the ends just protrude through the buccal tubes. This is a heavy gauge wire and not easy to bend, use heavy duty pliers and cutters. The arch should be widened and expanded in the molar region by approximately 1 cm (0.5 inch) on either side. The expanding arch will need to be firmly squeezed while being inserted into the headgear tubes on the maxillary molars. Once the activated arch has been placed in position, to prevent dislodgement, it should be tied with ligature wire to the brackets and existing archwire in the buccal and anterior segments.

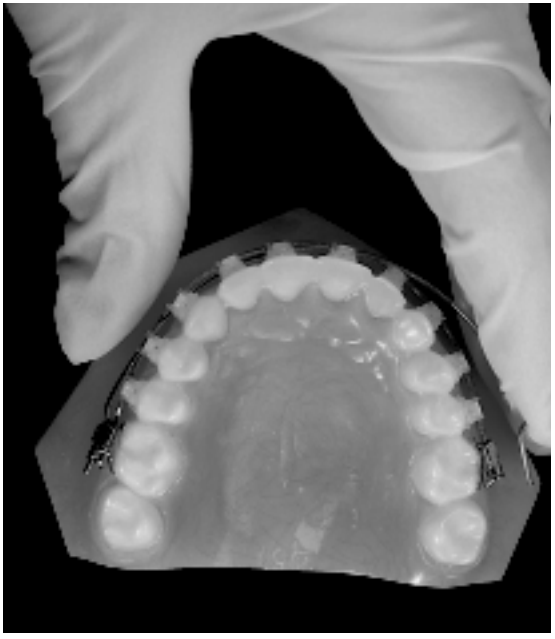


Figure 9.8

The overlay, 'piggyback' auxiliary expansion arch. The expanded arch is first placed into one buccal tube and then squeezed to engage the buccal tube on the other side.

This expanding auxiliary may also be used in the mandibular arch provided the mandibular molar bands have double buccal tubes.

This appliance is very efficient and needs to be monitored regularly to prevent excessive molar expansion.

The advantages of this expanding auxiliary are:

- The ease of construction.
- Simple design.
- Can be fitted and removed without interfering with any existing appliance.
- Works efficiently.
- It is not dependent on patient co-operation.
- In contrast to crossbite elastics, it has no vertical component of force contributing to molar extrusion.

As with a removable palatal expansion appliance or crossbite elastics, there will be a degree of buccal tipping of the molars. Depending on the requirements of the case, this tipping may either be desirable or not, if not then molar buccal tipping may be counteracted by the incorporation of buccal root torque in the existing archwire.

Modified Quad Helix Appliance

Colin Wallis

The conventional quad helix appliance is widely used in clinical practice. The active palatal expanding wire is either soldered to the palatal surface of the maxillary molar bands or adapted to fit into palatal sheaths, spot-welded to the bands.

I have modified the attachment of the palatal expanding wire to allow insertion into the auxiliary tube on the buccal aspect of the first molar (Figure 9.9a–c).[12] The palatal arch is

(a)

(b)

(c)

Figure 9.9

(a) The modified quad helix appliance with the palatal arch extending around the distal of the second molars and mesially towards the buccal tubes on the first molars. (b) Buccal extension fitting into the auxiliary headgear tube and held in position with an elastomeric module. (c) Intra-oral view of the modified quad helix in situ.

continued along the palatal side of the maxillary buccal teeth, curved bilaterally behind the most distal molar tooth, passing anteriorly into the buccal sulcus and finishing with a reverse bend into the headgear tube on the first molar band or double buccal tubes bonded directly to the enamel. It inserts into the mesial opening of the tube. To prevent accidental displacement, an indent is formed to allow placement of a retaining ligature or elastomeric module hooked to the buccal hook on the molar tube.

The advantage of this modification is that it allows for the placement of an expansion auxiliary at any stage during treatment without the need to remove existing bands. The modified quad helix can be pre-formed using the original study models. The essential proviso is the availability of double buccal tubes on the maxillary molars (Chapter 8). This modified quad helix can also accept soldered springs or an acrylic palatal Nance button; the appliance can be removed regularly to check and clean the palatal mucosa.

Rapid Maxillary Expansion

Brett Kerr

The concept, rationale for use, design, construction and fitting of rapid maxillary

expansion appliances have been well documented and discussed in the literature. Following completion of the expansion and the consolidation period of about three months, the cemented appliance is generally removed with conventional band-removing pliers. This may be an uncomfortable procedure particularly for young, sensitive patients. In order to make this procedure more comfortable, I have taken to weakening the bands prior to cementing the appliance (Figure 9.10a, b).

(a)

(b)

Figure 9.10

(a) Modified rapid maxillary expansion appliance weakened to facilitate removal. The molar and premolar bands are weakened by cutting a notch in the mesio-buccal region. (b) Rapid maxillary appliance in situ showing the position of gingival notches cut in the premolar and molar bands.

Pearl: Use either a cutting disc or a diamond burr to cut a gingival vertical notch on the mesio-buccal surface of each band. Do not cut more than half the height of the band.

The cut should be placed on the mesio-buccal aspect to allow for easy access if you wish to use a band slitting pliers or a burr.

I have never had a problem with the appliance becoming loose during treatment. The removal of such a weakened appliance is comfortable for the patient.

Stabilizing Molar Bands in an Impression

Brian Nebbe

In the construction of certain appliances such as lingual arches or rapid maxillary expansion appliances, impressions are taken over bands fitted to molar and/or pre-molar teeth. These bands are then placed in the impression prior to casting. Unless the casting is done very carefully, it is possible for these bands to become dislodged during the casting process.

To assist in holding the band firmly in position in the impression, place a drop of superglue (cyanoacrylate) on the lingual aspect of the band in contact with the impression material. This glue will set rapidly when it comes into contact with moisture. This technique has also been reported by Lisenby and Bowman.[13]

ALIGNING DISPLACED SECOND MOLAR TEETH

Not infrequently, both maxillary and mandibular second molar teeth erupt during treatment, either displaced to the buccal, lingual or rotated. Often, it is not possible to incorporate or engage these displaced teeth into the line of the main archwire. Under these circumstances using a sectional auxiliary is a useful adjunct.

Depending on the position of the tooth it is necessary to fit either a conventional band with a buccal tube and a lingual cleat, or to bond a buccal tube. In cases where only a small area of buccal, lingual or occlusal enamel surface is available, it may not be possible to place a conventional band or molar tube. Under these circumstances, it is usually possible to bond a conventional Begg lightwire bracket in a horizontal orientation rather than the conventional vertical orientation, this bracket acts as a small buccal tube. Depending on which auxiliary or what movement will be required, the archwire slot may face mesially or distally. The design of the auxiliary and the attachment on the second molar will be dictated by the position of the second molar and its relationship to the first molar.

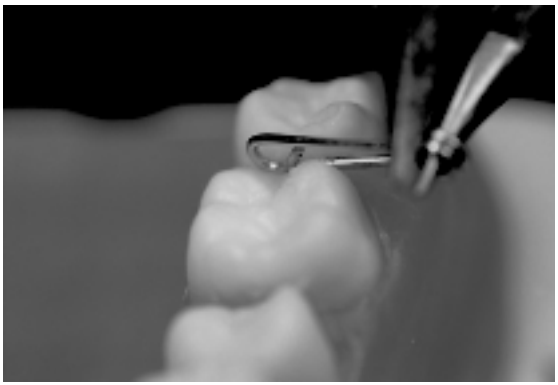
Uprighting Second Molars

Separating springs and elastomerics

If the second molar is only mildly mesially tipped and engaging the distal cervical region of the first molar, construct a separating spring from 0.711 mm (0.028 inch) wire and slip it between the contact points. The design of the spring is similar to the separating springs marketed by TP Orthodontics Inc, USA (Figure 9.11a–c). The spring is fitted with the gingival arm slipping under the contact point; this procedure is sometimes a little difficult and initially uncomfortable for the patient. The spring should be left in place for about three weeks then removed, the area well irrigated with water and if necessary replaced and the procedure repeated until the second molar disengages from the distal surface of the first molar.

Still remaining with the concept of using separators, Cerny described a technique to resolve mild impaction using jumbo separators. Instead of using conventional elastomeric ring separators, he used commercial black 'O'-rings, 6 mm (0.24 inch) in diameter and 2 mm (0.08 inch) thick.[14] These are sterilized in a conventional manner, softened in hot water and then gently stretched through the contact points using fine needle holders.

(a)



(b)

(c)

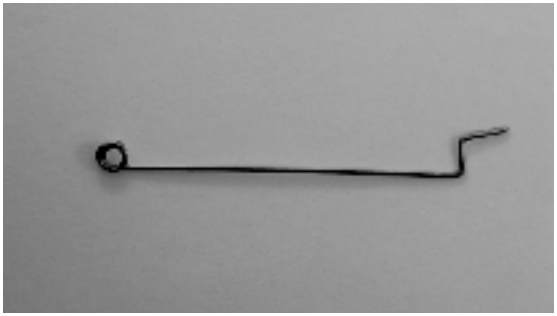
Figure 9.11

(a) Separating spring constructed from 0.7 mm (0.028 inch) stainless steel wire for reducing mild mesial second molar impaction. (b) Placing the separating spring, one arm above the contact point, the coil opened and the other arm slipped below the contact point. (c) Separating spring in position.

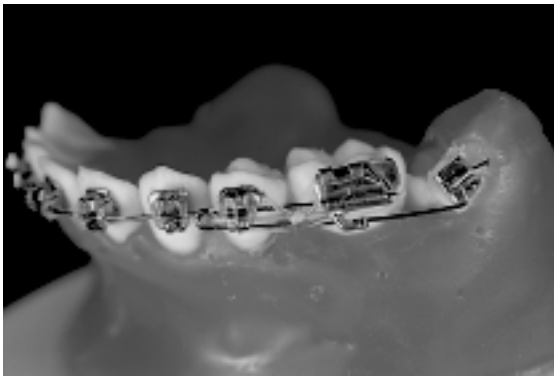
Following conventional separators the use of jumbo separators can move teeth up to 2 mm (0.08 inch) apart.

Sectional arches and jigs

Where the second molar is mesially tipped and it is still possible to bond a conventional buccal molar tube, then the simplest auxiliary comprises a straight section of 0.356 mm (0.014 inch) nickel-titanium wire slipped through the buccal tube on the first molar or tied to the bracket on the first molar and extended into the tube on the second molar. The mesial end of the sectional should be bent 90 degrees, leaving a vertical extension of 4 mm (0.16 inch), cut off the rest of the wire. The sectional arch is tied with ligature wire to either the canine or pre-molar teeth (overlying the main archwire). The presence of a vertical channel in the brackets makes this procedure much easier. From the gingival aspect, the vertical extension of the auxiliary is slipped into the vertical slot of the bracket and the excess protruding from the occlusal, is firmly gripped with a small pliers and bent over the bracket. It is essential to ensure that the sectional wire cannot slip or become dislodged in either a mesial or distal direction. As the tooth uprights, the sectional auxiliary can be changed to a 0.406 mm (0.016 inch) nickel-titanium or stainless steel wire and the wire size or stiffness increased until the tooth has aligned sufficiently to allow engagement of the main archwire into the tube on the second molar tooth.



(a)



(b)

Figure 9.12

(a) Auxiliary for distal movement of a mesially impacted second molar, using elastic traction. (b) Auxiliary for distal movement of a mesially impacted second molar. Distal force generated by an elastic tie from the auxiliary eyelet to the first molar hook.

Partial eruption

If the second molar tooth is partially erupted and needs considerable active distal movement, the chances are that there is only a limited amount of buccal enamel exposed. Under these conditions, it is usually possible to bond a horizontally placed Begg bracket with the archwire slot facing mesially. The auxiliary is constructed from a straight length of 0.406 mm (0.016 inch) stainless steel wire (Figure 9.12a, b). Bend a 3 mm (0.12 inch) vertical offset at the distal end of the auxiliary, the distal horizontal section should not exceed approximately 3 mm (0.12 inch), this section is slipped into the horizontal Begg bracket, the vertical arm of the offset should lock into the archwire slot of the bracket. The anterior section extends mesially and is marked with a pencil opposite the canine area, removed from the mouth and an eyelet or mesially directed hook bent at the mesial end of the sectional. The sectional auxiliary is replaced in the mouth and tied with ligature wire to the first molar and canine tooth (overlying the main archwire). To create a distally directed force against the mesial end of the bracket on the second molar, an elastomeric chain, thread or a nickel-titanium coil spring with eyelets is tied from the mesial hook on the first molar to

the hook or eyelet at the mesial end of the sectional auxiliary. Be careful not to leave too much wire extending distally to the bracket on the second molar, it will impinge on the soft tissues and lead to irritation and swelling of the soft tissues in a region where oral hygiene is a problem and gingival swelling interferes with access to the crown of the second molar. It is essential to monitor the movement of the second molar to ensure it is not driven too far distally into the soft tissues and bone of the ascending ramus of the mandible. It is assumed that the clinician will have assessed and taken into account the presence and position of the unerupted third molar. Once the tooth has moved distally sufficiently to relieve the mesial impaction, the force vector and auxiliary will need to be changed to encourage vertical eruption.

To assist the vertical eruption, it may be possible to place a horizontal high hatpin (TP Orthodontics Inc, USA) through the bracket slot, bend the tail gingivally and hook a vertical up-and-down elastic from the mandibular second molar to the maxillary first or second molar.

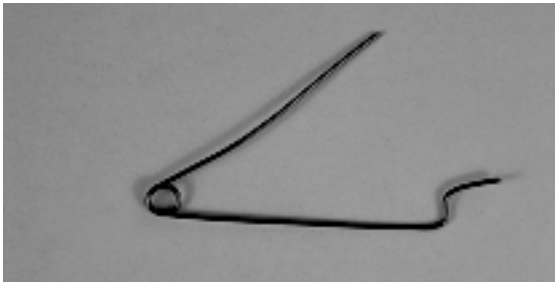
Santoro et al. approach the impacted mandibular second molar from the lingual aspect.[15] A palatal sheath is bonded to the lingual of the first molar tooth and a transpalatal arch from which one end has been cut off, is bent to fit into the lingual sheath, and extended along the lingual of the alveolus to the distal of the second molar. The end is formed into a loop from where an elastomeric thread or chain is tied to a button bonded to the occlusal surface of the partially impacted second molar.

With a partially erupted second molar, Park recommends bonding a lingual button on the partially exposed occlusal surface and a conventional band on the first molar.[16] He bends an uprighting spring from 0.356 mm (0.014 inch) high tensile stainless steel wire. At one end a hook is bent to engage the lingual button on the occlusal of the second molar and at the other end of the spring he places a stop which will rest against the distal opening of the buccal molar tube on the first molar. The spring is inserted into the distal opening of the buccal molar tube and the hook of the spring engaged on the lingual button. The degree of distal activation will depend on the position of the stop and can be adjusted as required. The wire projecting through the mesial opening of the molar tube is bent gingivally to prevent dislodgement.

Dis-impacting Mandibular Second Molar Teeth

Farah R Padhani

Bond a horizontally orientated Begg bracket to the exposed buccal surface of the second molar and bond a double buccal tube on the first molar. Construct the auxiliary from 0.406 mm (0.016 inch) stainless steel wire. At



(a)

(b)

Figure 9.13

(a) Auxiliary for distal movement of a mesially impacted second molar; incorporating a helix. (b) Auxiliary for distal movement of a mesially impacted second molar. Distal force generated by cinching back the distal extension of the helix as it exits the buccal tube.

one end, bend a horizontal stop to engage the horizontal slot of the Begg bracket. As the wire extends mesially place a mark opposite the contact between the first and second premolar teeth and at this point bend a full helix with the free end extending back distally. This section passes through the auxiliary tube on the first molar and extends distally; anneal this section of wire. Replace the auxiliary in the mouth, grip the wire extending distal to the molar tube with pliers, pull distally and bend the extension so that it cannot retreat into the molar tube (cinch the auxiliary). (Figure 9.13a, b). This will have the effect of bowing the gingival section of the auxiliary and exerting a distally directed force on the second molar.

Figure 9.14

Stainless steel sectional arch for palatal movement of a buccally displaced second molar.

Horizontally Displaced Second Molar Teeth

Once again, it is essential to band or bond a buccal tube or bracket on the displaced tooth. The design of the auxiliary will depend on the position and severity of the tooth displacement. On the assumption that the first molar tooth is in its correct position, it should be maintained in this position with the main archwire. The auxiliaries should move the displaced tooth and not the correctly placed first molar.

In the case of a mild displacement, then the simplest auxiliary comprises a straight section of 0.356 mm (0.014 inch) nickel-titanium wire slipped through the buccal tube on the first molar or tied to the bracket on the first molar and extended into the tube on the second molar. The mesial end of the sectional should be bent 90 degrees and tied with ligature wire to either the canine or pre-molar teeth (overlying the main archwire). As mentioned previously, make sure the auxiliary is well secured to prevent mesial or distal dislodgement.

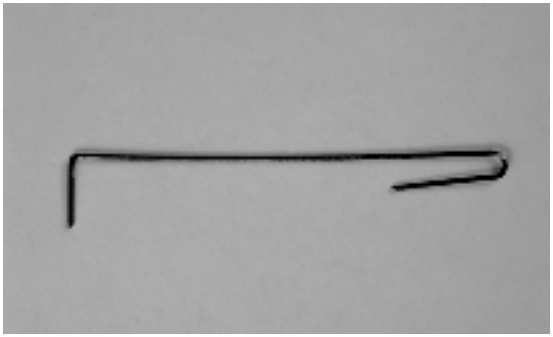
Buccal displacement

When a maxillary second molar erupts with a buccal displacement close to the end of treatment, Kirshon has developed a technique using a length of 0.547 × 0.635 mm (0.018 × 0.025 inch) stainless steel wire threaded through the first molar auxiliary archwire slot, the distal protruding section bent down at 45 degrees then pushed distally to lie on the buccal surface of the second molar.[17]

Where the second molar is excessively buccally displaced, it will not be possible to thread the auxiliary through the buccal tube on the first molar, as the exit from the tube will be blocked by the mesial surface of the second molar (Figure 9.14). In such cases, use 0.356 mm (0.014 inch) stainless steel wire extending from the second molar to the canine tooth bypassing the first molar and tie the sectional auxiliary with ligature wire to the buccal tube or bracket on the first molar. As the second molar moves into a more favourable position, it should be possible to replace the sectional arch with a more rigid steel sectional arch until such time as a new full arch incorporating the first and second molar teeth can be accommodated.

Palatal displacement

Where the second molar is excessively palatally/lingually displaced, once again it is not possible to place a sectional arch through the tube on the first molar and then through the tube on the second molar (Figure 9.15a, b). In such a case, the distal end of a steel sectional arch should be bent back on itself 180 degrees and then slipped into the distal



(a)

(b)

Figure 9.15

(a) Stainless steel sectional arch with a reverse back bend for buccal movement of a palatally displaced second molar. (b) Stainless steel sectional arch with a reverse back bend inserted into the distal opening of a buccal tube for buccal movement of a palatally displaced molar.

opening of the buccal tube of the second molar. The mesial segment of the sectional arch then overlies the buccal attachment on the first molar and ends at either the premolar or canine tooth. As described above, the sectional arch should be securely tied to the premolars to prevent any dislodgement. Once the tooth is more favourably placed, it becomes possible to gain access to the mesial end of the buccal tube and the auxiliary can be changed.

Management of Unerupted Impacted Teeth

This subject is large and complex. It encompasses careful diagnosis, surgical procedures and the orthodontic mechano-therapy required to finally place the impacted tooth in good functional occlusion, and an aesthetically acceptable position within the dental arch. This topic is well presented and covered in a textbook by Becker.[18]

A glance at the literature reveals that there are many variations in the auxiliaries and springs that orthodontists use to assist in the eruption and movement of impacted teeth; the design is limited only by the imagination and ingenuity of the clinician. The task of the orthodontist can, in many cases, be greatly eased by the surgical uprighting of impacted mandibular second molars.[19]

A technique was shown to me many years ago by Reed Holdaway but which I have not seen in the literature. This involves the use of a temporary plastic crown, particularly for deeply embedded palatal canines. Request the surgeon to cement an oversized temporary plastic crown (the type used in restorative dentistry) over the crown of the impacted tooth. It does not have to fit accurately and the field of operation does not have to be dry, the temporary crown is loaded with glass ionomer cement, firmly placed into position over the crown of the impacted tooth and left to set. The advantages of this technique are:

- The plastic temporary crown artificially lengthens the crown of the impacted tooth.
- Prevents closure of the wound thus eliminating any time pressure on the clinician to bond a bracket to the impacted tooth.
- Appears to act as a stimulus to encourage eruption of the impacted tooth.
- Ease of bonding a bracket of your choice on the plastic surface of the artificial crown to apply traction.
- Once the elongated crown has reached the required position, the plastic crown can be removed with a scaler and any residual cement removed. The surrounding mucosa will be standing away from the enamel surface and a regular bracket may be bonded to the crown of the impacted tooth.

Traction will continue until the impacted tooth reaches its final position.

The problems with this technique are:

- Persuading the surgeon to acquire and keep a selection of temporary plastic crowns.
- Occasionally, the crown of the impacted tooth may be in too close contact with the root of an adjacent tooth and access to place a plastic crown over the crown of the impacted tooth may not be possible.

In cases where mandibular molars are unerupted, and the last standing teeth are pre-molars, it is not possible with conventional fixed appliances, for an unsupported archwire to extend distally over the unerupted first and second molar teeth. As an alternative, Resch described a fixed lingual arch soldered to bands on the first and second premolars extending distally on the lingual aspect of the unerupted molar teeth.[20] The lingual arch was reinforced with an acrylic covering into which 0.508 mm (0.020 inch) extruding finger springs were embedded. The lingual arch extended to the molar band at the other end of the arch. Following conventional surgical exposure and bonding of a gold chain to the unerupted teeth, the chain was tied to the extruding spring, generating an occlusally directed eruptive force.

DISPLACED MAXILLARY LATERAL INCISOR TEETH

Palatally displaced maxillary lateral incisor teeth are frequently associated with malocclusions displaying varying degrees of dental crowding. In these types of cases, it is good practice to follow one of the basic principles in orthodontics:

> **Pearl:** First create space in the dental arch before moving a tooth into the arch.

This procedure is not difficult and there are many methods of creating space. However, a problem may arise when the lateral incisor is in crossbite with a lower incisor: a labially bonded bracket will either traumatize the lower incisor (particularly when using porcelain brackets) or is repeatedly sheared off during function.

Palatally Displaced Lateral Incisor Teeth

Victor Lalieu

On upper lateral incisors in linguo-version, where a buccally placed bracket interferes with the bite and may thus be fractured, I often bond a Begg bracket on the palatal surface, and ligate this to a nickel-titanium 'piggyback' archwire. Once the tooth is across the bite I re-bond on the labial surface with an edgewise bracket upside down to provide the necessary buccal root torque.

A variation on this technique has been described by Smith et al.[21]

Palatally Displaced Lateral Incisor Teeth

Farah R Padhani

With a displaced tooth, such as a lateral incisor, I like to bond a horizontally orientated Begg bracket. This acts as a mini-labial tube through which I thread a nickel-titanium 'piggyback' sectional archwire.

Missing lateral incisor

In many cases where the space is being maintained for an artificial lateral incisor, it is aesthetically desirable to replace this tooth with a pontic during orthodontic treatment. Select a plastic tooth with the correct size, shape and colour, and adjust it to fit passively in the space available. Bonding a bracket directly to an individual tooth is not easy. It is difficult to hold the tooth, and at the same time bond a bracket at the correct height and orientation. Instead, I prefer to tie an edgewise bracket to the rectangular archwire in the pontic area,

place composite on the mesh base and then move the plastic tooth into position from the lingual approach, with the tooth in the correct position the composite is light-cured.

Prior to moving an incisor tooth across the bite, the anterior overbite can be temporarily reduced by placing glass ionomer cement on the occlusal surface of first or second molar teeth. It is essential to ensure that the mandible occludes evenly on both left and right molars, the cement can be easily ground to achieve an evenly balanced occlusion. This procedure is uncomfortable and interferes with mastication, the cement should be reduced or removed as soon as the anterior crossbite has been corrected.

The use of a temporary bite raising auxiliary has been described by Guray.[22] He bends a 1.02 mm (0.040 inch) stainless steel wire into a rectangle, the two terminal ends are bent to slide into the mesial and distal opening of the auxiliary buccal tube of the maxillary molar. The rectangle conforms to the occlusal surface of the molar and the palatal side of the rectangle is notched and tied to a palatal cleat or hook on the molar band. When the bite-raising auxiliary is no longer required, it can be easily removed.

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10 AUXILIARY SPRINGS FOR CROWN AND ROOT MOVEMENT

CORRECTING MESIO-DISTAL ANGULATIONS

Uprighting Auxiliary Springs

Contemporary orthodontic brackets incorporate built-in tip designed to position the tooth at its correct inclination in the finished occlusion. The final expression of the built-in tip is dependent on careful and correct placement of the bracket in relation to the long axis of the tooth. Variations in final tip do occur due to variations in manufacture, prescription, crown–root angulations and placement of bracket during bonding. The importance of correct final root angulations is highly relevant to achieving root paralleling following extractions, and achieving satisfactory aesthetics of the anterior teeth. Notwithstanding the use of prescription brackets there are occasions when it is necessary or expedient to modify the tooth uprighting procedures with the use of auxiliary springs.

Uprighting springs are used extensively in the Begg light-wire technique as are the sidewinder springs in the Tip-Edge technique (Figure 10.1a, b). These springs are very effective small intra-oral mechanical machines acting in the mesio-distal or sagittal plane; however, they can only be used in combination with a bracket incorporating a vertical slot. While they are most efficient in combination with the light-wire bracket or the Tip-Edge bracket, they can be used with any edgewise bracket provided there is a vertical slot (Chapter 8).

To be effective with a standard edgewise bracket, the archwire size must allow for sufficient slack within the bracket slot to allow for uprighting of the tooth or the archwire must incorporate a second order bend, which will work in the same direction as the uprighting spring. While uprighting springs and sidewinder springs are commercially available (TP Orthodontics Inc, USA), there are occasions where it is necessary to bend-up individual uprighting springs to suit a specific situation. Variations that may be introduced into an individually constructed spring include, different size wires ranging from 0.305 mm (0.012 inch) for mini-springs to 0.356 mm (0.014 inch) for conventional springs

Figure 10.1

(a) Uprighting spring for use with a Tip-Edge bracket or any bracket incorporating a vertical slot. (b) Sidewinder spring for use with a Tip-Edge bracket. This spring has been modified from the original design to allow the hook arm to overlie the main archwire, making it less visible. (Photographs courtesy of TP Orthodontics Inc, USA.)

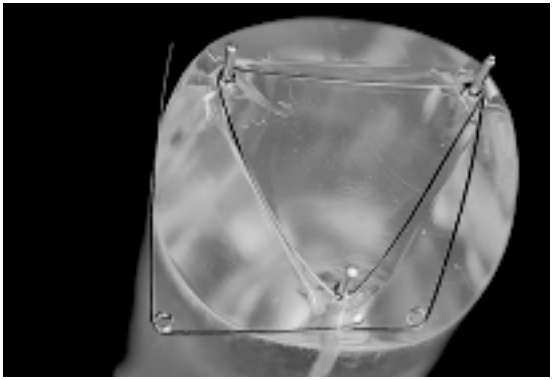


Figure 10.2

Jig for bending multiple coils. A length of stainless steel wire has been sequentially wound three times around each vertical post. The wire is cut with extensions at each end of the coil allowing a variety of different springs to be formed.

and variations in the size of the stem or hook arm of the spring. These may be bent free-hand with fine 'bird beak' pliers or by using a jig incorporating three vertical steel posts. The diameter of the posts of the jig will determine the size of the coil spring (Figure 10.2).

Whenever these springs are used, it is essential to tie the relevant tooth to the main archwire with a steel ligature to prevent unwanted tooth displacement. Furthermore, ensure that the ligature tie does not impede the uprighting action of the spring. It is important to select the correct spring for the desired tooth movement. Clockwise or counter-clockwise uprighting springs are conventionally inserted from the gingival aspect, and the tooth crown will move in the *opposite* direction to the hook arm of the spring. In certain cases it may be expedient to insert the spring from the occlusal direction (as are sidewinder springs). In such cases the tooth crown will move in the *same* direction as the hook arm of the spring.

Uprighting springs constructed from 0.406 mm (0.016 inch) wire and with longer hook arms, can also be used for uprighting molar teeth, provided the buccal tubes incorporate a vertical slot (TP Orthodontics Inc, USA). Once again, the main archwire must incorporate a second order bend to work in the same direction as the uprighting spring.

CORRECTING ROTATIONS

Rotating springs

In contrast to uprighting springs, rotating springs work in the horizontal plane. Selection of either clockwise or counter-clockwise springs will produce mesio-labial or mesio-palatal rotations (Figure 10.3a–d). Once again, these springs are designed to work with brackets incorporating a vertical slot (Chapter 8). They are equally effective with Begg, Tip-Edge or regular edgewise brackets. In certain twin edgewise brackets that do not incorporate a vertical slot, it may be possible to slip the vertical arm of the spring lingual to the main archwire between the mesial and distal tie-wing elements.

They are commercially available (TP Orthodontics Inc, USA) and if necessary they can be individually constructed from 0.356 or 0.406 mm (0.014 or 0.016 inch) stainless steel wire. Clinically, they are a very useful adjunct irrespective of which technique is used—there are occasions when it is desirable to rotate a tooth just that little bit extra, in such cases it is possible to place a rotating spring to achieve the desired tooth movement without having to remove the entire archwire. These springs will work on flat surfaced incisors as well as on curved labial surfaces of canines and pre-molars.

Pearl: Bonding a lingual button and tying an elastomeric thread to complement the clockwise or counter-clockwise movement of the tooth can enhance the rotating action of the spring.

Rotation Wedges

Rotation wedges are more efficient on teeth with flat labial surfaces than on curved canines and pre-molars. While they are effective, their action is slower than that of rotating springs. They are useful for maintaining a corrected or mildly over-corrected rotation.

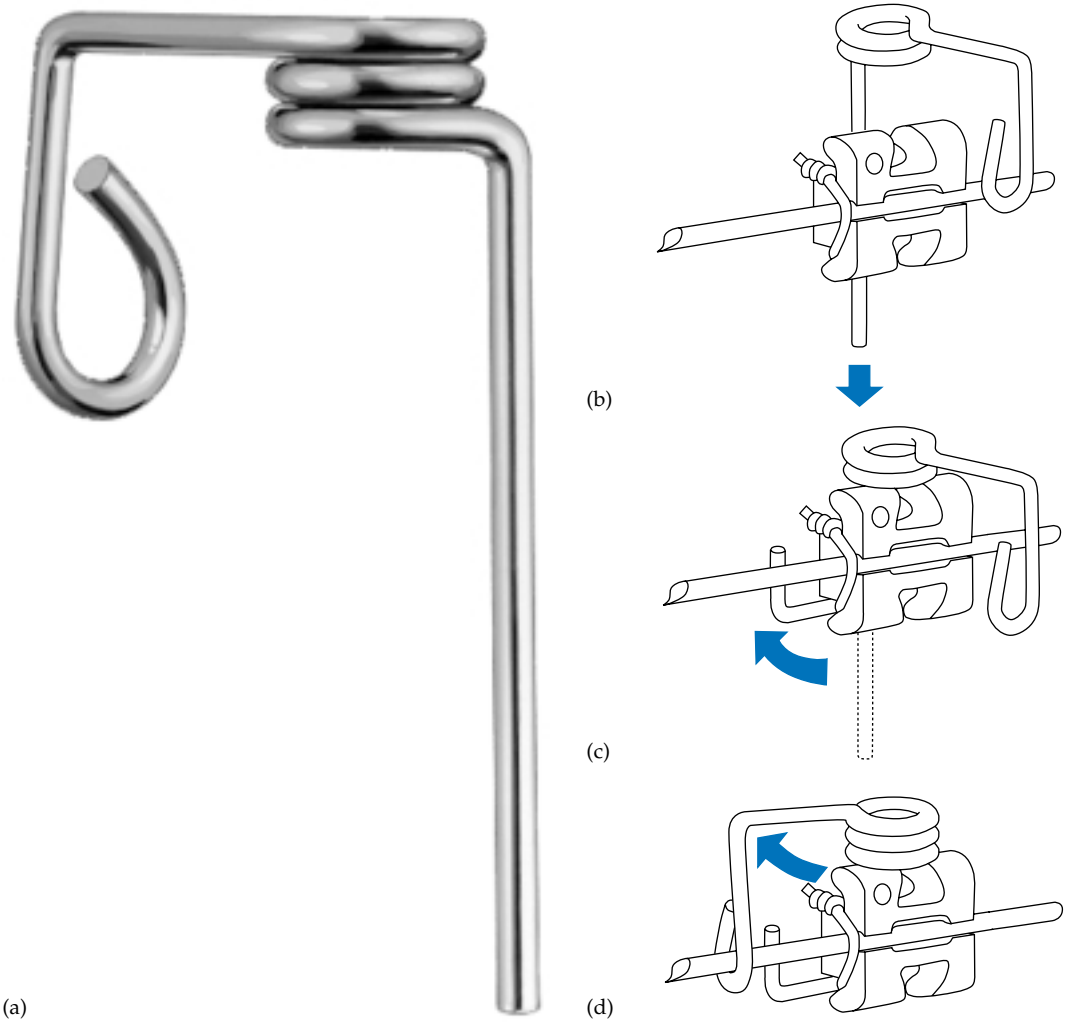


Figure 10.3

(a) Counter-clockwise rotating spring. (b) The vertical arm is placed into the vertical slot from the gingival aspect. (c) With the hook arm lying perpendicular to the tooth surface, turn the protruding section of the vertical arm 90° to lie parallel to the tooth surface. (d) The spring is activated by engaging the hook arm on to the main archwire. (Photograph courtesy of TP Orthodontics Inc, USA.)

Bracket Offset

Prior to bonding, a stainless steel bracket can be offset to correct and maintain a mild over correction of a rotation. To offset a bracket, a small section of 0.356 or 0.406 mm (0.014 or 0.016 inch) stainless steel wire is spot-welded to the mesial or distal edge of the mesh base.

Using aesthetic porcelain brackets Schneeweiss describes a technique to offset the archwire within the bracket slot.[1] One side of the slot is blocked out with a small amount of light-cured composite, the archwire is ligated only to the opposite wing and the resulting pressure from the archwire will rotate the tooth.

TORQUING AUXILIARIES

Contemporary orthodontic techniques incorporating prescription brackets with built-in torque have, in most cases, simplified and standardized the establishment of the correct torque in the final finished occlusion. However, different manufacturers have varying prescriptions for torque and different skeletal jaw relationships may also require variations in torque not catered for in the original prescription bracket. It is essential for the orthodontist to be able to clinically introduce varying degrees of torque or countertorque into his or her selected appliance.

Torque may be actively varied or incorporated into an appliance in a number of ways:

1. Incorporating torque into a segment of the main rectangular archwire by holding the wire firmly with two pliers (Tweed arch adjusting pliers) closely adjacent to each other and placing a twist in the wire. Clearly, the twist must be in the direction required to produce the necessary torque and the twist must be counteracted at the other end of the relevant archwire segment.
2. Varying the archwire size in relation to the bracket slot size. To fully express the built-in torque, the wire size must match the bracket slot size and must be fully engaged into the bracket slot. By contrast to under or not fully express the prescription torque, the archwire size must be reduced.
3. The adjunctive use of torquing auxiliaries. These auxiliaries are available in many different formats, some are commercially available (TP Orthodontics Inc, USA) others need to be individually constructed to suit a specific requirement. Historically, these auxiliaries have been associated with the Begg light-wire technique, however, they can be adapted for use with any edgewise technique or bracket. When used with an edgewise bracket it is advisable to use the auxiliary in combination with a round archwire. If used with a rectangular archwire, then the archwire should be expressing torque in the same direction as the torquing auxiliary. Whether a round or rectangular archwire is used, it should be rigid enough to resist any undesired side effects of the auxiliary, such as expansion of the molar teeth.

Torquing Auxiliary Design

Two spur torquing auxiliary

This has been used as a standard auxiliary with the Begg light-wire technique for many years. It can be added to an edgewise appliance by first placing the auxiliary into the bracket slot and then tying the main archwire over the auxiliary. The active spurs may be constructed to act either mesial or distal of the bracket. The auxiliary must be modified to avoid impingement with the tie wings of the edgewise bracket. If the spurs are acting

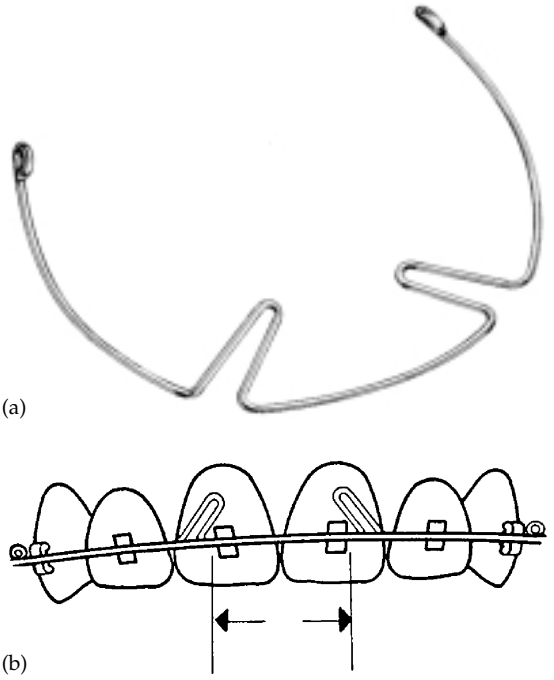


Figure 10.4

(a) Two spur torquing auxiliary. (b) Diagrammatic representation showing the torquing auxiliary in position. This can be used with any bracket provided the auxiliary is adjusted to avoid interference of the torque spurs with the brackets. (Photograph courtesy of TP Orthodontics Inc, USA.)

mesial to the bracket, it is necessary to tie the two central incisors together to avoid the development of a diastema, if the spurs are positioned distal to the central incisor brackets, a diastema should not develop (Figure 10.4a, b).

Udder torquing auxiliary

This auxiliary may look intimidating and complicated, but in reality it is very simple and very useful. It may be purchased commercially (TP Orthodontics Inc, USA) or it can be pre-formed and kept in stock. Variations occur in the size of the trapeze for the central and lateral maxillary incisors; for the four mandibular incisors there is no variation in the size of the trapeze. Its main advantage is that it can be inserted and removed without having to remove or modify the existing main archwire. It can be used in the upper and the lower arch, the same auxiliary can be used for palatal root torque (labial crown torque) when inserted from the gingival aspect and for labial root torque (lingual crown torque) when inserted from the incisal aspect (Figure 10.5).

Figure 10.5

Udder torquing auxiliary. (Photograph courtesy of TP Orthodontics Inc, USA.)

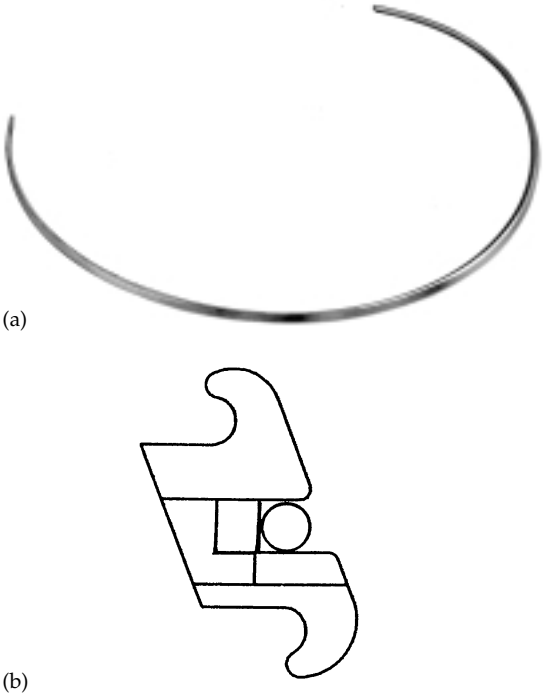
Pearl: This auxiliary is useful in the early stages of bimaxillary protrusion cases. When placed to produce palatal/lingual crown torque in the presence of archwires that are free to slide distally, it is possible to achieve a reduction in protrusion without taxing anchorage.

If there is anchorage to burn, this action can be enhanced with the use of intra-maxillary elastics.

When using any form of palatal root torquing auxiliary on maxillary incisors, it is essential to determine where you wish to place the maxillary incisal edges at the end of treatment. A reciprocal labial movement of the crown invariably accompanies palatal root torque. If you do not wish the crowns to move forward, then it is essential to either tie-back the arch or to counteract the labial movement with Class II elastics.

Torque bar

Tip-Edge brackets for maxillary central and lateral incisors have an optional deep groove; this allows for the placement of a 0.457×0.559 mm (0.018×0.022 inch) nickel-titanium torque bar to be placed palatal (deep) to the main archwire (Figure 10.6a, b).



(a)

(b)

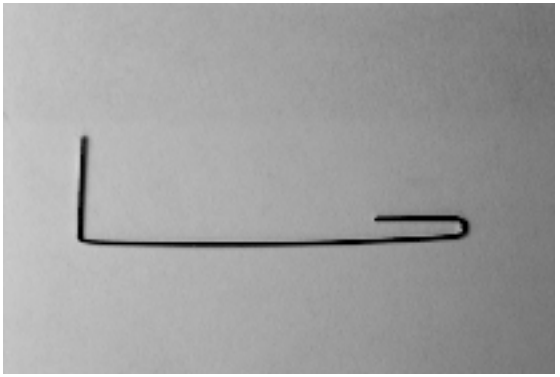
Figure 10.6

(a) Pre-formed nickel-titanium palatal torque bar. (b) Nickel-titanium torque bar placed in the deep groove of a Tip-Edge bracket under the main archwire. (Photograph courtesy of TP Orthodontics Inc, USA.)

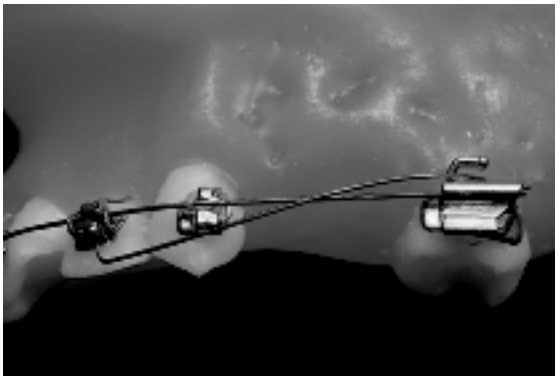
Reciprocal root torquing auxiliary

Moving the crown of a palatally displaced lateral incisor tooth into alignment with the rest of the dental arch is not difficult. However, in most cases, the root apex of this tooth will remain more palatally placed than the crown. To complete such a case successfully, it is essential that adequate labial root torque of the lateral incisor tooth be carried out. There are a number of ways to perform this procedure.

- If a prescription bracket is used with built-in palatal root torque, this bracket may be inverted (placed upside down) provided there is no conflict with the prescription built-in tip. The correct rectangular archwire placed in such a bracket will induce labial root torque.
- Labial root torque for the lateral incisor may be bent into the main rectangular archwire.
- If a bracket with a vertical slot is used (Chapter 8), it is possible to place a preformed individual tooth torquing auxiliary (TP Orthodontics Inc, USA) to produce either labial or palatal root torque.
- In conjunction with a bracket incorporating a vertical slot, a very simple and efficient root torquing auxiliary can be easily fabricated at the chairside and is quick to place. One end of a length of 0.356 mm (0.014 inch) high tensile stainless steel wire (Wilcock, Australia or TP Orthodontics Inc, USA) is bent back on itself 180 degrees (Figure 10.7a, b). Cut the short end to a length of 8 mm (0.32 inch) and slip this short end into the distal opening of the auxiliary tube (headgear tube) on the first molar, it should just protrude through the mesial opening of the tube. Pull firmly on the long section extending mesially, mark the wire at the lateral incisor bracket, remove the auxiliary and create a vertical post by placing a right angle bend at the mark. Leaving 6 mm (0.24 inch) after the bend, cut off the rest. Replace the auxiliary into the molar tube as before; the right angle bend (vertical post) should lie opposite the lateral incisor. For *labial* root torque of a maxillary left lateral incisor tooth, hold this post-section with Howe pliers and turn (wind) it *counter-clockwise* 180 degrees and without letting go, slip the post into the incisal opening of the vertical slot of the lateral incisor bracket. Push it right through the bracket then with fine 'bird beak' pliers, turn the gingivally protruding end either mesially or distally to prevent dislodgement. To stabilize the buccal section of the auxiliary, loosely tie it to the canine or premolar teeth. Be aware that if the active end of the auxiliary is turned *clockwise*, it will deliver a *palatal* root torquing action. For the maxillary right lateral incisor tooth, winding the auxiliary counter-clockwise



(a)



(b)

Figure 10.7

(a) Wind-up single tooth torquing auxiliary. (b) Wind-up single tooth torquing auxiliary; the distal end is bent back on itself 180° and inserted into the distal opening of the buccal tube. Depending on the torque required, the mesial post is wound either clockwise or counter-clockwise and inserted into the vertical slot of the relevant bracket.

will deliver a *palatal* root torquing action and clockwise a *labial* root torquing action. This auxiliary takes its anchorage from the molar tooth; labial root torque on the lateral incisor will produce palatal root torque on the molar tooth. However, the root surface areas of the molar is so much larger than that of the lateral incisor that the action on the lateral will have been completed before the molar starts to move adversely.

- If bilateral labial root torque is required, then the reciprocal torquing auxiliary, which delivers palatal root torque for the central incisors and labial root torque for the lateral incisors, is a very useful auxiliary (TP Orthodontics Inc, USA).

Palatal and buccal root torquing auxiliaries soldered to the main archwire have been described by Reyenders and Massaro.[2]

Molar root torque auxiliary

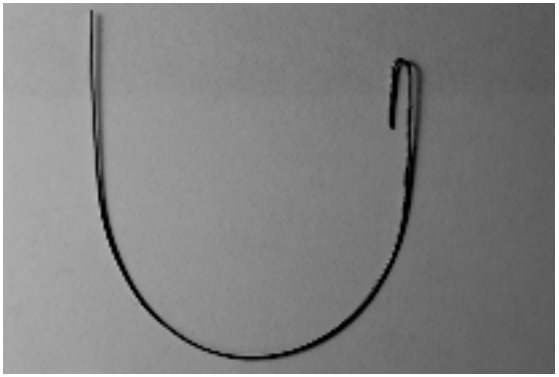
In certain cases it may be necessary to increase or decrease buccal or palatal molar root torque. If you are using a round main archwire with double buccal molar tubes, the torquing auxiliary may be placed without removing the archwire. If you are using a rectangular archwire, ensure that the torque bent into the archwire is working in the same direction as the auxiliary. The auxiliary is constructed from high tensile 0.406 mm (0.016 inch) stainless steel wire (Figure 10.8a, b).

Construction

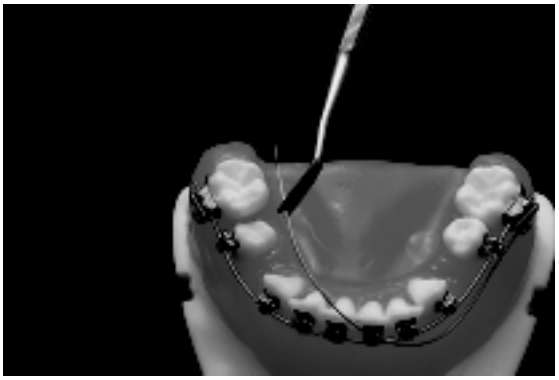
- Curve the wire to conform to the general arch shape.
- Place the auxiliary on the maxillary model or working directly in the mouth mark the wire at the distal end of the relevant molar buccal tube.
- Bend the wire back on itself 180 degrees and cut off leaving a section of 6 mm (0.24 inch). The double back should be in the same flat horizontal plane as the curved section of the auxiliary.

Placement

- As an example, if you required buccal root torque of the left maxillary molar, then insert the doubled back section into the distal opening of auxiliary or headgear tube of the left maxillary molar, the auxiliary torque arch is now turned clockwise a full 360 degrees and the free end is slipped into the second buccal tube of the right maxillary molar. The auxiliary overlies the main archwire and should be tied with ligature wire as an overlay arch in the buccal and anterior segments. The main archwire should be rigid enough to prevent any arch shape distortion. It is unlikely that the occlusal plane level will alter over a period



(a)



(b)

Figure 10.8

(a) Wind-up molar tooth torquing auxiliary curved to conform with the dental arch. (b) Wind-up molar tooth torquing auxiliary; the distal end is bent back on itself 180°. Depending on the torque required, the curved auxiliary is wound either clockwise or counter-clockwise and the free end is tied or slipped into the buccal tube of the molar on the opposite side.

of approximately three months; however, the level should be monitored regularly. For palatal root torque, the auxiliary must be turned counter-clockwise. The same auxiliary and the same principles can be used in the mandibular arch.

If the buccal tube has a vertical slot, then instead of a double back bend, a post is created by bending a 90 degree bend in the same flat horizontal plane; this post is inserted into the vertical slot either from the occlusal or gingival aspects, depending on access. To activate, the auxiliary is turned either clockwise or counter-clockwise and tied to the main archwire.

COIL SPRINGS

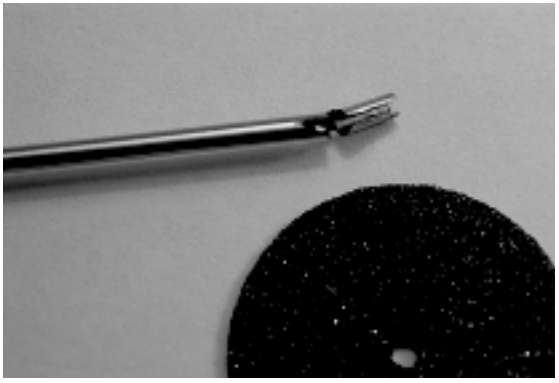
Coil springs are very useful auxiliaries; they may be used either as push springs to expand or as pull springs to close spaces. Historically, coil springs have been manufactured from stainless steel wire; currently, they are also manufactured in nickel-titanium wire. These coil springs may be purchased in different lengths and sizes either on a coil or as individual springs with pre-formed eyelets at either end. Nickel-titanium springs retain their activity more efficiently than conventional stainless steel springs.

Measured cut lengths are threaded on the archwire prior to placement in the mouth. To assist in the placement of an active coil spring, Binder describes a technique to render the coil spring passive by threading a length of ligature wire through the coil spring and compressing the spring by tying the ends of the ligature wire in a 'pigtail'.[3] Once the archwire and coil spring are in position in the mouth, cut the ligature wire and the coil spring will return to its active state. During treatment, coil springs may be activated in a number of ways. With two notched flat plastic instruments placed over a section of coil spring it is possible to overstretch a section and thus increase overall activation. Squeezing the tips of light wire pliers between adjacent helices of the coil spring will also result in an effective increase in the resting length of the spring.[4]

Activating Coil Springs

Ronald G Melville

Open push coils used to expand space between two teeth will lose activation as the teeth move and the space gets larger. It is possible to activate the coil spring with a short length of stainless steel tubing 0.762 mm (0.030 inch), which has been split longitudinally and crimped on to the archwire. The length of tubing used will depend on the



(a)

(b)

Figure 10.9

(a) Stainless steel tube stop for coil spring activation. Slit the tubing lengthwise. Cut the tubing across almost completely at the desired length. (b) Compress the coil spring with a notched flat plastic instrument, holding the long section of the stainless steel tubing, place the slit section on the archwire, break by twisting the stainless steel tubing then crimp the remaining cut section on the archwire.

amount of activation required, usually 2–3 mm (0.04–0.08 inch). The tubing is split longitudinally with a cutting disc and then at the required length, the tube is cut across but not fully, the small section should still remain attached to the main length. To reactivate the coil spring, compress it with a notched flat plastic instrument, then using the main length of stainless steel tubing as a handle, slip the small split section over the archwire, crimp it in position, then break off the main length by twisting it (Figure 10.9a, b).

Activating Coil Springs

Farah R Padhani

In anticipation of the need to reactivate push coil springs as adjacent teeth move, at the time of placement of the active spring, passive pieces of closed coil spring are threaded on the archwire and left in the adjacent interdental areas. When the need arises to activate the main coil spring, the adjacent tooth is untied, and the passive section of coil spring is moved across and compressed up against the main coil spring. The tooth is re-tied. This has the effect of lengthening the coil spring and rendering it more active, a technique also described by Binder.[3]

PLASTIC TUBING

Plastic or elastomeric tubing slipped over an archwire contributes to patient comfort. This is particularly relevant in cases where the archwire rubs against the inner surface of the cheek, and in lingual orthodontics to reduce archwire irritation of the tongue. The tubing is cut to size and the archwire slipped into the tubing prior to placing it in the mouth. In certain cases it is possible to place the tubing over the archwire in situ. Cureton describes a technique whereby the tubing is split lengthwise by threading a ligature wire through the tubing and using the ligature wire to slice through the wall of the tubing.[5] The split tubing is placed over the relevant section of archwire and the heated tip of an instrument is used to fuse the plastic seam.

In cases requiring mild expansion, an overextended length of plastic tubing compressed between two adjacent teeth can act as an expansion auxiliary.

AUXILIARIES IN ORTHODONTICS

André O Hugo

Numerous auxiliaries have been developed for use with labial and lingual appliances with and without vertical slots (V-Slots).[6] A number of these auxiliaries can be used to create space, others for root movements and some for a combination of both. Furthermore, some of these auxiliaries are used only with labial appliances, some only for lingual appliances and some are for both. Since the majority of our lingual cases have lower labial appliances I have decided to include both labial and lingual auxiliaries in this discussion and have divided them into two categories:

1. Auxiliaries for labial and lingual appliances using brackets *incorporating* a vertical slot.
2. Auxiliaries for labial and lingual appliances using brackets *without* a vertical slot.

Pearl: To achieve and maintain adequate activation, unless otherwise stated, all auxiliaries are constructed from high tensile stainless steel wire, manufactured by either Wilcock, Australia or TP Orthodontics Inc, USA.

Auxiliaries for Labial and Lingual Appliances plus Vertical Slot

These are in the following categories:

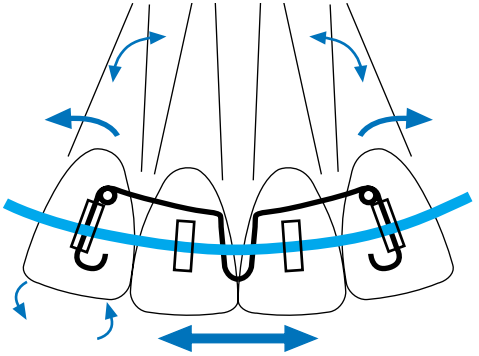
- Hugo Tipping, Torquing, Rotating and Spacing auxiliary (TTRS)
- Hugo lingual reciprocal torquing auxiliary
- Hugo staple auxiliary
- Super-mini occlusal uprighting spring
- Hugo rotating/uprighting spring.

Hugo TTRS

T—Tipping: For correcting and maintaining mesio-distal angulation (limited control if no vertical slot exists).
T—Torquing: For reciprocal labio-lingual torquing of the anchor teeth (limited if there is no vertical slot).
R—Rotating: For correcting axial rotations (most effective with a vertical slot).
S—Spacing: Mesio-distal expansion within the arch.

This sectional auxiliary may be used in conjunction with either the labial or lingual appliances and has been designed to create intra-arch space whilst simultaneously having the capability for tipping, torquing and rotating the anchor teeth as desired, hence the name: TTRS (Figure 10.10a–c).

Construction. The auxiliary may be constructed either directly in the mouth or indirectly on the patient's study models. A length of high tensile stainless steel wire either 0.356 mm (0.014 inch) or 0.406 mm (0.016 inch) is bent with vertical arms engaging the two anchor teeth which are to be reciprocally tipped, torqued, rotated or spaced. Such teeth may be adjacent to each other, or with any number of intervening teeth. To create space one or more vertical loops are incorporated, this also facilitates the alignment of the intervening teeth. The vertical loops are activated to varying degrees depending on the degree of crowding that has to be overcome, and the enface root surface of the engaged teeth. Depending on the angle at which the vertical end posts are bent, it is possible to also tip, torque and rotate the anchor teeth.



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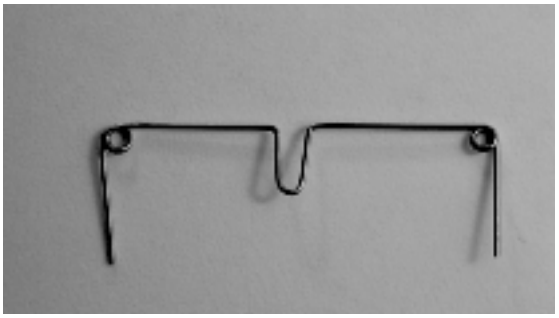

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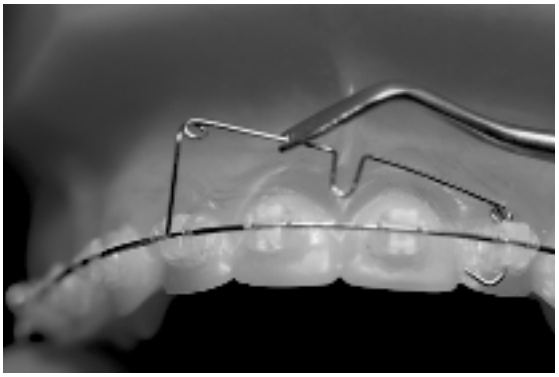


(c)

Figure 10.10

(a) Diagram of the Hugo TTRS (Tip, Torque, Rotate, Spacer) auxiliary. The vertical arms can alter the angulations and torque of the lateral incisors, The horizontal arm on the lateral incisors can correct rotations and the vertical loop between the central incisors can produce either expansion or space closure. (b) Wire example of a TTRS auxiliary fabricated from high tensile stainless steel. (c) Auxiliary designed for mesio-lingual rotation of the 22 and labial root torque of the 12.

Placement. All teeth are ligated to the main archwire. The vertical arms of the auxiliary are inserted into the vertical slots of the brackets on the anchor teeth and the vertical loops are slipped behind the main archwire. The 0.356 mm (0.014 inch) TTRS auxiliary is typically adjusted to produce approximately 2–3 mm (0.08–0.12 inch) of activation, which in turn generates a force of about 140–170 g (5–6 ounces). Once fully inserted, the protruding ends of the vertical posts are bent over to prevent dislodgement of the auxiliary.

The enface root surfaces of an upper central incisor (50 mm^2) and an upper lateral (40 mm^2) are often pitted against the enface root surface of an upper first pre-molar (75 mm^2) in the process of creating space for the eruption of an upper canine. The 140–170 g (5–7 ounces) of force generated by the typical clinical activation of the TTRS by 2–3 mm (0.08–0.12 inch) approximates the ideal force level of 1 g/mm^2 of enface root surface (considering purely mesio-distal movement).

The advantages of this method of expansion (without even considering that in addition, desired angulations, torquing and rotations may simultaneously be achieved) are as follows:

- Greatly improved oral hygiene compared to coil springs
- Simplicity of construction
- The ability to insert and remove the auxiliary without the need to remove or adjust the main archwire
- Cost-effectiveness
- Partial pre-fabrication.

Hugo lingual reciprocal torquing auxiliary

Sometimes, maxillary lateral incisors require labial root torque while the central incisors need palatal root torque. With the vertical arms activated correctly and inserted into the vertical slot of the lateral incisors, simultaneous uprighting and de-torquing of the laterals can be achieved (Figure 10.11a–c).

Construction. This lingual reciprocal torquing auxiliary is made from high tensile 0.356 mm (0.014 inch) stainless steel wire. Vertical loops are incorporated to create the

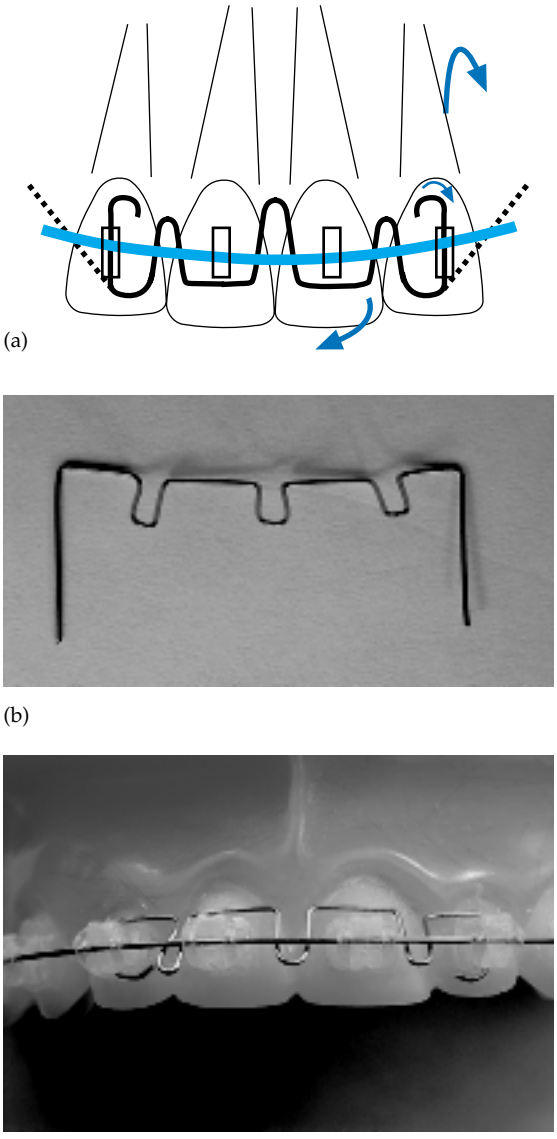


Figure 10.11

(a) Diagram of the lingual and labial reciprocal torquing auxiliary. The horizontal trapeze on the central incisors produce lingual crown torque (labial root torque) and the vertical arms on the laterals can produce labial crown torque (or vice versa). It is also possible to alter the angulations of the lateral incisors. The vertical loops behind the main archwire can create expansion or space closure. (b) Wire example of an auxiliary fabricated from high tensile stainless steel. (c) Auxiliary designed for labial crown torque of the central incisors and reciprocal lingual crown torque of the lateral incisors.

trapeze (horizontal section), which will act on the lingual or labial surface of the tooth in an opposite direction to the activation incorporated into the vertical post of the auxiliary that will be inserted into the vertical slot of the anchor teeth (lateral incisors). As with the previous auxiliary, it is also possible to incorporate a degree of tipping action on the anchor teeth depending on the angle at which the terminal posts of the auxiliary are bent.

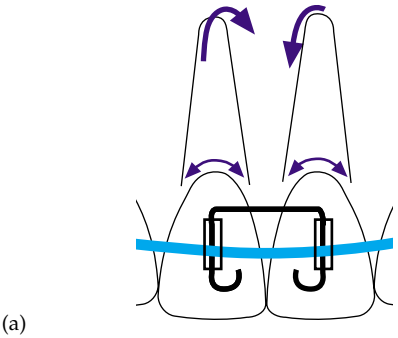
Placement. All teeth are ligated to the archwire, the vertical loops are slipped behind the main archwire and the vertical posts of the auxiliary are inserted into the vertical slots of the anchor teeth. On the assumption that the main archwire is round, these auxiliaries will continue to work until all the activation is dissipated; it is essential to continually monitor the progress of the root movements to avoid excessive over-correction. If the main archwire is rectangular, then either it should be reduced in size to allow corrective movement of the relevant teeth, or the correct torque should be bent into the arch to assist in the torquing action of the auxiliary.

Hugo staple auxiliary

The staple auxiliary is very useful for correcting the differential torque of two adjacent teeth. To use the lateral incisor as an example, it is often clinically possible to feel the palatal displacement of the lateral incisor root and the prominence of the adjacent canine root (Figure 10.12a–c).

Construction. The auxiliary is made from 0.356 or 0.406 mm (0.014 or 0.016 inch) high tensile stainless steel wire. Vertical posts are bent at each end, then in the horizontal plane, the posts are bent in opposite directions to generate recprocal root torquing actions on the lateral and canine teeth.

Placement. This auxiliary can be used with any bracket incorporating a vertical slot. The staple is inserted usually from the gingival into the vertical slots of the brackets and the protruding ends of the vertical posts are bent over to prevent accidental displacement of the staple. The correction can be exaggerated or overcorrected by further bending the posts of the staple in the direction designed to correct the



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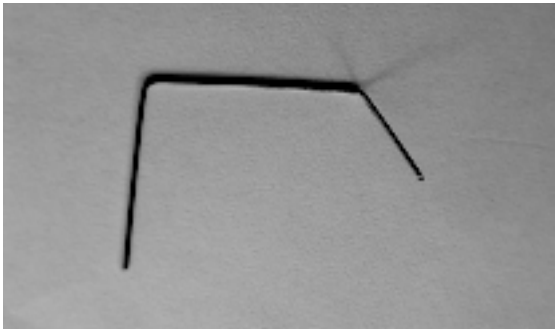

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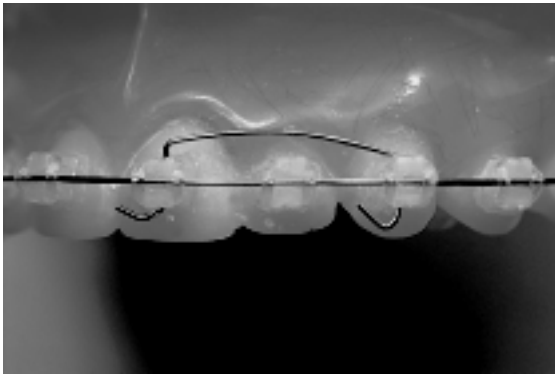


(c)

Figure 10.12

(a) Diagram of the Hugo staple auxiliary. The vertical arms are adjusted to parallel the torque of adjacent teeth. The vertical arms can be adjusted to parallel or change the angulation of adjacent teeth. (b) Wire example of a staple designed for palatal root torque of a maxillary canine and labial root torque of a central incisor. (c) Auxiliary placed on a model.

original torque differential. The vertical arms also parallel the angulation of adjacent teeth.

This auxiliary is small, neat, can be used on any maxillary or mandibular teeth and can be inserted and removed without disturbing the main archwire.

Super-mini occlusal uprighting spring

This spring was designed to overcome some of the problems encountered with the use of the conventional Begg uprighting spring. The conventional spring generally inserted from the gingival aspect has certain disadvantages:

- An extrusive effect as a result of the contact of the spring helix with the gingival part of the bracket.
- A tendency to rotate the tooth being uprighted.
- A food-trapping effect as a result of the 'box' formed between the horizontal hook arm and the main archwire.
- It cannot be inserted from the occlusal aspect without generating occlusal interference.

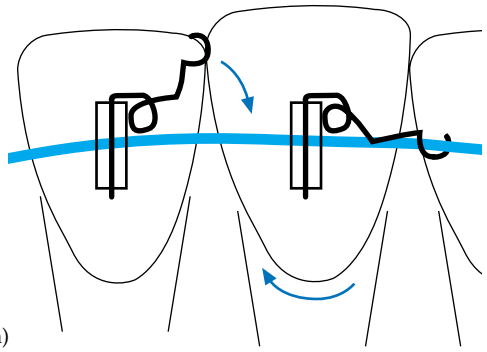
The ability to insert an uprighting spring from the occlusal aspect is advantageous in situations where competition for space on the archwire is a factor and in situations where the gingival tissue limits access for placement or cleaning.

The modified (Hugo and Weber) super-mini occlusal uprighting spring (Figure 10.13a–c) has the following advantages:

- It can be inserted from the occlusal without interfering with the occlusion.
- The spring helix (circle) lies adjacent to the bracket and has no intrusive or extrusive action on the tooth.
- There is reduced food-trapping because the horizontal hook arm lies adjacent to the main archwire.

Unfortunately, if the super-mini uprighting spring is inserted from gingival aspect, the masticatory forces sometimes impinge on the helix (circle) and tend to unseat the spring.

This spring can be used with any bracket that incorporates a vertical slot. It is especially useful in lingual orthodontics using the light wire bracket.



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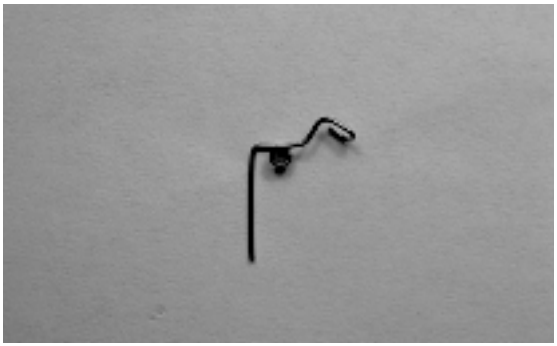


(b)

(c)

Figure 10.13

(a) Diagram of the Hugo and Weber modified super-mini occlusal uprighting spring inserted from the occlusal. (b) Wire example. (c) Super-mini occlusal uprighting spring placed on a model (Lingual Appliance).

Construction. This mini uprighting spring is totally pre-fabricated by the practitioner or his staff from 0.035 mm (0.012 inch) high tensile stainless steel wire. It has a vertical shaft of 3 mm (0.12 inch), and a horizontal offset of 1 mm (0.04 inch) as it emerges from the bracket's vertical slot. The helix (circle) of 1 mm (0.04 inch) diameter is then bent so that the circle lies adjacent and not occlusal or gingival to the bracket. The horizontal hook arm of 3 mm (0.12 inch) has a shallow V-bend so as the tooth uprights and the spring becomes less active, the horizontal arm will bend towards and not away from the main archwire.

The tips of commercially available 'bird-beak' pliers are not fine enough to handle these small uprighting springs, it is necessary to trim the round beak of small 'bird-beak' pliers to a smaller dimension using either sandpaper discs or a diamond burr in a high speed turbine (No. 105G, Dentronix Inc, USA).

Placement. The teeth should first be ligated to the main archwire. Using fine 'bird-beak' pliers, the stem is inserted into the vertical slot from the occlusal aspect and with a notched flat plastic instrument, the spring is activated by engaging the hook on to the main archwire.

Hugo rotating/uprighting spring

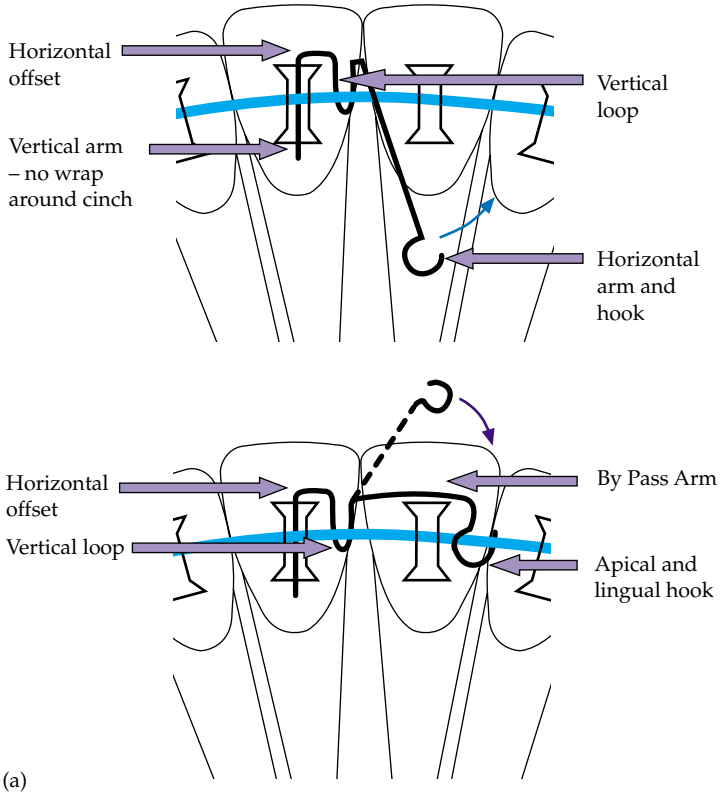
This spring was designed as an alternative to the conventional Begg rotating spring and it can be used in conjunction with both labial and lingual appliances (Figure 10.14a–c). It has the following advantages:

- It is self-retained and is therefore particularly useful when used in conjunction with the mandibular lingual appliance where limited access makes it difficult to bend over the protruding end of the vertical shaft of a conventional rotation spring. When the conventional rotating spring is activated, it is this crucial horizontal bend that applies the rotating force to the crown of the tooth.
- It can be inserted from the occlusal aspect (essential with lingual appliances) since it can be adjusted so as not to interfere with the occlusion.
- It is the only spring that can simultaneously effect disto-lingual/palatal rotation and distal root tip to upper canine teeth when used with the light-wire bracket lingual appliance (Begg). When used only as a *rotating spring*, the horizontal arm is deflected in a horizontal direction only, with no vertical deflection. When used as an *uprighting spring*, the horizontal arm is deflected vertically. If simultaneous rotation is desired then the arm may also be deflected horizontally.

Construction. The spring is made from 0.356 mm (0.014 inch) high tensile stainless steel wire. As with most auxiliaries described in this section, a vertical post is bent at 90 degrees, to fit into the vertical slot of the bracket. Adjacent to the vertical post bend a vertical loop—it is this loop, which will produce the rotating force when the spring is activated. The horizontal arm incorporating a terminal hook is bent after the vertical loop at an angle to the vertical loop; this angle will determine the degree of activation and will also determine whether a purely rotational or a rotational plus combined tipping force will be delivered to the relevant tooth. The length of the hook arm will be dependent on the space available on the main archwire to engage the retaining hook. It is possible to bypass one or more adjacent teeth.

Placement. All the teeth are ligated to the main archwire. The vertical arm of the auxiliary is inserted into the vertical slot of the tooth, ensuring that the vertical loop is positioned behind the main archwire in contact with the tooth surface (lingual or labial). The hook arm will be projecting away from the main arch in a horizontal direction for pure rotation; activate the spring by engaging this hook arm on to the archwire. If a degree of tipping is required, the hook arm will have a horizontal and a vertical deflection prior to engagement with the archwire.

As with the other auxiliaries, this rotating spring can be inserted and removed without disturbing the main archwire.



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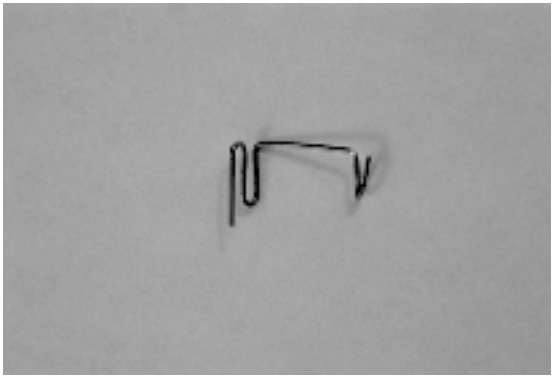

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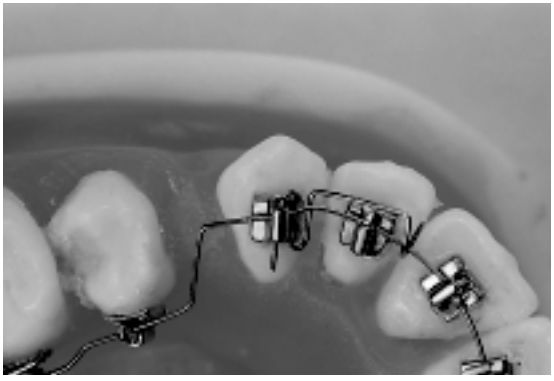


(c)

Figure 10.14

(a) Diagram of the Hugo self-seating lingual rotating spring. (Top) When used as a rotating spring, the horizontal arm is deflected and activated in a horizontal direction only. (Bottom) When used as an uprighting spring the arm is deflected and activated in a vertical direction only. By varying the deflection a combination of uprighting and rotation can be achieved. (b) Wire example. (c) Auxiliary designed for mesio-labial rotation of a maxillary canine, placed on a model.

Auxiliaries for Labial and Lingual Appliances plus those without a Vertical Slot

The first two are essentially crown-moving auxiliaries and the second two are root-moving auxiliaries.

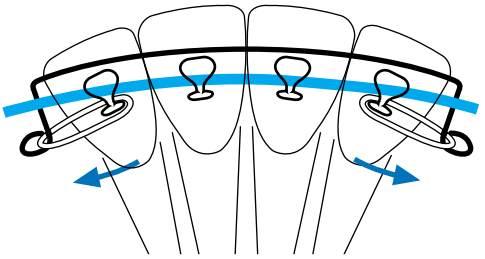
- Hugo space bar
- Overlay expander
- Hugo lingual torquing auxiliary
- Hugo de-torquing bar.

Hugo space bar

This is a space-creating auxiliary for any labial or lingual appliance irrespective of the bracket used. It is easier to make than the Hugo tipping, torquing, rotating spacing (TTRS) sectional auxiliary but does not provide the ability to tip, torque or rotate teeth. The expansion force is derived from elastomeric rings or thread and not directly from the wire base (Figure 10.15a–c).

Construction. The space bar is constructed from a length of 0.406 or 0.457 mm (0.016 or 0.018 inch) high tensile stainless steel wire with short vertical arms (2 mm or 0.08 inch) the ends of which are bent into small circles or hooks. The transverse length of the space bar is made 2–3 mm (0.09–0.12 inch) longer than the mesio-distal distance of the teeth to be reciprocally spaced.

Placement. The auxiliary is inserted from the incisal aspect with the two vertical legs sliding behind the main archwire and positioned distal to the teeth at each end of the dental segment requiring expansion. Elastomeric rings (doughnuts) are hooked over the brackets (e.g. the palatal hook of the Ormco lingual appliance or over a high hatpin on the Begg appliance or the vertical post available on certain edgewise brackets) of the teeth adjacent to the circles or hooks of the space bar and stretched to engage the circle or hook of the space bar. The elastic force moves the respective teeth closer to the hooks of the space bar and so creates space. The central portion of the space bar is tied to the main archwire to prevent it from being displaced. It should follow the contour and offsets (if any) of the main archwire.



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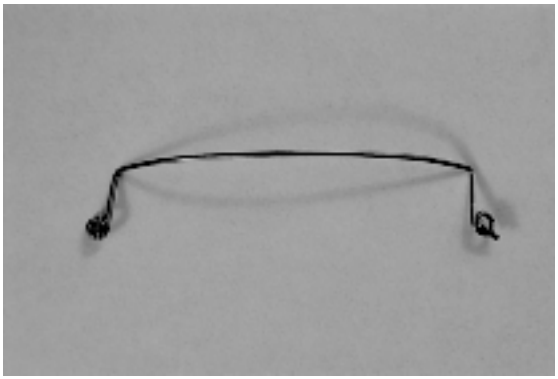

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Figure 10.15

(a) Diagram of a Hugo space bar designed to create space using either labial or lingual techniques. The central portion needs to ligated to the main archwire. (b) Wire example. (c) Space bar auxiliary designed to create space for mandibular incisors. Elastomeric thread tied from the lateral incisors to the circles of the auxiliary.

As with the other auxiliaries, this expansion auxiliary can be inserted and removed without disturbing the main archwire.

Overlay expander

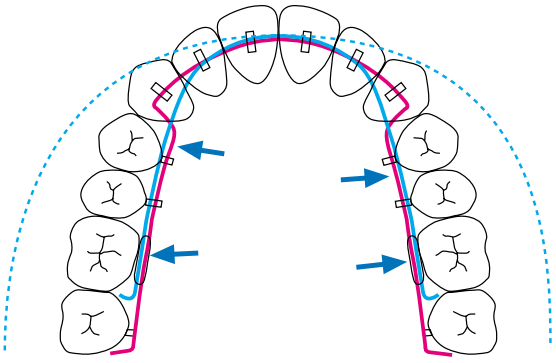
In certain cases, it is expedient to create a degree of buccal expansion during treatment. It is possible to remove the main archwire, and replace it with an expanded heavier archwire. However, this expanding auxiliary provides the facility to achieve buccal expansion at any stage during treatment without having to disturb or adjust the main archwire. As this auxiliary is of a larger gauge than the light main archwire used in the early stages of treatment, this overlay arch will expand a constricted arch while the main archwire continues to align the teeth (Figure 10.16a–c).

Construction. The overlay expander follows the expanded contour of a labial or lingual archwire. This auxiliary is constructed from a length of 0.406, 0.457, or even 0.508 mm (0.016, 0.018 or even 0.020 inch) high tensile stainless steel wire. The terminal ends of the overlay expander can have any of the following:

- Straight ends that simply slide into the extra buccal tubes on the molar teeth.
- Hooks that can be crimped on to the main archwire in the bicuspid or molar region.
- Right angle bends which can be inserted in the vertical slots of the molar tubes for buccal root torque if desired.

Depending on the gauge of wire selected, in its passive state, the auxiliary should have approximately 1 to 2 cm (0.4–0.8 inch) buccal expansion in the molar region.

Placement. When used with a labial appliance, the two distal ends are squeezed closer and slipped into the extra buccal molar tube or tied to the molar brackets. When used with a lingual appliance, the arch is similarly squeezed and hooked to the palatal arch generally between the second pre-molar and first molar teeth. In all cases the auxiliary should be tied to the anterior and buccal teeth to prevent any dislodgement.



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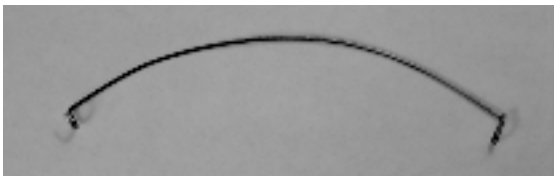

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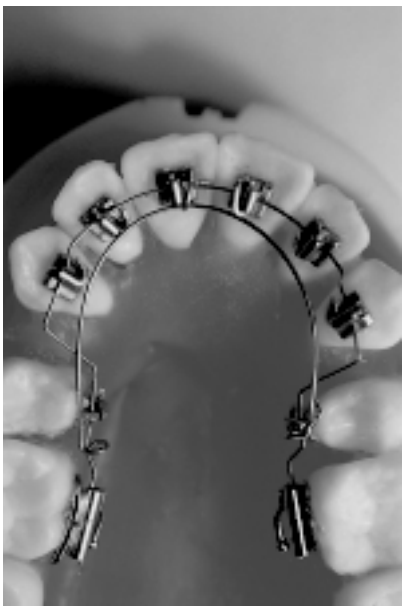


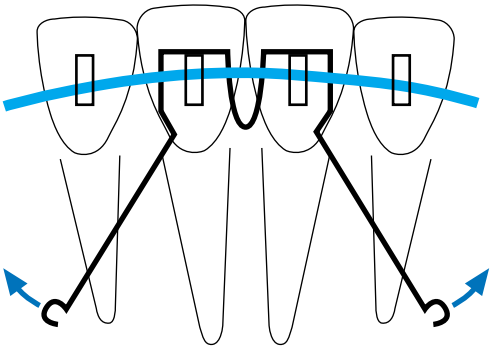
(c)

Figure 10.16

(a) Diagram of the lingual overlay expander. The auxiliary is usually only pinned or tied to the central incisors and pre-molar teeth. (b) Wire example. (c) Auxiliary designed for lingual maxillary expansion placed on a model.

Hugo lingual torquing auxiliary

Conventional torquing auxiliaries used with labial appliances are not suitable for lingual appliances. This auxiliary was developed to achieve palatal root torque of maxillary incisors in the lingual technique and is designed for use with any lingual appliance or bracket using a round archwire. Usually only a 2-bar torquing auxiliary is needed with horizontal bars incisal to the bracket on the maxillary centrals. As with a labial 2-spur torquing auxiliary the lateral incisor roots tend to follow the central incisor root as they torque palatally (Figure 10.17a–d). The 4-bar



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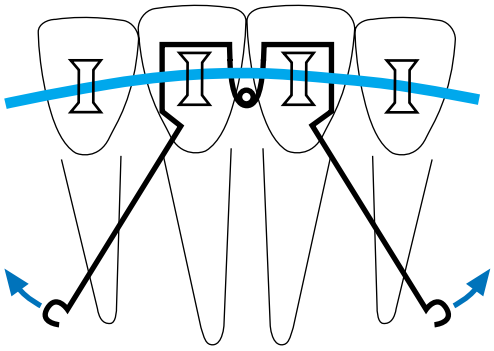

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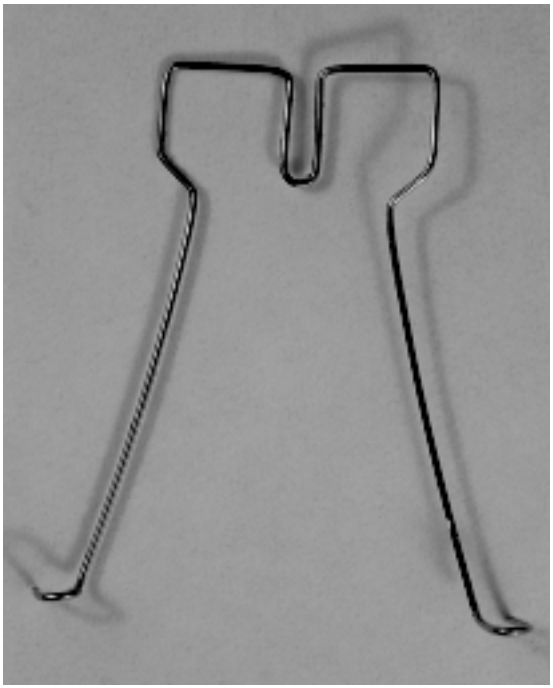

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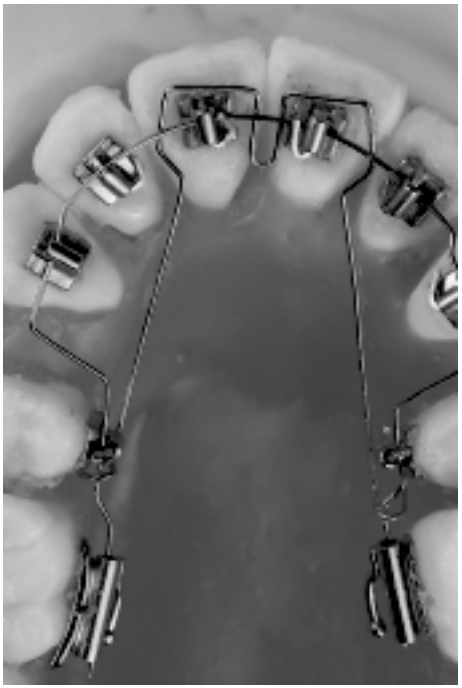


(d)

Figure 10.17

(a) Diagram of the palatal torquing auxiliary for lingual technique. The vertical loop and activating arms pass behind the main archwire. (b) Diagram: small circle in the reduced vertical loop for ligating to the archwire when the incisal papilla is swollen. (c) Wire example. (d) Palatal root torquing auxiliary placed on a model.

lingual torquing auxiliary has vertical loops between the laterals as well and is required in rare situations when the torque in the lateral incisors does not follow the torque of the central incisors.

Construction. This auxiliary is constructed from either 0.356 or 0.406 mm (0.014 or 0.016 inch) high tensile stainless steel wire. There are two possible designs for this auxiliary. Where there is no hypertrophy of the lingual incisive papilla a vertical loop is incorporated in the mid line and this is slipped under the main archwire.

Modified Root Torquing Auxiliary for Lingual Appliances

Ziegfried J Weber

Where there is gingival hypertrophy or some other impediment to the vertical loop, a small circle is bent instead of the loop and this is ligated to the main archwire.

After bending the vertical loop, the widths of the horizontal bars are determined by the corresponding width of the two central incisor teeth. The distal arms are bent at 90 degrees to the horizontal bars and at the gingival margins of the teeth a mesial off set is placed. In its pre-fabricated form it lacks the terminal hooks on the arms which should be individualized for each patient to engage the main archwire in one of the following situations:

- In the region of the canines, however, this is rarely the best position, since this area is somewhat congested with the inter-maxillary circle, uprighting springs, bicuspid offset and elastics.
- Between the first and second pre-molars, this site is favoured in non-extraction cases.
- Between the second pre-molar and first molar; favoured in extraction cases.

Placement. The two arms incorporating the distal hooks are inserted under the archwire in the embrasure between the central and lateral incisor teeth. Once the hooks are under the archwire, the auxiliary can be gently moved up into position taking care to slide the midline vertical loop under the archwire between the central incisor teeth. If the auxiliary with a midline circle is used, then this circle must be tied to the main archwire. Once the auxiliary is in position, the hook arms are moved in an occlusal direction and the hooks engaged on the main archwire. When correctly inserted and activated the posterior hook arms bend and curve along the palatal contour to some extent, this can be further curved and adjusted in various ways for patient comfort.

The advantages of using this auxiliary for palatal root torque of maxillary incisor teeth are:

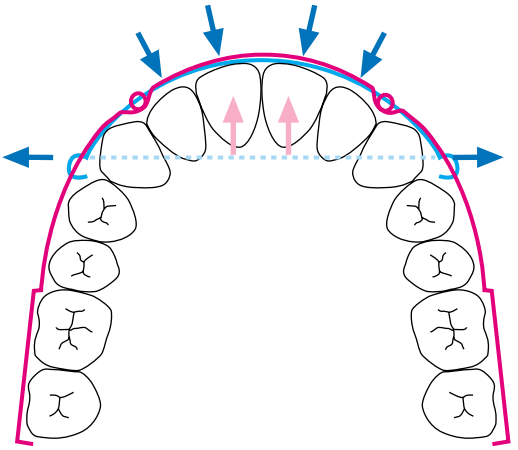
- Torquing of the central incisors can be started from the outset of treatment if desired, even with a very light 0.356 mm (0.014 inch) nickel-titanium main archwire, without undue side effects. However, with such a light main archwire, there may be some tendency for constriction and intrusion of the posterior teeth if the arch is left for more than 3–4 months without progressing to a heavier main archwire.
- Partial pre-fabrication.
- Ease of insertion and removal without having to remove or adjust the main archwire.
- Cost-saving. Inexpensive wires can be used to achieve rapid results.

Hugo de-torquing bar

This auxiliary is very useful for uprighting excessively tipped lower or upper incisor teeth and is used in combination with a lower or upper labial appliance (Figure 10.18a–c).

Construction. It is constructed from a *straight* piece of 0.406 mm (0.016 inch) high tensile stainless steel with small terminal hooks. The length of the auxiliary should be measured to finish with the terminal hooks fitting between the canine and first premolar teeth.

Placement. The auxiliary is placed incisal to the brackets of proclined incisors and the terminal hooks are crimped on to the main archwire between the canine and first pre-molar



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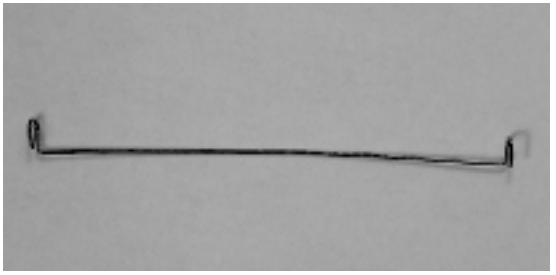

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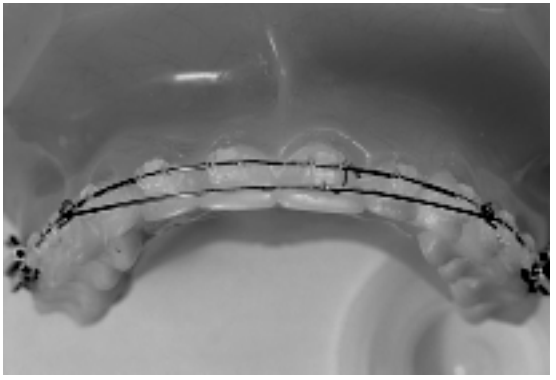

(c)

Figure 10.18

(a) Diagram of the Hugo de-torquing bar. Effective in the lower labial segment to upright proclined lower incisors. (b) Wire example. (c) De-torquing auxiliary for lingual crown torque of maxillary incisor teeth placed on a model.

each side. Since this straight wire is curved around the anterior arch it exerts a lingual force on the incisal part of the crown thereby effecting lingual crown torque. Clearly, some expansion of the buccal segments will tend to occur. However, if this side effect is not desired then the main arch should be constricted in this area to counter this action, or as an alternative a more rigid main archwire fitted.

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11 DETAILING THE FINAL OCCLUSION

Despite the sophisticated prescription appliances currently in common usage, there are minor adjustments that can be incorporated into the final stages of treatment, which contribute to improving the functional and aesthetic features of the final occlusion. Apart from clinical evaluation of the occlusion, it is at this stage that pre-completion radiographs, dental panoramic tomograms (DPTs) and cephalographs need to be taken to assess root parallelism, anterior root torque, root resorption, position and angulations of unerupted third molars and the possible development of any other anomalies. Radiographs taken at this stage still allow for the possible corrective procedures to be instituted as opposed to radiographs taken after the removal of appliances.

As you near the end of active treatment tell your patients, particularly adult patients, that as the treatment is approaching the final stages, you would like them to start checking their teeth periodically in the mirror and to make a note of any feature about which they are unhappy. They need to let you know at the next appointment.

Pearl: The patient may see a feature or have a perception of their teeth of which you are unaware; it is far preferable to be in a position to correct this particular feature or perception prior to the removal of appliances.

Apart from the input given by your patient, there are a number of features you need to examine carefully as you approach the end of active treatment. As you examine the dentition it is a good idea to bear in mind Andrews' six keys of occlusion.[1]

Final Detailing of the Occlusion

Luc Dermut

As an aid to final detailing of the occlusion, it helps to have an overall view of the entire dental arch. To get a better view of the dental arch use a large mouth mirror (No. 6) or the occlusal mirror used for intra oral photography.

Progress study models also help to identify errors and details that need to be corrected.

ANTERIOR SEGMENTS

From the patient's point of view, the aesthetic component of the final occlusion is of greater significance than the functional component. It is incumbent on you, the clinician, to also evaluate and correct the functional component.

Angulation of Anterior Teeth

The centrals, laterals and canine teeth should all have a mesial tip. While this feature may be built into the bracket prescription, it is possible that an incorrect placement of the bracket at the initial strap-up will only start to express itself as an incorrect tip when the final archwires fully express the bracket prescription. It is a common fault to leave the lower lateral incisors either upright or with a distal tip. If there is a problem with tooth angulation it may be corrected by:

- Repositioning the bracket and correcting for tip

- Placing corrective bends in the archwire
- Using an uprighting auxiliary.

Alignment of Incisal Edges

Look carefully at the incisal edges, check for chipped or excessively worn incisal edges. Marked incisal mamelons may also be aesthetically unacceptable. The incisal edges of the four maxillary incisor teeth should be in the same horizontal plane or the lateral incisors slightly palatal to the central incisors, the maxillary lateral incisal edges should be 0.5 mm (0.2 inch) shorter than the central incisors. This arrangement contributes to a more youthful smile, but placing the four maxillary incisors at the same vertical level ages the smile. When the patient smiles the incisal edges of the maxillary anterior teeth should curve and follow the smile line of the lower lip.

Check the horizontal cant of the occlusal plane, ask the patient to close on a flat tongue depressor (flat wooden blade) held across the front of the mouth. Check the level with the rest of the face with particular reference to the inter-pupillary line.

Correcting the levels of the incisal edges can be done by:

- Repositioning the brackets to correct for vertical height discrepancies.
- Adjusting the archwires using vertical offset second order bands.
- Selective grinding of the incisal edges with a mounted stone or diamond burr. Minor artistic grinding or reshaping of the incisal edges, particularly the mesial and distal incisal angles, can make a tremendous difference to the final smile. If you use a slow handpiece, then support the tooth with finger pressure to reduce the sensation of vibration.
- Aesthetic composite bonding can also mask certain anatomical deficiencies. You have the choice of either carrying out this procedure yourself or requesting the patient's dentist to do the bonding according to your prescription.

Recontouring Technique

Richard N Carter

In my adult practice, I re-shape and make slender some teeth on virtually all patients.[2] I have found a thin, double-sided diamond disc can be bent slightly to contour the teeth, not just flatten them. The procedure is fast, painless, clean, and simple. It can be done at any stage of treatment. Remove the archwire first.

With a flexible disc it is easier to round the incisal edges than using a burr, a flame-shaped diamond, or a wheel. After any re-contouring, polish with an abrasive-impregnated wheel. These wheels are very soft and will last for only a few teeth, but this softness is the secret for attaining a beautiful, smooth surface while removing a minimum of enamel.

Torque of anterior teeth

Check for expression of the correct torque for all the anterior teeth. Examine the anterior crowns from the front and the side. It is also helpful to examine the maxillary teeth from the palatal aspect and the mandibular incisors from the lingual aspect.

Pearl: Look at the palatal and lingual gingival margins; uneven torque will show up clearly.

Inadequate labial root torque of initially palatally displaced maxillary lateral incisors will become more obvious when the palatal aspect is examined. Surgically exposed impacted maxillary canine teeth also need to be evaluated for adequate labial root torque. Uneven torque between central incisors may be due to abnormal crown anatomy or failure to seat the bracket flat on to the labial surface at the time of the initial bonding. Uneven or inadequate torque can be corrected by:

- Repositioning the bracket.
- Incorporating torque adjustments into the archwire or by using individual or multiple, palatal or labial torquing auxiliaries (Chapters 9 and 10).

Rotations of anterior teeth

Rotations are notorious for their relapse tendency.

> **Pearl:** It is advisable for all rotations to be corrected to ideal or slightly over-corrected positions in the early stages of treatment. The longer the rotated teeth are held in the correct position, the greater the chances of stability.

If you correct a rotation just before the end of treatment, there is a good chance that this will relapse very quickly after the removal of appliances. Irrespective of how good your memory is, you cannot recall the original position of the teeth. Therefore, to assess whether all rotations have been correctly managed, it is essential to have either the original study models or clinical photographs at hand.

> **Pearl:** The mesio-labial rotations of maxillary lateral incisors in Class II division 2 malocclusions should be slightly over-corrected; they relapse very easily.

Rotations can be corrected by:

- Incorporating mild artistic palatal offsets into your final archwire. Maxillary lateral incisors should generally be fractionally more palatally placed than the central incisors.
- Offset the bracket base on the tooth surface either at the time of initial bonding or as a corrective measure during treatment. To create a predictable base offset, spot-weld a small piece of 0.356 mm (0.014 inch) wire to the mesh base at either the mesial or distal edge of the bracket base as the case requires.
- Rotation wedges are fairly efficient on flat surfaced teeth but not on curved canine and pre-molar teeth.
- If the brackets incorporate vertical slots, clockwise or counter-clockwise rotation springs are efficient, they may be made in-house or purchased commercially (TP Orthodontics Inc, USA).

Facial and dental centre-lines

Check the maxillary and mandibular centre-lines. They should be coincident with each other and with the facial centre-line. Centre-line discrepancies may be due to many dental or skeletal factors and in certain cases accepting a centre-line discrepancy may be unavoidable.

> **Pearl:** However, if you planned for the centre-lines to be coincident, then it is essential to see that this has been achieved some time prior to completion before all available space has been closed.

If the centre-line needs to be corrected as you approach the end of treatment, then this can only be achieved by:

- Mild tooth tipping of selected teeth in one or both arches. If the correction requires bodily tooth movement, then this should have been carried out earlier on in treatment.
- The use of anterior diagonal elastics as well as unilateral Class II or Class III elastics can achieve mild tipping. Or if your brackets incorporate vertical slots, unilateral uprighting springs will assist in tipping teeth and correcting centre-line discrepancies.

Whatever method you choose, if you want the teeth to tip at this late stage you will need to reduce archwire thickness; with full thickness archwire engagement, the teeth will not tip.

It is assumed that overjet and overbite have been adequately corrected with due regard to the original malocclusion. The overbite should provide adequate incisal guidance and posterior disocclusion on mandibular protrusion.

Closing a Small Diastema

Ronald G Melville

If a patient has been scheduled for removal of appliances and you notice that there is still a

(a)

(b)

(c)

Figure 11.1

(a) Small residual midline diastema. (b) Stainless steel band material (tape) placed as a wedge between the central and lateral incisors, note the closure of the diastema. (c) The wedges are removed after placing a lingual retainer to hold the central incisors, the lateral incisors move back into contact with the central incisors.

small midline diastema, you are faced with three choices:

1. Both you and the patient accept the space and all appliances are removed.
2. *Or* the two central incisors are tied with an elastomeric thread and a new appointment is scheduled for the removal of appliances.
3. *Or* take two lengths of band material (stainless steel tape) folded over two or three times and force it between the centrals and the lateral incisors on each side. This will close a diastema of about 0.50 mm (0.02 inch) instantly. A fixed palatal retainer can be bonded to hold the central incisors together. The lateral incisors 'spring back' so no gaps are left between them and the central incisors (Figure 11.1a, b, c).

POSTERIOR SEGMENTS

When evaluating the posterior segments, it is incumbent on you, the clinician, to examine and correct the details of the buccal occlusion irrespective of the patient's perceptions regarding their significance. Patients generally are not too concerned about the aesthetic or functional features of the buccal occlusion.

Root Parallelism

Check to see that all the buccal teeth are upright and the roots are parallel, particularly on either side of an extraction site.

> **Pearl:** In second pre-molar extraction cases, special attention needs to be paid to uprighting distally tipped first pre-molars and mesially tipped first molars.

Failure to achieve this parallelism will be due to incorrect bracket placement or failure to reach full thickness archwire engagement in relation to bracket slot size. Correct this fault by:

- Repositioning the relevant brackets and introducing the correct tip.
- Re-bending the archwire placing corrective second order bends.
- If the brackets incorporate vertical slots, place the correct uprighting or sidewinder springs.

If molar teeth have been moved distally as part of the original treatment plan, check to see that they are not left with a distal crown tip. Distal molar tip, particularly of the maxillary molars, will relapse and what looked like a Class I molar occlusion will relapse to a cusp-to-cusp Class II relationship. Molar teeth can also finish with either a mesial or distal tip due to poor initial buccal tube placement. Try to seat the disto-buccal cusp of the maxillary first molar down into the embrasure between the mandibular first and second molars.[1] To correct poorly tipped molars, it will be necessary to:

- Place corrective second order bends in the archwire.
- Reposition the buccal tubes. The maxillary first molar will have a slight mesial crown tip. If the case finishes with a Class II molar relationship, the maxillary first molar will need to be more upright.

Premolar rotations

These rotations should be carefully checked in relation to the original malocclusion; rotations should be slightly over-corrected. Conventional bands on pre-molars generally incorporate buccal brackets and lingual buttons; this arrangement makes it easy to rotate pre-molars, using palatal and buccal elastomeric threads. The presence of a lingual button on a pre-molar tooth also provides the facility for a lingual ligature tie, which can be used to hold the rotation throughout treatment. With the current replacement of conventional bands by brackets bonded only to the buccal surface, correcting rotations becomes more difficult and unfortunately in certain cases, may be overlooked.

Pearl: Poor initial bracket placement will also lead to poor rotation control.

If detected, rotations can be corrected before finishing by:

- Repositioning the bracket to aid in over-correction if desired.
- Bonding a lingual button and placing elastomeric threads to create a rotational couple.
- Use clockwise or counter-clockwise rotating springs if vertical slots are present.
- Although not very efficient on curved teeth, rotation wedges can assist.

Molar rotations

At the end of treatment maxillary first molars should exhibit a mild mesio-buccal rotation.

Pearl: Unfortunately, it is not uncommon in an extraction case or in a case exhibiting initial generalized spacing, for the molars to result in mesio-palatal rotation due to the action of buccal space closing mechanics.

Undesirable molar rotation can also occur as a result of using molar tubes with no distal offset, or placing the buccal tubes either too far mesially or distally. To correct the rotation of the molars:

- Final space closing should be carried out using an elastomeric chain or thread from a palatal cleat or button on the molar to a hook on the main archwire placed between the canine and lateral incisor.
- If necessary, reposition the buccal tube, or replace it with a tube having the correct distal offset, this will vary with the appliance prescription.
- It is also possible to correct molar rotations by placing toe-in or toe-out bends in the main archwire.

Lower molars should exhibit no rotation and should finish with the buccal cusps lined up with the pre-molars and the second molars.

Pre-molar and molar torque

Finishing off with full thickness archwires should express the predetermined torque as designated by the prescription brackets and appliance of your choice. Failure to achieve

the correct torque may be the result of incorrect bracket placement, anatomical variation in crown shape, or failure to match archwire size with bracket slot size.

> **Pearl:** Carefully examine the bucco-lingual inclination of the teeth, particularly the palatal cusps of the maxillary molars; they tend to 'hang down' if there is inadequate buccal root torque. Check for excessive buccal root torque of the lower molars, the lingual cusps may be positioned too far below the level of the buccal cusps.

To correct errors in torque:

- Place adjusting torque in the main archwire.
- Reposition the bracket or buccal tube.
- If the brackets have vertical slots, an individual tooth-torquing auxiliary may be placed on any premolar or molar tooth (Chapter 9).

Marginal ridge heights

It is good practice to check that the marginal ridge heights of adjacent teeth are correct and match up with each other. Inadequate matching of marginal ridge heights will result in poor intercuspation and poor occlusion. Extrusion of one or more teeth above the occlusal level of adjacent teeth may lead to cuspal interference. Marginal ridge discrepancies are a result of incorrect bracket heights. The most common site for bracket height errors to occur is in the region of the second pre-molars and is due to either incomplete tooth eruption at the time of bonding or due to poor access or visibility in the presence of hypertonic buccal musculature interfering with accurate bracket placement. Marginal height levels can be corrected by:

- Repositioning the bracket.
- Placing compensating vertical offset bends in the main archwire.
- Using vertical intra-oral elastics either from single opposing teeth or multiple teeth. The vertical elastic will not override the main archwire, however, it will complement the action of a vertical offset bend. These elastics are more effective if the archwire is sectioned between adjacent teeth that need vertical movement. As an alternative to sectioning the archwire, replace it with a dead-soft arch made by twisting two strands of 0.254 mm (0.010 inch) dead-soft stainless steel ligature wire as described by Binder and Scott.[3] Pay careful attention to the direction of pull or force vectors of the vertical elastics. If, for example, you require vertical eruption of a maxillary canine, then use triangular elastic from the maxillary canine to the mandibular canine and first pre-molar; if you require some slight Class II correction as well as vertical eruption, then use angulated vertical elastic from the maxillary canine to the mandibular first pre-molar.

The use of 'W'-elastic as described originally by Wick Alexander is very useful and effective in improving overall inter-cuspation.[4] As an example, in a Class II division 1 extraction case, using a large 1.88 cm (0.75 inch) elastic, start by hooking it on to the buccal hook of the first maxillary molar then taking both strands of the elastic hook it in a zig-zag fashion down to the mandibular molar, up to the maxillary pre-molar down to the mandibular pre-molar and finish up at the maxillary canine. Either the maxillary or the mandibular or even both main archwires need to be sectioned distal to the canine teeth. In a Class II malocclusion, the elastics finish off at the maxillary canines with a Class II directional pull. In a Class III case, the elastic should finish off at the mandibular canine with a Class III directional pull.

FUNCTIONAL EVALUATION

Prior to the removal of appliances it is essential to evaluate the occlusion in function. Check the occlusion in lateral excursions and forward excursion. Look for cuspal interferences; generally the main culprits are the palatal cusps of the maxillary second molars hanging down too low below the level of the buccal cusps. This interference may be eliminated by:

- Judicious occlusal grinding of the offending cusps.

- Introducing further buccal root torque of the offending tooth, generally the second maxillary molar.

The teaching in most schools favours the establishment of canine guidance or a 'canine-protected' occlusion. However, there is still much debate concerning the long-term benefits of both canine-protected occlusion and group-function occlusion. Many believe that what may start off as a canine-protected occlusion in a young patient, will with age, develop into a group-function occlusion. If you aim to finish off with canine guidance, then the bracket heights on the canine teeth need to be placed about 0.5 mm (0.02 inch) higher than the pre-molars and central incisors. The final position of the canine teeth can be further adjusted by placing vertical offsets in the archwire or with vertical elastics. To check for canine guidance or canine protection, ask the patient to slowly slide the mandible to one side. Then, when they disocclude on the canine, ask them to gently tap up and down on the canine cusp tip, and ask them to the try and feel if any other teeth are making contact. Use articulating paper to assist and confirm the presence or absence of cuspal interference in lateral excursions.

Excursions in the sagittal plane should exhibit incisal guidance with complete disocclusion of the posterior teeth. While deep overbite cases are notorious for their relapse tendency, it is necessary to avoid the temptation to finish off the case with no overbite and no anterior incisal guidance. An overbite covering one third of the lower incisors can be established by reducing the curve of Spee in the maxillary archwire and increasing it in the mandibular archwire, this can be further supplemented with anterior vertical elastics.

Establishing incisal guidance in anterior openbite cases remains an intractable problem dependent on the degree of skeletal contribution to the aetiology. In many cases, orthodontic treatment alone without surgical intervention cannot satisfactorily treat this type of malocclusion.

FINAL RECORDS

It is essential that final records are made at the end of treatment. As stated previously, radiographs should have been taken some time prior to the completion of treatment.

Following removal of appliances impressions are taken for retainers and duplicated for final study models. Final study models are essential for a number of reasons:

- As a medico-legal aid. Final study models will assist in the defence against any claims related to the treatment and the final occlusion.
- Patients who fail to wear their retainers cannot claim that the teeth were not well aligned at the conclusion of treatment. Patients have poor memories.
- A comparison of before and after study models impresses patients and helps to enhance your reputation.
- As a possible requirement by a third party payer.
- As a teaching aid for yourself, close examination of study models may reveal deficiencies and inadequacies that you did not pick up on clinical examination. Such evaluations help to continually raise your own standards.
- As a teaching aid for students. If you are involved in orthodontic teaching either at graduate or postgraduate level, before and after study models are essential for case discussions with students.

Final Photographs

Ronald G Melville

Apart from final study models, intra- and extra-oral photographs should be taken. I duplicate all photographs routinely, so that I have a full set for myself and I give one set to the patient on completion of treatment.

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12 REMOVABLE APPLIANCES

A removable orthodontic appliance may be defined as:

> An appliance that can be inserted and removed from the mouth, at will, by the patient.

Pearl: By virtue of this definition it follows that the success or failure of removable appliance therapy is dependent to a very large extent on the full participation and compliance of the patient. To this end, it is essential that the design and construction of the appliance should assist in maximizing patient cooperation.

The design of removable appliances is open to many variations and modifications as required by different malocclusions as well as the preferences of different clinicians. However, excluding the design factors that are dictated by a specific malocclusion, there are certain general principles that need to be borne in mind when designing any removable appliance.

Patient comfort

If the appliance is uncomfortable the patient will have an excuse to take it out of the mouth. The appliance should be smooth, well polished and have no protruding sharp wires.

Simplicity

The patient should be able to remove and insert the appliance easily. Keep the design simple; do not try to do too much with one appliance, limit the active components of the appliance to two finger springs. If the patient finds difficulty in inserting an appliance, either because it is too tight or there are too many active components, they will tend to leave it out.

Retention

It is essential that the appliance be well retained. Make sure there is adequate retention with particular regard to the sites where there are active components, such as finger springs. Select the correct clasp design and wire size to maximize retention on specific teeth.

Strength

The risk of breakage while in the mouth should be minimized. The acrylic base should have adequate thickness and should not be unduly weakened by the wire components. Gentle handling of the wire during construction can reduce the risk of breakage. If you are making the appliance in-house, do not forget that stainless steel becomes work-hardened with repeated bending. Be accurate in the placement of bends, discard and start afresh rather than correcting an inaccurate bend.

Oral hygiene

Removable appliances can cover a large area of the mouth. It is essential that they are kept clean and debris is not allowed to accumulate and remain between the appliance and the oral tissues. The design should contribute to easy cleaning, eliminate boxed-in areas where debris collects and is difficult to dislodge.

Aesthetics

This is generally not a problem. However, in certain cases with very self-conscious patients, if cooperation can be enhanced by the removal of a labial bow, then this should be considered in the original design.

Design factors related to a specific malocclusion need to be determined after careful

study of the malocclusion and should be related to an overall treatment plan.

> **Pearl:** Of the five possible tooth movements namely, tipping, rotation, bodily movement, extrusion and intrusion, removable appliances are efficient only in tipping a tooth.

While it may be possible to design a removable appliance to execute some of the other tooth movements, generally, for those tooth movements, fixed appliances are more efficient.

Removable Appliances

Matie Grobler

Patients should be instructed not to remove a removable appliance for eating, if they do, they will invariably lose or break the appliance. Never wrap the appliance in a tissue or napkin; it will probably be thrown away.

Allow at least one or two weeks for a removable appliance to settle in before activating any finger springs.

Fitting and Adapting Removable Appliances

Luc Dermut

When fitting a removable appliance, if it does not fit well, first deactivate all clasps then check to see if the acrylic base is the cause of the problem. When you have corrected the acrylic fault, then activate one clasp at a time until the appliance fits well and stays in place.

When using finger springs to move teeth mesially or distally, make sure that the springs lie against the mesial or distal surface of the teeth near the gingival margin. It is important to check that active springs do not slip on to the occlusal surface of the teeth.

If active finger springs dislodge the appliance, deactivate them and then gradually increase the activation. Thus, activate finger springs gradually and see the patient more frequently.

Enhanced Retention for Removable Appliances

Robert A Katz

Retention of a removable appliance in young dentition can be a problem. To enhance retention, I have found it helpful to place a small 'button' (1–2 mm, 0.04–0.08 inches) of composite on to the buccal surface of one or more primary teeth. A suitable clasp (C-clasp) can then be hooked above the composite to aid in retention. This method can also be used with functional appliance treatment in the mixed dentition when retention of the removable appliance is a problem (Figure 12.1).

Figure 12.1

Composite material placed as a mound on the first deciduous molar to enhance retention of the C-clasp.

Retention for Removable Appliances

Ronald G Melville

Retention is vital if you expect the patient to wear the appliance. In this respect placing Adams clasps on anterior teeth is very helpful. When moving an upper incisor over the bite, clasp one of the other incisors to prevent the appliance from displacing downwards when activating the palatal spring. A modified arrowhead clasp can be used as a clasp between maxillary incisor teeth.[1]

Avoid using removable appliances for expansion in the deciduous or mixed dentition stages because of the difficulty of obtaining good retention. Rather use a fixed 'Rapid Expansion' appliance banding only the maxillary second deciduous molars.

Removable appliances with wraparound labial bows have the advantage of eliminating occlusal interference produced by conventional clasps as they traverse the embrasure areas. Unfortunately, the retention of wraparound appliances is often reduced due to the absence of clasps. Retention of such removable appliances may be enhanced by a modification of the labial bow.[2] Locks et al. describe a technique whereby they use a wraparound 0.813 mm (0.032 inch) labial bow fitted accurately to the buccal contour of the premolar teeth.[2] In this region small vertical posts are spot-welded to the labial bow to assist in the retention of acrylic resin applied over the labial bow to fit the contour of the pre-molar teeth. They maintain that the heavy labial bow together with the acrylic coverage of the buccal surface of the pre-molar teeth enhances retention of the appliance.

The Essix Appliance Modified For Tooth Movement

John J Sheridan

The Essix appliance was first introduced in 1993.[3] It is a plastic removable device that snaps over the teeth and, for all practical purposes, is invisible (Figure 12.2). Additionally, it is inexpensive, quickly fabricated in the office, has minimal bulk, high strength, and does not interfere with speech. It is retentive without clasps, usually requires no adjustment, does not interfere with function, and has little, if any, influence on the efficiency of the occlusion when the patient follows the proper schedule of wear. For instance, when an Essix appliance is used for orthodontic retention, data indicate that it is as efficient as bonded wire or Hawley-type appliances.[4–6] Therefore, it makes professional sense to become familiar with the applications of an appliance that offers so many advantages.

Figure 12.2

An Essix appliance is an efficient retainer and can be modified for selective tooth movement.

Delivering a satisfactory Essix appliance is directly correlated with arch preparation, impression technique, cast construction, and associated materials.

Pearl: The fabrication of a working cast should be done with the precision applied to crown and bridge standards.

A restorative dentist would not conceive of taking an alginate impression for a bridge in a non-rigid tray and pouring it with stone that has been in an open bin absorbing humidity. The fit of the resultant restoration would be compromised because a precision impression is necessary for an accurate cast. The detailed

cast is, in turn, necessary to fabricate the well-fitting appliance.

Sheridan's First Law of Biomechanics states that Force + Space + Time = Tooth Movement, and this law must be observed with Essix mechanics. There must be adequate *force* to move a tooth without inducing pathology, there must be enough *space* to accomplish the desired tooth movement, and there must be an appropriate length of *time* for the patient to wear the appliance for the induced force to be effective.

The clinician can control two out of three of these essential prerequisites, force and space. However, as with any dynamic removable appliance, the patient must provide the third essential, time. The patient must wear the appliance as directed by the clinician who can, in turn, create and direct the force within the appliance.

Pearl: Therefore, the target populations who are most eligible for tooth movement with an Essix appliance are adults and responsible adolescents because cooperation is mandatory and this population will usually use the appliance as directed.

The Essix tooth-moving system is centred on the clinician modifying the appliance during the course of treatment when it is necessary to make in-course corrections. The clinician constantly modifies conventional fixed appliances because of the multiple variables that arise during treatment. That can also be done with Essix clear plastic appliances. The Essix system has these specific advantages:

- The clinician can precisely apply and incrementally augment force as the case progresses.
- The clinician can quickly and precisely modify the initial appliance at the chairside.
- The appliance is practically invisible, and patient acceptance is usually enthusiastic.
- Fabrication is a fraction of the cost of multiple laboratory-fabricated appliances.
- The appliance is most efficient in tooth tipping. However, to a limited degree, tooth movement is possible in all three planes of space.

When using the Essix appliance, you must remember that as a full coverage appliance, fluids will accumulate and stagnate in the space between the plastic and the enamel surface. If these fluids are acidic (carbonated beverages) then there is a high risk of enamel decalcification occurring.[7]

Gaining space to move teeth into

If at all possible, I avoid extractions or expansion on adults. I find that mild-to-moderate crowding is best resolved by gaining space with interproximal reduction with the air-rotor stripping (ARS) technique.[8,9] ARS works well in conjunction with clear plastic appliances, especially if the anterior crowding, the usual chief complaint, is mild-to-moderate and evenly dispersed throughout the incisors.

Generating tooth moving force by mounding

Treatment results can be obtained with one or, at most, a few appliances that can be fabricated and adjusted in-house with routine laboratory procedures, with minimal cast modification, with minimal expense, and very little chair time.

The original article on the Essix tooth-moving appliance described cutting a window in the clear plastic appliance to provide space for the target tooth to move into, and placing a force-inducing divot (bump) in the plastic appliance with an instrument heated to a specific thermo-forming temperature (Figure 12.3). The same bump could be made sequentially deeper to induce additional tooth movement at subsequent visits. However, as the divot was made deeper the plastic became thinner and the force-inducing bump could collapse.

An equally efficient method of inducing a force on the tooth is to turn the concept around and rather than placing a projection in the plastic appliance, place a projection on the enamel surface of the target tooth by adding a small mound (1.0 mm thick, 0.04 inch) of light-cured bonding composite to the enamel surface. This involves negligible chair time with light-cured composite. When the appliance, fabricated from the unmodified working cast, is seated, the resiliency of the plastic will

Figure 12.3

The bump in the labial plastic will induce lingual tooth movement when the appliance is seated. The window cut into the lingual of the appliance will afford the necessary space.

create a tooth moving pressure due to the composite mound on the enamel surface that is interfering with the plastic returning to its resting shape. The mound can be sequentially built up, 1.0 mm (0.04 inch) at a time, during the patient's periodic visits, and with each additional composite layer, the mound becomes increasingly sturdier (Figure 12.4). Also, the mound can be placed anywhere on the crown to affect different tooth movements: more incisally for tipping, gingivally for more bodily movement, and to the left or right of the midpoint to change the vertical axis of rotation.

When the appliance is seated, use the patient's input to evaluate the induced force by simply asking if the patient feels pressure on the target tooth. If so, then schedule the next appointment. If not, add an additional thickness of composite until pressure is apparent. If the thickness of the mound is too excessive and the appliance cannot seat correctly, remove a slight amount with a sandpaper disc mounted in a handpiece.

The adult or responsible adolescent patient should be seen every two to three weeks; this timespan is more than adequate to induce additional tooth movement. Six to eight week intervals between appointments extend the treatment time and are at odds with my 'adult chief complaint' treatment philosophy. I want to treat adults rapidly, consistent with the resolution of the patient's chief complaint and quality of occlusion.

The concept of retaining and moving teeth with Essix appliances has gained wide acceptance. It is incumbent on the professionally competent clinician to be familiar with the fabrication and application of these appliances.

A publication by Rinchuse et al. indicates that it is possible to use elastic traction in combination with upper and lower Essix appliances.[10] The prerequisite for this form of traction is enhanced retention of the appliance, this can be achieved either by placing undercuts in the dental cast prior to forming the appliance or by using thermopliers to increase retention in the interproximal areas. Elastics are attached by placing a 'Rinchuse Slit' at specific locations depending on the elastic traction required. Using scissors, cut a slit into the gingival margin of the appliance: for Class II traction this would be in the region of the mandibular molars and maxillary canines and the opposite for Class III traction. The elastics are hooked into the slit.

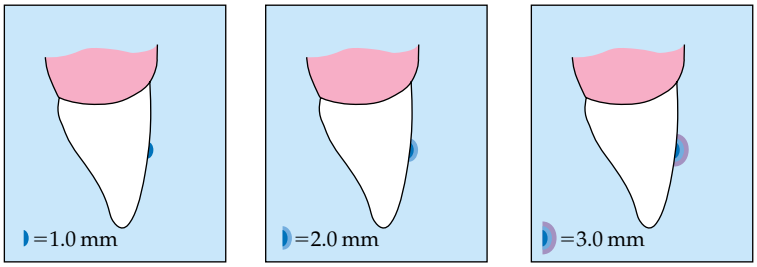

Figure 12.4

The mound of composite on the labial of the tooth can be built up to move the tooth 1 mm (0.04 inch) at a time at subsequent visits. The resiliency of the plastic returning to its resting state will induce tooth movement. It is still necessary to cut a window into the lingual of the appliance.

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13 RETENTION

Retention must be considered as an integral component of orthodontic treatment. While one of the objectives of orthodontic treatment is to place the teeth in a stable position within the oral cavity, this ideal in not always achievable. Both patients and clinicians should appreciate that the oral cavity is a vital, living environment which, like the rest of the body, is in a continual state of flux and change. What may be a stable position of the dentition for an adolescent will not necessarily be stable for a 20- or 40-year-old individual.

Pearl: The supporting alveolar bone, the periodontium, the surrounding tongue, lips and cheeks all mature and change with age and so the effect of these surrounding tissues on the dentition also changes.

With the increasing demand for orthodontic treatment by adult patients specifically for aesthetic considerations, orthodontists are being obliged in many cases to place the dentition in positions which we know from the outset are unstable; in such cases permanent retention is inevitable.

Whether you include the cost of retainers and the subsequent supervision within the cost of overall treatment or whether you charge a separate fee for retainers, is your choice. However, it is essential that the patient or parents be informed at the outset how the cost of retention is managed in your practice. I prefer to charge a separate fee for retainers and their supervision and I explain to the patient or parents, that the type of retainer and the cost will only be determined at the end of treatment. I will give them an idea of the approximate fee usually charged for retention.

Pearl: At the case discussion (Chapter 6) it is incumbent on the clinician to inform the patient that following completion of active orthodontic treatment a stage of retention will be essential.

INTERDENTAL STRIPPING

In cases that display initial incisor crowding, some gentle interdental stripping should be carried out one or two appointments prior to de-bonding. The stability of the anterior dentition post-treatment and post-retention has been a subject of much research and debate over many years. The theoretical advantage to flattening the incisor contact points and its potential for increasing stability was discussed by Barrer in 1975.[1] He described the concept and technique for creating 'keystone architecture' for the anterior dentition; I believe that the use of hand-held metal abrasive strips should be adequate for this type of interdental stripping; handpiece-mounted abrasive discs may be rather aggressive. The technique is a gentle procedure designed to break a tight contact point and gradually convert a contact 'point' into a contact 'surface'. In cases retained with a removable appliance, I do some mild interdental stripping at each post-treatment six monthly and subsequent yearly appointments. Interdental stripping should be followed by topical fluoride application to enhance the resistance of the interproximal enamel to caries.

The use of interdental stripping as an aid to retention is different to the use of air-rotor stripping (ARS) as advocated by Sherridan and Sherridan and Hastings.[2,3] ARS is more aggressive and is a technique designed to

create space within the dental arch as an alternative to extractions in specific mild crowding cases.

The degree to which interdental stripping contributes to long-term incisor stability is uncertain and to a certain extent may be anecdotal. However, in 2001 Sparks showed that interdental stripping following removal of fixed retainers contributed to 25% less crowding than in a non-stripped group.[4]

TYPES OF RETAINERS

There are essentially two groups of retainers, fixed and removable; before deciding on the type or coverage of the retainer, it is helpful to re-examine the original study models or photographs.

Pearl: Do not rely on your memory; check the original overjet, overbite, buccal occlusion and the position of individual teeth with particular reference to rotations.

Fixed Retainers

These generally comprise sectional arches bonded to the lingual surface of mandibular incisors or the palatal surface of maxillary incisors, extending from canine-to-canine. However, depending on the original malocclusion the fixed sectional arch may extend to include pre-molars. In some cases where the re-opening of extraction spaces may be a problem, a small sectional arch may be bonded across the extraction site either on the lingual or on the buccal surfaces.

The fixed retention arches may be constructed from braided wire or round wire, flattened or bent into a small circle at their extremities. If the extremities are left straight and not bent into circles, they should be sandblasted just prior to bonding. All teeth across the retainer may be individually bonded to the arch or only the two terminal teeth. Once again, this depends on the original malocclusion and your decision as to which teeth need to be retained.

The need for permanent fixed retention is well described by Durbin.[5] His study showed that 86% of a sample of 100 adult patients, who had been given removable lower retainers, showed various degrees of crowding seven years post-treatment. After further examination of a comparable group of patients who received fixed lower retainers, he concluded that patients were happy to accept lifetime stability; the teeth remained stable, with less staining and calculus than with removable appliances and virtually no decay.

Technique

Retainer arches may be purchased pre-formed with individual mesh-backed steel pads for each tooth or they may be constructed at the chairside. Fixed retainers may be constructed either indirectly or directly.

Pearl: Whichever wire or technique you use, it is essential that the sectional arch be made of soft wire, hard spring wire will not allow for individual tooth adaptation and may with time gradually change its shape.

Indirect retainers

For indirect retainers, an impression is taken one appointment before de-bonding, sent to the laboratory and an accurately fitting lingual retainer is fabricated. If the retainer is made with a carrier, it can only be bonded after the removal of all brackets. If the retainer is made as a unit on its own it can be bonded either prior to or after removal of all appliances. Depending on the availability of laboratory services, some clinicians will take an impression immediately following removal of fixed appliances and fit the retainer either later on the same day or a few days later.

A simple technique for the construction of an indirect lingual retainer using a transfer tray made from light body silicone and putty, is described by Haydar and Haydar.[6]

Direct retainer

This form of retainer is constructed at the chairside prior to de-bonding. To make a braided lingual arch, take four pieces of 0.25 mm (0.010 inch) soft steel ligature wire about 75 mm (3 inches) in length, hold the four pieces as a bunch, grip them at both ends with artery forceps, keeping them under tension wind them up to produce an evenly braided soft wire which can be easily curved and shaped as necessary (Figure 13.1).

- Conventional lip retractors are placed and a saliva ejector is adjusted to lie lingual to the mandibular incisors.
- Curve the soft twist flex arch to fit the lingual contour of the incisor teeth.
- Place a canine offset at one end of the arch, replace it on the lingual surface of the incisors and mark the arch between the lateral and the canine teeth at the other end, place the second canine offset. Check to see the arch is symmetrical and flat, and place the arch aside.
- Using a small round mounted green stone, gently abrade the lingual surface of the mandibular and maxillary incisors.

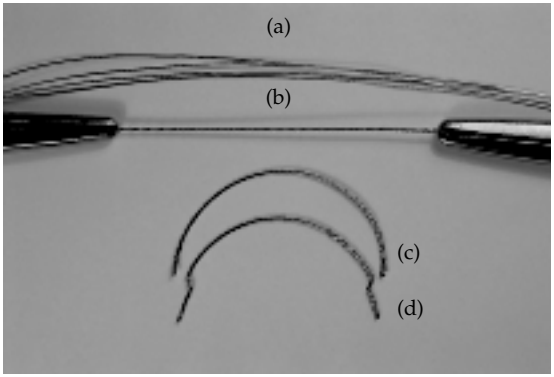

Figure 13.1

Fabricating a lingual retainer. (a) Four strands of dead soft stainless steel ligature wire. (b) Using two artery forceps held in tension, the strands are twisted into a cable. (c) With fingers and pliers, the twistflex cable is formed into a lingual arch and (d) canine offsets placed if necessary.

Pearl: Although the lingual surface of the mandibular incisors may appear clinically clean, it is possible that a thin layer of calculus not easily seen may cover part of this surface; bonding to this film of calculus invites bond failure.

- The palatal surfaces of maxillary incisors are not smooth; they are often covered with irregular ridges and crevices. Gently abrading this surface produces a smoother surface, which will contribute to a stronger and longer lasting bond.
- Pumice the lingual surface with glycerine-free pumice. Because the lingual surfaces of incisors are concave as opposed to the convex labial surfaces, it is preferable to use a bristle 'tuft' brush rather than a bristle 'cup' brush (Figure 13.2). The tuft brush is more efficient than a cup brush in cleaning the concave surface. Make sure you do not impinge on the gingival margins; blood seepage from the gingival tissues will interfere with the integrity of the bond and compromise the lifespan of the retainer.
- Take a length of waxed dental floss, holding the two ends with tweezers thread them under the labial archwire from incisal aspect and pick up the ends gingival to the labial archwire. Pull the floss labially and holding the closed loop of the floss lingual to the teeth, gently slip the floss through the contact point taking care not to traumatize the gingiva. Leave a 1 cm (0.5 inch)

Figure 13.2

(a) Bristle cup brush. (b) Flat bristle tuft brush. (c) Tapered bristle tuft brush. (d) Rubber prophy cup on mandrel. (e) rubber prophy cup—clip on type.

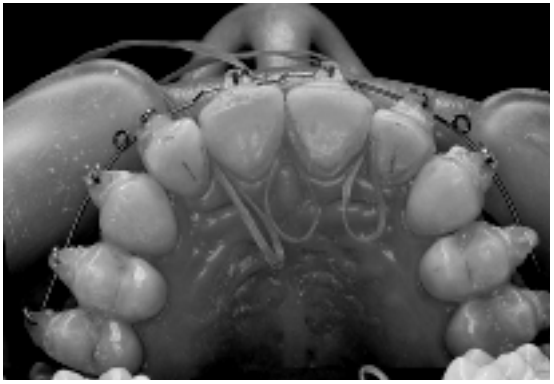

Figure 13.3

Loops of waxed dental floss threaded under the labial archwire from the incisal aspect and pulled through the contact points.

Figure 13.4

Lingual arch threaded through the palatal loops, placed into position by pulling the labial free ends of floss, which are then twisted up with an artery forceps. Etching material is placed over the lingual archwire and tooth surfaces.

loop protruding lingually. Usually, three loops are sufficient, one in the midline, and one on either side between the laterals and the canines (Figure 13.3).

- Pick up the lingual retainer arch with tweezers and thread it through the three lingual loops of floss.
- Gently move the arch against the lingual surface by pulling on the free ends of floss, first the midline loop then the side loops. Check the position of the arch, adjust if necessary then pull the floss tight. The lingual arch can be further adapted by pressure with an amalgam plugger. Holding all six floss tails with an artery forceps twist up the six strands of floss until they are tight against the labial surface of the teeth and can hold the lingual arch in position under pressure. Let the artery forceps rest gently on the lips while the bonding procedure continues (Figure 13.4).
- Apply the etchant to the enamel and lingual archwire; make sure it covers all the necessary areas. Wash and dry well, ensure that the enamel under the wire is dried thoroughly.
- Bond the lingual archwire to each tooth with either chemical or light cured composite. The use of a flowable composite has been described by Elaut et al., their technique appears to be quick, easy and apparently reliable.[7] Once the composite is cured, untwist the floss, cut one end short and gently pull the longer end out. If you used waxed floss it should slip out without any difficulty.
- Using a very fine tapering fissure burr make sure there is no composite in the lingual interdental areas, a small tapering mounted stone can be used to smooth around the gingival margins. Gingival seepage at this stage will not compromise the bond strength. A metal abrasive strip should be used to ensure there is no composite material in the interdental area incisal to the lingual retainer.
- After placing a maxillary palatal retainer check the occlusion with articulating paper to ensure there is no occlusal impingement on the retainer.

With minor variations Cook has described the same technique.[8]

Removable Retainers

There are many different types and designs of removable retainers. The type and design of retainer you select will be dependent on many factors. These include the original malocclusion, the corrective tooth movements, the age of the patient, anticipated compliance and aesthetic considerations. To maximize patient compliance, the retainer should be comfortable and

well retained; unfortunately, clasp-held lower removable appliances are not easily retained. Removable retainers do provide the facility for a limited degree of corrective tooth movement to be carried out as part of the retention stage.

The conventional Hawley-type retainer is frequently used for retaining the maxillary dentition, with variations in the clasps and labial bow and the possible incorporation of anterior bite planes. The labial bow can provide a degree of labio-lingual tooth movement of the incisors.

If control is required in the vertical plane, particularly when trying to retain an anterior open bite, composite mounds can be bonded to the labial surface of the incisor teeth. The labial bow can be activated in an incisal direction and after insertion it should rest on the gingival margin of the composite mound.[9]

The pressure- or vacuum-formed clear plastic Essix-type retainer described by Sherridan et al. is also extensively used, it provides efficient retention, particularly for the mandibular dentition and it is also possible to carry out minor corrective tooth movements using differential pressure on selected teeth[10,11] (Chapter 12). In the presence of missing teeth such as second pre-molars, artificial teeth can be incorporated in these retainers.

Pearl: A replacement denture tooth is positioned on the working model and held in place with a little plaster or stone. Make sure there is sufficient undercut for the soft plastic sheet to flow around the tooth; to assist in retention of the artificial tooth, a small amount of epoxy adhesive may be placed on the tooth an instant before the plastic material is sucked down on the model.

The use of an Essix-type retainer as a temporary bridge to replace missing anterior teeth is well described by Moskowitz et al.[12] Essentially, plastic denture teeth are selected and fitted to a stone model over which the plastic material is formed. The artificial teeth are retained in the appliance by cutting a mesio-distal groove 4 mm (0.16 inch) wide and 3 mm (0.12 inch) deep into the palatal surface of the plastic teeth. The appliance is trimmed to cover the six anterior teeth.

Prior to forming the appliance, use a universal scaler to clean around and define the gingival margins of the teeth on the working model, this procedure can enhance the retention of the appliance. The working model should be allowed to dry for at least two days before creating the vacuum-formed retainer, the steam generated by the hot plastic coming into contact with a wet model will inhibit close adaptation of the plastic material resulting in poor fit and retention of the appliance.

The vacuum- or pressure-formed retainers are aesthetically very acceptable and are well tolerated by most patients. While they are efficient retainers for most tooth movements, they are not reliable for the retention of posterior maxillary expansion. If you particularly wish to retain posterior expansion, it is preferable to use a Hawley type of retainer with acrylic palatal coverage. A comparison of Essix and Hawley retainers showed no significant difference in their effectiveness in retaining orthodontic corrections.[13] If a patient requests tooth bleaching following completion of fixed appliance therapy, an Essix retainer can be modified to double up as a bleaching tray and a retainer.[14] Whether you believe bleaching falls within your domain, depends on your relationship with the referring dentist; if the patient's dentist feels that you are taking away work, which he would normally do, you risk alienating a source of referral.

White advocates giving each patient a syringe of tooth-bleaching gel to inject into their Essix retainer; he believes it encourages patient cooperation and more consistent wearing of the retainer.[15] Apart from a fixed mandibular lingual retainer, he also provides a removable Essix retainer to be worn as insurance against future breakage of the fixed retainer. He encourages his patients to take responsibility for the long-term retention of their occlusion.

Essix Retainers

Victor Lalieu

I usually use Essix full coverage upper and lower retainers. The patient is always provided with spare lower polycarbonate retainer (cheaper and more rigid) and they are given

both their working models. If retainers are lost or break, these models are used to remake the retainers. If minor tooth movements are required, then the tooth in question is reset on the model and a new Essix retainer made on the adjusted model.

Tooth Positioners

Custom-made or pre-formed tooth positioners are very useful retainers. They are active appliances and are specifically selected to assist in the final settling in of the occlusion. Pre-formed tooth positioners can be fitted at the time of appliance removal while custom-made positioners need some laboratory time. Unfortunately, the appliance is not very comfortable, however, if the patient is compliant, they are very successful. But if compliance is suspect, then this form of retention should not be selected. They are also not very efficient in retaining posterior expansion. In some cases they may induce some temporo-mandibular joint discomfort. At the first sign of any joint dysfunction this form of retention should be discontinued.

Prefinisher Retainers

Gerald Gavron

The majority of malocclusions are primarily related to skeletal differences between the maxilla and mandible, and the goal of treatment is to correct this discrepancy by so-called growth adaptation. To obtain maximum effect, treatment is often carried out during the pubertal growth period, when the intensity of growth is greatest. Whereas facial growth can be of great help during treatment of skeletal problems, it can also cause instability of the treatment result. As growth in most orthodontic patients is not completed by the end of the pubertal growth spurt but continues for several years beyond this, retention of the treatment result should also continue for several years.

Upper removable retainers and fixed lingual-bonded retainers are commonly used for extended periods of time. I believe there is also a useful role for pre-formed or custom-made pre-finishers for retention purposes. For pre-finishers, I have developed a modified regime, which I believe to be more acceptable to patients, more sensible, logical and useful, furthermore it extends the life and use of the appliance.

The pre-finisher is fitted immediately after removal of all fixed appliances. This appliance guides the teeth into 'ideal' occlusal relationships while allowing soft tissue and periodontal adaptations to take place.

Patients are usually given standard instructions to wear the pre-finisher for three to four hours, alternating clenching with relaxation. This is followed by night time wear. After four to six weeks this programme ends and more commonly recommended retainers are then worn. This routine is not necessarily the most suitable approach.

> **Pearl:** My experience indicates a more logical and more acceptable approach is to ask the patient to start wearing the pre-finisher for ten to fifteen minutes each afternoon, and increase this gradually over a number of weeks to a limit of two hours per day. Night time wear is continued.

This routine enables the patient to adjust gradually to the two hour period of wear rather than immediately to the unnecessarily long four hours, which is usually far too demanding. After six months this is reduced gradually for a further six months, followed by night time use only. This is sufficient to maintain an excellent occlusion and healthy supporting tissues until the third molars have erupted or been extracted. Indefinite wear may be necessary. The pre-finisher may also serve as a mouth protector for contact sports.

The final occlusion has fully 'Stollerized' first molars and when the study models are viewed from the lingual, the cuspal relationships are optimal, a feature not usually seen with the use of standard retainers, which do not allow this final guidance and settling-in of the occlusion.

As long ago as 1934 Oppenheim said that: 'Retention is the most difficult problem in orthodontics, in fact it is the problem'. Even pre-dating this statement, Hawley in 1919 wrote: 'If anyone of them would take my cases when they are finished, retain them, and be responsible for their further progress, I would gladly give them half the fee'.

Kesling (2002) recently described a variation of the spring aligner/retainer where the stainless steel loops were replaced by nickel-titanium loops.[16] These were put under tension during the fabrication thus providing a means of maintaining permanent activation. The nickel-titanium loops were joined to straight sections of stainless steel wire, which were bent and embedded in the lingual acrylic section of the appliance.

SUPERVISION AND RETENTION PROTOCOL

How frequently should you see a patient under retention, for how long should you provide supervision and for how long should the patient wear retainers? These are questions that orthodontists have always asked and will probably continue to ask for the foreseeable future.

- If the patient is compliant, and the retainers are passive and fit well; I believe it is only necessary to see them after three months then, if all is well, at six months and then yearly intervals.
- If the original dentition showed incisor crowding, then at each visit during retention, I prefer to do some interdental stripping of the incisors. This stripping is done by hand using a fine metal lightening strip.
- If the retainers are actively moving certain teeth then during this active process the patient should be seen at more frequent intervals, possibly six weekly. Once they become passive, then the above regimen may be adopted.
- Generally, patients are advised to wear removable retainers permanently for the first six months and thereafter at night only.
- The duration of retention must depend on the original malocclusion, conventionally for adolescent patients, they are advised to continue with retention, both fixed and removable until the third molars either erupt or in some cases, are removed. The reason for this timing is not so much that the third molars are responsible for relapse, but because the eruption of the third molars generally coincides with the completion of mandibular growth and it is a convenient time for patients to remember.

Pearl: As mentioned previously adult patients often require their teeth to be placed in less than stable positions, these patients require permanent retention.

For how long you are required to supervise a patient in retention is very much dependent on your own philosophy and on how you run your practice. Some orthodontists will inform their patients that after two years they are 'on their own' and they must assume responsibility for their retention. They need to continue to visit their general dentist at regular intervals and if they have a problem with their retainers, they should return. Other orthodontists are happy for their patients to continue to return for recall visits for many years.

Retention Protocol

Ronald G Melville

I tend to use fixed retainers as far as possible with the intention of stabilizing maxillary and mandibular incisors, particularly where these teeth originally had vertical, horizontal and rotational discrepancies. I leave maxillary fixed retainers in situ indefinitely unless there are indications that they may cause periodontal problems. In general, I favour prolonged retention with removable retainers (about two years for children). I insist on permanent retention for adults and I confirm the importance of retention by letter.

I never really dismiss patients, but suggest that they return for a yearly check-up.

Retainers

Richard N Carter

Bonded retainers allow clinicians to offer extended retention periods; they may give excellent service for ten or more years without replacement. Usually, lower bonded retainers extending from canine-to-canine are only bonded to the canine teeth. This is important, as the teeth must be relatively free to move independently with function. Lingual retainer arches, 0.76 mm (0.030 inch) are formed by bending around a 'turret'; they should not be bent with pliers in order to avoid marking the wire and creating asymmetries. To compensate for the difference in thickness between the canines and lateral incisors, you need to place a horizontal offset at the contact area. The arch should rest at the level of the contact points, namely, the incisal/middle third junction of the crown. Placing the arch at the middle or gingival third of the crown will allow the contact points to slip and the incisors will crowd.

Rotations should be considered differently from crowding. They should be held firmly for two years after active treatment. In addition, free gingival fiberotomies, as described by Edwards, should be done six months before brackets are removed.[17] In order to hold the rotations and still allow the periodontal ligaments to function, retainer arches made from flexible spiral wires are used to hold adjacent teeth.

Retainers/Space Maintainers

Ronald G Melville

In order to maintain absent pre-molar space in the mandibular arch, I use a commercially available canine-to-canine lingual retainer

Figure 13.5

Pre-formed lingual retainer with mesh-backed pads bent and modified for bonding to the buccal surfaces of a mandibular first pre-molar and first molar. Retaining space for an absent second pre-molar.

with mesh pads at the extremities. In the case of an absent second pre-molar tooth, this is bent and adapted to fit along the gum and alveolar ridge in the buccal sulcus, one pad will be bonded to the buccal surface of the first pre-molar and the other pad bonded to the buccal surface of the molar tooth (Figure 13.5).

Retention

Simon Ash

Fortunately, teeth move throughout life, this physiological process enables orthodontists to provide their services to adults as well as adolescents and children. By virtue of the same process, following removal of orthodontic appliances, teeth will continue to move but unfortunately they generally move in a direction aimed at re-establishing the original malocclusion.

Permanent or semi-permanent retention may be provided in the form of either a fixed appliance bonded to the teeth or as a removable appliance worn at a set time for an indefinite period. I have found the following group of retainers provide the versatility to cover most retention demands.

- Bonded lingual retainers using a hands-free carrier
- Whipps retainer
- Chrome-cobalt retainer
- The Quatro appliance.

The bonded lingual retainer using a hands-free carrier

Bonded lingual retainers are widely used and extensively reported in the literature. However, the method for placing a bonded lingual retainer is highly technique-sensitive and impacts on the long-term success of the retainer. The hands-free carrier was devised to simplify the bonding of a fixed multiflex wire to the lingual or palatal surface of teeth (Figure 13.6).

Immediately following removal of fixed appliances, an alginate impression is taken and a stone model cast. On the model, a multistrand wire 0.41 mm (0.0175 inch) is accurately adapted to the lingual surface of the relevant teeth. The distal ends of the wire are bent into loops, conventionally overlying the lingual surface of the canine teeth. The wire is then continued further distally to form tags, which will be embedded in the acrylic carrier.

The carrier can be constructed either in the laboratory or in the surgery. On the model a wax strip is placed covering the gingival quarter of the labial surface of the teeth to be bonded. Cold cured acrylic is mixed and at the dough stage the acrylic is placed on the model covering the exposed labial surfaces of the relevant teeth. To provide adequate strength, the acrylic should not be thinner than 3.0 mm (0.12 inch). The wire extensions at both ends of the retainer are embedded in the carrier by extending the acrylic over the occlusal and lingual surfaces of the teeth distal to the last tooth to be retained. Once cured, the retainer is removed and the acrylic carefully trimmed.

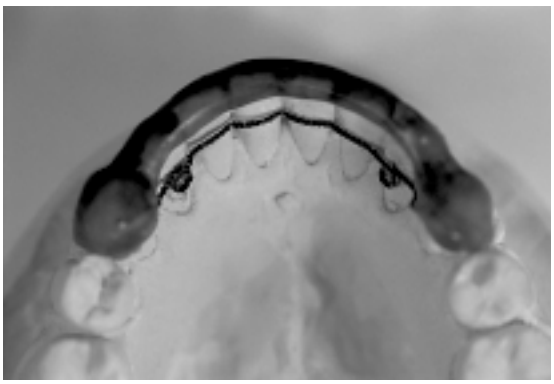

Figure 13.6

A hands-free lingual retainer constructed on a model incorporating acrylic extensions on the pre-molar teeth.

At the chairside, the lingual retainer plus its carrier is tried-in, and if necessary, adjusted. Remove the retainer and prepare the lingual or palatal surfaces of the teeth to be bonded using the standard procedure of pumice, etching and drying. Unfilled resin is placed on the tooth surface, the retainer with its carrier is carefully re-fitted and the lingual arch is bonded in position using either light or chemically cured composite resin. With a fine tapered diamond burr, cut through the distal extensions of the retainer to separate it from the carrier, smooth and polish the distal ends.

> **Pearl:** The advantage of this technique is that the retainer can be accurately positioned and retained in place throughout the bonding procedure. The operator has both hands free and can concentrate on the bonding procedure without being concerned with possible movement of the lingual archwire.

There is good visibility and adequate access for the placement of the bonding material. This technique is fast, economical and reliable.

Banks described a variation on this design. He uses a single acrylic carrier or index covering only one distal extension of the retainer.[18]

The Whipps retainer

Unfortunately, patients frequently do not report any failures of fixed retainers until they experience discomfort or notice unwanted tooth movements or relapse. In addition, the teeth occasionally may still move despite the bonded retainer. Furthermore, these retainers do not retain the buccal teeth in the transverse plane. In some instances where the arches have been significantly expanded, maintenance of the expansion is required. The Essix

retainer has previously been described, however, this retainer being thin has a limited life, it provides little transverse control and is liable to fracture. The ability to improve retention of this appliance is limited. The 'Whipps' and 'chrome skeleton' retainers are designed to overcome these problems.

Construction. The Whipps retainer is a clear plastic tooth-borne retainer constructed in the laboratory using a 'Biostar' vacuum machine. Following the fitting of a conventional bonded lingual retainer, an accurate impression is taken including a record of the occlusal surfaces of all standing teeth and the appliance is constructed on a stone model. The bonded retainer is blocked out with plaster. Ball-ended clasps constructed from 0.9 mm (0.036 inch) hard stainless steel wire are placed passively in the premolar region on both sides of the arch. A 2 mm (0.08 inch) thick plastic transparent blank is heated and vacuum formed on to the stone model embedding the tag arms of the ball clasps. When cool, the retainer is cut out and trimmed.

As this plastic material is thicker and considerably more rigid than the Essix retainer, the plastic is cut so that the occlusal surfaces, lingual surfaces and only the incisal third of the labial surface are covered. If the plastic is overextended into undercuts then it may prove difficult to remove. If necessary, retention of the appliance can be enhanced by adjusting the ball clasps (Figure 13.7).

Patients are advised to wear the Whipps retainer at night following teeth cleaning. The patient is warned that if the bonded retainer fails at any stage, they need to wear the Whipps retainer constantly until a repair to the fixed retainer can be made. This belt-and-braces approach to supplement the fixed retainer prevents relapse following fixed retention failure. Since bruxism and parafunctions are mainly nocturnal habits, then the wearing of the Whipps retainer will also act as a protective occlusal splint. By virtue of the thickness of the material used for this retainer, it is effective in *retaining buccal expansion* that may have been carried out during active treatment.

The retainers should be kept damp when out of the mouth and should be cleaned before and after use with cold water only. Hot water will cause distortion and result in a poor fit. Bleach or toothpaste may damage the plastic material. Patients should be warned not to drink or eat while wearing the Whipps retainer.

Figure 13.7

Whipps retainer constructed from 2 mm (0.08 inch) thick plastic material and incorporating ball clasps.

The chrome-cobalt retainer

A chrome-cobalt retainer is used as a long-term solution for an inherently unstable correction, especially in the transverse dimension. Following removal of fixed appliances, an accurate impression is taken and the model cast in hard stone; this is surveyed and unwanted undercuts blocked out. A skeleton chrome framework is then cast with mini inter-proximal occlusal clasps placed to ensure good retention and to assist in the prevention of undesirable tooth movements. If necessary, teeth may be incorporated where relevant.

These retainers are very comfortable, durable, thin and kind to the oral tissues (Figure 13.8).

The Quatro appliance

This is named after a well-known musical star. It is a removable appliance, which can be used either as an active appliance or a passive retainer.

Figure 13.8

The chrome-cobalt retainer.

Figure 13.9

The Quatro removable appliance (retainer). Removable labial bow attached (adjusted) to a sliding lock. The grub screw is adjusted using a hex wrench.

There are occasions when minor relapse occurs in the labial segments or when minor corrective tooth movements are required (e.g. slipped contacts, minor rotational relapse or slight misalignment). While the ideal approach is correction with fixed appliances; in some cases this may not be acceptable or practical. The 'Barrer' appliance (spring aligner) may be used, however, it is poorly retained and has limited adaptability. The Quatro appliance solves these problems.[1]

Construction. The Quatro appliance is constructed in the laboratory on an accurate stone model. As for any removable appliance, the appliance is well clasped. An ideal palatal or lingual stainless steel archwire 1 mm (0.036 inch) is fitted to contact the palatal surface of the maxillary incisors. If the intention is to slightly retract the incisors, the palatal arch should be positioned distal to the palatal surfaces of the incisors. Two buccal arms of 1 mm (0.036 inch) stainless steel wire support the locks soldered to their ends (Rocky Mountain, USA). These locks may also be purchased pre-soldered to the arms (OB Orthodontics). These arms pass over the embrasure between the canine and pre-molar teeth, the locks should stand just proud of the canine eminences, with the slot parallel to the occlusal plane preferably at the maximum bulbosity of the crowns. An acrylic base is poured, cured and polished in the conventional manner. In the laboratory, an accurately fitting sectional archwire is constructed to extend bilaterally through the locks (Figure 13.9).

When the appliance is available, first check the retention and fit of the passive appliance, and then insert the sectional archwire into the two locks. These locks carry milled slots and small grub screws, which are tightened on to the sectional archwires using a hex wrench. The locks are placed so that as the grub screw is tightened, it pulls the archwire slightly tighter in a distal direction. These sectional labial arches can be selectively adjusted with first order bends and minor tooth movements may be accompanied with inter-proximal stripping. In addition, slight adjustments of the two arms supporting the locks can alter the vertical height of the sectional archwire.

This appliance is comfortable, well tolerated and efficient. I find it a useful adjunct when selecting retainers.

Correcting Incisor Relapse with Removable Appliances

Adam A Ryan

During the retention phase, maxillary or mandibular incisors occasionally relapse as a

result of inadequate wear, loss or fracture of removable retainers. 'Active' retention may then be indicated, with retainers used to correct rotations, labio-lingual displacements or occluso-gingival displacements.

Labial displacements

The correction of labial displacement or rotation is readily corrected with a lingually directed force from a labial bow of a retainer. The required point of application of the wire is marked with a chinagraph pencil and a dimple inserted at the point with triple beak pliers. Any inter-proximal enamel stripping or selective trimming of the lingual acrylic is carried out as necessary. A degree of over-correction is recommended. Some clinicians prefer the use of acrylic facing on the labial bow and in these circumstances an alternative method of producing a lingually directed force is required. Rather than insert a dimple in the labial bow, cold-cure acrylic can be employed to serve the same purpose. First, the required point of application is noted and the adjacent area on the fitting surface of the acrylic facing is cleaned and roughened with a tapered acrylic burr. Cold-cure acrylic is then mixed to a thin consistency and a small drop applied with a probe to the area on the acrylic facing. The acrylic will set rapidly if held for a short time in hot water. (Beware—distortion of the baseplate is a distinct possibility if the entire retainer is immersed in hot water!) Some minor trimming of the added acrylic may be needed.

Lingual displacements

The correction of a lingual displacement or lingual rotation requires a labially directed force and therefore an active component on the lingual aspect of the tooth is needed. An elastomeric separator can be adapted to serve as the active component in a modification of the method suggested by Cureton.[19] Again, the point of application is noted and at that point, a hole is drilled through the baseplate from the fitting surface to the polished surface using a fine composite removing burr (8000-1171, Tip 1.2 mm, OrthoCare, UK). An elastomeric separator is threaded on to a steel ligature. The ligature is in turn threaded through the hole in the baseplate, and the separator is pulled into the hole. Approximately one quarter of the separator is left protruding from the fitting surface, although this can be varied to suit the degree of activation required. Melting it with a hot wax knife can reduce the separator protruding from the polished surface. This improves patient comfort and also aids the retention of the separator with the baseplate. Adjustment of the labial bow may be needed to permit labial movement of the incisor, along with inter-proximal enamel stripping as necessary.

It should be noted that in cases of rotation relapse, correction might involve a combination of the techniques described above, with active components on both the labial and lingual aspects.

Occluso-gingival displacements

Sometimes, occluso-gingival displacements of incisors occur during retention, and hence corrective movements will involve either extrusion or intrusion. A modification of the method described by Picard may be employed to create a small-customized ledge on the labial surface to permit engagement of an activated labial bow.[20] The incisor is etched and primed with light-cured composite resin primer. The retainer is inserted and if extrusion is required, the labial bow is activated by holding it 1–2 mm (0.04–0.08 inch) gingival to the passive position. A small dab of composite paste is placed along the occlusal aspect of the bow, smoothed with a Microbrush dipped in primer, and then cured. Care should be taken to ensure the composite does not run over the labial bow thus making removal of the retainer somewhat difficult. The composite is then smoothed with the retainer removed. When inserting the retainer, the labial bow is lifted over the composite ledge to permit engagement. As it returns to the passive position, the incisor will be extruded. Again, a degree of over-correction is recommended.

Should intrusion of the incisor be required, a similar procedure is followed, with the composite ledge created on the gingival aspect of the activated labial bow.

With experience, these techniques for correcting incisor relapse can be carried out rapidly. Patients are usually appreciative of the efforts made to improve the alignment of their anterior teeth.

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14 LABORATORY AIDS

All orthodontic practices, to a greater or lesser extent, make use of dental laboratories. Depending on the size of the practice and the preferences of the orthodontist, the laboratory may be: an external concern; an in-house laboratory employing a dental technician; or on a smaller scale, an in-house laboratory where limited procedures are carried out by the orthodontist and/or his or her staff. Most orthodontic practices will have at the very least a designated area where some technical procedures can be carried out. By the very nature of the work a degree of mess is created in the daily routine of a small laboratory.

Pearl: Keep the laboratory clean at all times. Use plastic film, changed daily, to cover and protect working equipment, such as dental vibrators.

After working with plaster or stone, clean all working surfaces and hand instruments, such as spatulas, before the plaster has a chance to set hard. Working surfaces should be sprayed or cleaned regularly with a silicone furniture polish, this prevents any set plaster from sticking to the surface.

The availability of a vacuum cleaner in the laboratory is very useful, it can be adapted to act as a dust extractor and to routinely clean spilt plaster powder or acrylic dust. Plaster powder will stick to your shoes and spread throughout the office, and acrylic cuttings and powder render a floor slippery and dangerous.

POLISHING DISC

Polishing Disc for Soft Mouth Guards and Invisible Retainers

Desmond Solomon

Conventional Lisco discs (Erkodent, Germany) supplied by EM Natt Ltd (UK) are used for finishing and polishing soft mouth guards and vacuum formed retainers. The following alternative is both cheaper and more effective (Figure 14.1a–d).

Requirements

- A green scouring pad available from local supermarkets and hardware stores. Select pads approximately 6.0 mm (0.25 inch) thick.
- Straight screw-type mandrel.
- Pair of heavy duty scissors.

Method

- Using heavy duty scissors, cut the green scouring pad into 20 cm (0.75 inch) squares. Round off the square edges to create a circular wheel.
- Unscrew the screw from the mandrel and push it through the centre of the green wheel.
- Replace the screw, together with the green wheel, into the mandrel.

This type of polishing wheel can be used on all soft materials, such as gum shields and also hard, thin, clear retainer material. If used at high speed, it will cut the material, while at slow speed it will smooth and polish the material. I recommend that you first cut the mouth guards/invisible retainers to shape, smooth off any sharp edges in the normal manner and then smooth the edges with this finishing wheel.

It is also useful for cleaning and polishing soldered joints. The rough feel of the fitting

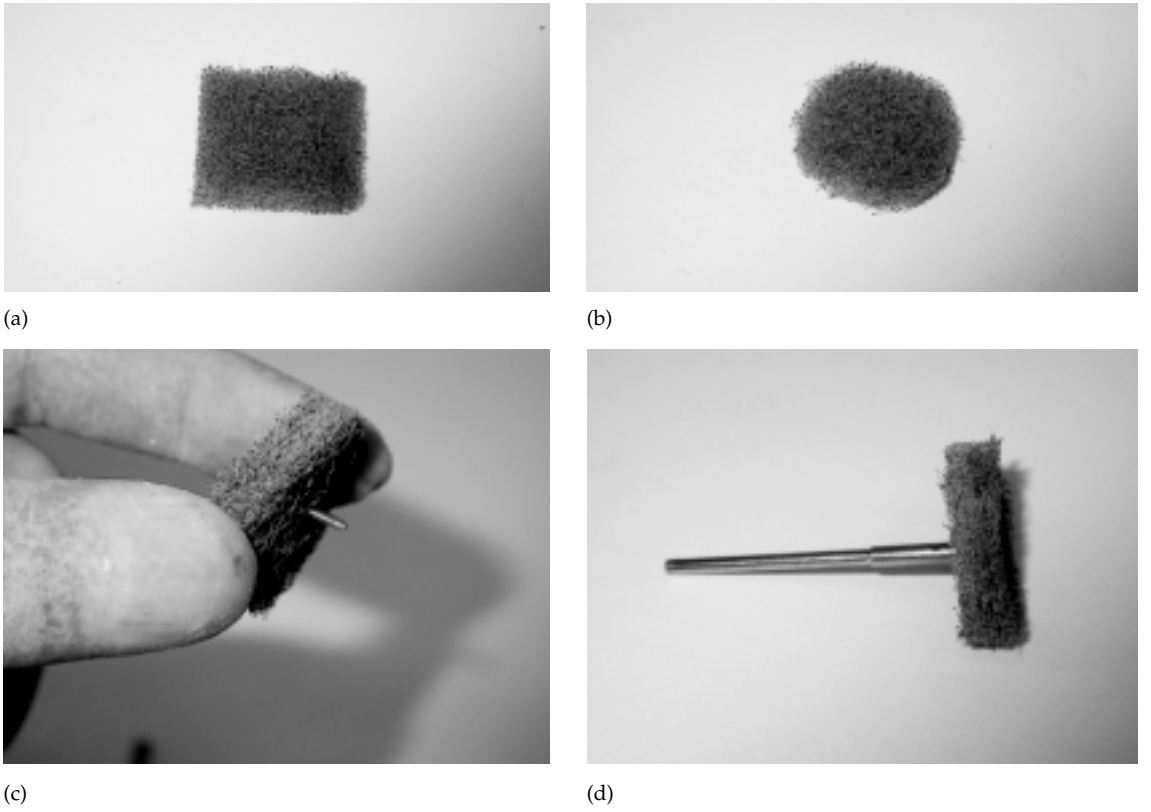

Figure 14.1

(a) Fabrication of a laboratory polishing wheel. With heavy duty scissors cut the scouring pad into 2 cm (0.75 inch) squares. (b) Trim the squares into circles. (c) Push a mandrel screw through the centre. (d) Screw the polishing wheel to a straight or contra-angle mandrel.

surface of an acrylic appliance can be smoothed by lightly running this polishing wheel over the acrylic. The advantages of this type of polishing wheel are:

- It is very inexpensive.
- It is flexible.
- It is possible to vary the size of the wheel to suit your specific requirement.
- It has no sharp edges, consequently there is no danger of cutting, nicking or scarring any plastic or metal components.

I find them very useful and I keep a stock at all times.

PLASTER

An Alternative Method for Mixing Plaster

Desmond Solomon

My great mentor, William Johnstone, passed down this simple method to me. Apart from the plaster, all you need is a small rubber bowl and a sheet of semi-rigid plastic material that covers the circumference of the bowl.

Fill the bowl with the required amount of water and gently sprinkle the required plaster into the water until it forms a crust, and then sprinkle a bit more on top of that. Leave it at this stage for a minute or so until all the plaster is completely saturated, then put your

hand under the tap and dribble little drops of water on the crust of the plaster. Place the plastic sheet over the top of the bowl. Firmly holding the plastic sheet in place with both thumbs and your fingers under the bowl, give it a good vigorous shake for about a minute. This results in excellent, smooth bubble-free plaster.

MODELS

Irrespective of how the plaster is mixed, it is important to cast air bubble-free models. Air bubbles trapped in the dental component of the model detract from the accuracy and quality of the final model. The following technique will almost always produce a good quality model:

- Under running water, rinse the impression well.
- While holding the impression tray on a vibrator, run plaster off a spatula at one end of the arch and let it run through to the opposite end. Do not be afraid to use excess plaster, as it runs along the arch it will displace any free water that may have accumulated in the dental component of the impression.
- Invert the impression over the plaster bowl and firmly tap the handle on the rim of the bowl. This should throw most of the plaster back into the bowl.
- Replace the impression tray on the vibrator and without adding any further plaster, watch the surface plaster that remained on the impression filling the dental component of the impression. Once the dentition is filled with plaster, the rest of the impression can be filled with plaster run off a spatula.

At this stage there are two options available:

1. Leave the cast impression to set and, as a separate procedure at a later stage, the set model separated from the impression may be based and trimmed.
2. As part of the same procedure, fill a rubber base mould with the same plaster mix and invert the cast impression over the base. Once the impression and base have set, the model can be trimmed.

EQUIPMENT

Protecting Equipment

Ronald G Melville

One of the problems of keeping a small in-house laboratory is maintaining and cleaning the standing equipment. All personnel using the laboratory need to be instructed to clean plaster off all instruments and equipment immediately after use while the plaster is still soft. If a plaster vibrator is used, place it in an open plastic bag or cover it in plastic film (Cling Film) to prevent plaster flowing over and sticking to the vibrator. The plastic covering can be discarded at the end of each working day.

Casting models

In order to obtain really good study models, deep impressions are essential and should be cast using high quality plaster mixed under vacuum. Use commercially available rubber base moulds to cast the bases, this reduces waste of plaster and is a much cleaner and neater procedure.

Trimming of models is usually a chore; they can be sent out to a professional dental laboratory or done in-house. The time and effort spent can be greatly reduced if the models are trimmed and sculptured as soon as the plaster is set. If you wait hours or days, the plaster will be very hard and more difficult to work. Once the models have been correctly trimmed, smoothed and sculptured, they must be left to dry completely for about three days to prevent the models turning yellow. Follow this with immersion in liquid model soap for about four hours. Rinse the models well in warm water, allow to dry and then rub with a cloth to shine. Total working time involved in preparing a set of models should not exceed one hour.

Appendices

DISCLAIMER

While the sample letters listed in Appendices A–E, are in many cases currently being used by their respective authors, these authors do not accept any responsibility or liability for the legal correctness or status of these documents. Notwithstanding the fact that these letters have served the authors well over many years, the suitability of these letters should be assessed in relation to the laws and practices pertaining to each country, state and individual practice.

Appendix A

Eliakim Mizrahi: Specimen forms and letters

Specimen forms and letters published with permission from Dr Eliakim Mizrahi, 128 Woodford Avenue, Gants Hill, Essex IG2 6XA, United Kingdom.

LETTER TO PRIVATELY TREATED ADULT PATIENT FOLLOWING A CASE DISCUSSION

Dear……

1. This is to confirm our discussion regarding the proposed orthodontic treatment for yourself.
2. You have an acceptable relationship of your lower jaw to your upper jaw.
3. You have a retruded lower jaw in relation to your upper jaw.
4. You have a protrusive lower jaw in relation to your upper jaw.
5. There is crowding of the teeth in……arch resulting in their malalignment and an incorrect bite.
6. In order to try and correct the position of your teeth, it will be necessary for you to wear orthodontic appliances.
7. In order to try and correct the position of your teeth, it will be necessary for ……teeth to be extracted and for you to wear orthodontic appliances.
8. In order to try and correct the position of your teeth, it will be necessary for you to wear orthodontic appliances. It may become necessary for certain teeth to be extracted at a later date.
9. The duration of treatment will be approximately ……, however this may vary greatly.
10. The cost of orthodontic treatment is made up as follows:

INVESTIGATIONS £ ……..

TREATMENT £ …….

This fee is payable by means of an initial payment of £……. at the start of treatment plus the cost of investigations and the balance by means of a monthly bankers standing order payment of £ ……..

10a. Should you request porcelain brackets there will be an additional charge of £ …….. payable at the start of treatment.

11. This fee is charged irrespective of the number of visits during the period of treatment. The fee does not include the cost of regular dental care such as fillings or extractions. In the event of an appliance being lost or broken an extra charge will be made.

11a. The cost of any future treatment will only be assessed if and when it becomes necessary.

11b. I must point out to you that in view of the close proximity of the crown of the impacted …….. to the roots of the adjacent teeth it is possible that the roots of these teeth may be damaged either during surgical exposure or during and/or following orthodontic treatment.

12. Please note that throughout the period of orthodontic treatment it is essential for you to continue to visit your dentist for your regular dental examinations as well as for any necessary dental treatment.

13. Following completion of active orthodontic treatment there is a tendency for teeth to move back to their original position (relapse). Therefore, it will be essential for you to wear a retainer for an extended period of time. The cost of the retainer will only be assessed at that time.

14. The success of orthodontic treatment is dependent on the highest degree of patient cooperation. Unfortunately, should this cooperation become inadequate at any stage during treatment, you will be notified and reluctantly the treatment may have to be terminated prematurely.

15. In fairness to all the patients in the practice, should you fail to attend for your scheduled appointment without adequate prior cancellation, you will be charged on a time related basis for the missed appointment.

16. As acknowledgement of having received, read and understood this report together with the notification on **'Potential Risks and Limitations of Orthodontic Treatment'**, please sign and return the enclosed **'Consent Form'** prior to the commencement of treatment.

17. If you have any queries I would be pleased to discuss them with you.

Thanking you

Yours sincerely

Dr …….

Select paragraphs 1 to 17 where relevant

LETTER TO PARENT/GUARDIAN FOLLOWING A CASE DISCUSSION FOR A MINOR PATIENT

Dear…….

1. This is to confirm our discussion regarding the proposed orthodontic treatment for…….
2. …… has an acceptable relationship of…. lower jaw to …… upper jaw.
3. …….has a retruded lower jaw in relation to……. upper jaw.
4. ..…….has a protrusive lower jaw in relation to……. upper jaw.
5. There is crowding of the teeth in……..jaw/s resulting in their malalignment and an incorrect bite.
6. In order to try and correct the position of …….'s teeth, it will be necessary for….. to wear orthodontic appliances.
7. In order to try and correct the position of…….'s teeth, it will be necessary for certain teeth to be extracted and for ….. to wear orthodontic appliances.
8. In order to try and correct the position of ….'s teeth, it will be necessary for…. to wear orthodontic appliances. It may become necessary for certain teeth to be extracted at a later date.
9. The treatment will be divided into two stages. The object of the first stage is to …… The need for a second stage of treatment will only be assessed at a later date. The availability of the second stage of treatment under the NHS will be dependent on the waiting list at that time.
10. The duration of treatment will be approximately ……., however, this may vary greatly.
11. The cost of orthodontic treatment is made up as follows:

INVESTIGATIONS	£…….
TREATMENT	£……..

This fee is payable by means of an initial payment of £……. at the start of treatment plus the cost of investigations and the balance by means of a monthly bankers standing order payment of £…….

11a. Should ……... request porcelain brackets there will be an additional charge of £….. payable at the start of treatment.

12. This fee is charged irrespective of the number of visits during the period of treatment. The fee does not include the cost of regular dental care such as fillings or extractions. In the event of an appliance being lost or broken an extra charge will be made.

12a. The cost of any future treatment will only be assessed if and when it becomes necessary.

13. I must point out to you that in view of the close proximity of the crown of the impacted …… to the roots of the adjacent teeth it is possible that the roots of these teeth may be damaged either during surgical exposure or during and/or following orthodontic treatment.

14. Please note that throughout the period of orthodontic treatment it is essential for….. to continue to visit …. dentist for…. regular dental examinations as well as for any necessary dental treatment.
15. Following completion of active orthodontic treatment there is a tendency for teeth to move back to their original position (relapse). Therefore, it will be essential for….. to wear a retainer for an extended period of time. The cost of the retainer will only be assessed at that time.
16. I must point out to you that the result of this case will depend to a large extent on the degree of growth taking place in the lower jaw over the next few years.
17. The success of orthodontic treatment is dependent on the highest degree of patient cooperation. Unfortunately, should this cooperation become inadequate at any stage during treatment, you will be notified and reluctantly the treatment may have to be terminated prematurely.
18. In fairness to all the patients in the practice, should …. fail to attend for …. scheduled appointment without adequate prior cancellation, you will be charged on a time related basis for the missed appointment.
19. As acknowledgement of having received, read and understood this report together with the notification on **'Potential Risks and Limitations of Orthodontic Treatment'**, please sign and return the enclosed **'Consent Form'** prior to the commencement of treatment.
20. If you have any queries I would be pleased to discuss them with you.

Thanking you

Yours sincerely

Dr ……

Select paragraphs 1 to 20 as considered relevant

LETTER TO A PATIENT'S DENTIST FOLLOWING AN INITIAL CONSULTATION

Dear……..

re……..

1. Thank you for your confidence and courtesy in referring this patient to me.
2. …… has a Class …… malocclusion……(with superimposed crowding, spacing, etc.).
3. A full orthodontic investigation has not as yet been carried out. ……., has been requested to return for a re-evaluation at …… intervals. When records have been taken you will be sent a full report.
4. I would, however, suggest that at this stage you extract……., complete any necessary conservation and carry out a fluoride application at your convenience.
5. This patient is now ready to start active orthodontic treatment.
6. A full orthodontic investigation has not as yet been carried out. When…….agree to have records taken, you will be sent a full report.
7. If you have any queries I would be pleased to discuss them with you.

Thanking you

Yours sincerely

Dr ……

Select paragraphs 1 to 7 as considered relevant.

LETTER TO A PATIENT'S DENTIST FOLLOWING FIRST VISIT WHEN RECORDS HAVE BEEN TAKEN AND AN APPOINTMENT HAS BEEN MADE FOR A CASE DISCUSSION

Dear……..

re ……..

Thank you for your confidence and courtesy in referring this patient to me.

Following a comprehensive orthodontic investigation, an appointment has been scheduled for a case discussion following which you will be sent a full report.

If you have any queries I would be pleased to discuss them with you.

Thanking you

Yours sincerely

Dr ……..

LETTER TO A PATIENT'S DENTIST FOLLOWING FIRST VISIT WHEN AN APPOINTMENT HAS BEEN MADE FOR INVESTIGATIONS

Dear ……..

re ……..

Thank you for your confidence and courtesy in referring this patient to me.

An appointment has been scheduled for orthodontic investigations to be carried out following which you will be sent a full report.

If you have any queries I would be pleased to discuss them with you.

Thanking you

Yours sincerely

Dr ……..

REPORT TO THE PATIENT'S DENTIST FOLLOWING CASE DISCUSSION

Dear…….

re ……..

1. Thank you for your confidence and courtesy in referring this patient to me.
2. This is a report on the proposed orthodontic treatment for ……..
3. …….. has a Class …….. skeletal pattern. There is crowding of the teeth in ……... resulting in their malalignment and an incorrect bite (overjet, overbite, crossbite, missing teeth, etc.).
4. ……. has a Class …….. skeletal pattern. There is . . . (overjet, overbite, crossbite, missing teeth etc.) . . . (case with no crowding).
5. After considering the relevant data, I have decided on the following treatment plan:
   1. Extract…….
   2. Full fixed appliance therapy
   3. Retention
6. **If the patient/parent/s decide** to go ahead with the treatment, I would appreciate it if you would (extract…….if relevant) complete any necessary conservation and carry out a fluoride application at your convenience.
7. It has been pointed out to the patient/parents that in view of the close proximity of the crowns of the unerupted ……to the roots of the adjacent teeth, it is possible that these roots may be damaged either during surgical exposure or during and/or following orthodontic treatment.
8. It has been pointed out to the patient/parent/s that the final result of this case will depend to a large extent on the degree of growth taking place in the mandible over the next few years.
9. It has been pointed out to the parent/s that this type of malocclusion does have a tendency to a certain amount of relapse following completion of orthodontic treatment.
10. Although the patient has been instructed to return to your surgery for regular consultations throughout active treatment, it has been our experience that they often neglect to do so. I would appreciate it if you could make a special note to recall this patient periodically during orthodontic treatment.
11. If you have any queries, I will be pleased to discuss them with you.

Thanking you

Yours sincerely

Dr …….

Select paragraphs 1 to 11 where relevant

LETTER TO THE PATIENT'S DENTIST REQUESTING EXTRACTIONS

Dear ……..

re……..

This patient appears to be progressing satisfactorily.

I would appreciate it if at this stage you would extract the……, complete any necessary conservation and carry out a fluoride application at your convenience.

If you have any queries I would be pleased to discuss them with you.

Thanking you

Yours sincerely

Dr ……

LETTER TO A PATIENT'S DENTIST FOLLOWING REMOVAL OF FIXED APPLIANCES

Dear……..

re ……

This is to inform you that your patient ……. has completed active orthodontic treatment and is now in retention.

The patient has been instructed to return to you for a general dental examination and a fluoride application.

Thanking you for your referral.

Yours sincerely

Dr ……

LETTER TO PATIENT: RETENTION

Dear ……..

Now that your phase of fixed appliance treatment has been completed, I wish to thank you for your cooperation and hope that you are pleased with the result.

We have now instituted the use of a special appliance to help complete orthodontic treatment.

This is an appliance designed to either move the teeth to their final positions and/or hold them until the bone becomes stabilized. It is absolutely essential for the appliance to be worn according to the instructions so that we can attain maximum correction.

Because of the importance of this phase of treatment, we must ask you to wear the appliance as directed during the time between surgery visits.

The duration of the retention phase varies with each individual case. Please follow our instructions regarding your retention schedule.

The appliance is difficult and expensive to make. Therefore, we suggest that care be taken to prevent its loss or destruction, to avoid replacement costs.

At this stage we advise you to return to your general dentist for a full examination and fluoride application.

Please note fixed retainers encourage the accumulation of food and plaque. They need to be cleaned thoroughly daily and checked at six monthly intervals by your dentist or orthodontist.

Thank you for your understanding and cooperation in this phase of the treatment. If you have any questions, please feel free to contact us.

Yours sincerely

Dr ……..

Given in conjunction with written instructions on the care of removable appliances

LETTER TO PARENT REGARDING POOR COOPERATION

Dear

1. This letter serves to inform you that we are experiencing certain problems with the progress of ……'s orthodontic treatment.
2. ……. is not maintaining an adequate level of oral hygiene. It has been explained to…… that this will lead to the teeth being permanently marked and the development of cavities.
3. General cooperation regarding the care of ……'s orthodontic appliances is poor. Failure to take care of the appliances or to wear elastics as directed will slow down the treatment progress.
4. In my original letter to you dated……., it was pointed out that the success of orthodontic treatment is dependent on the highest degree of patient cooperation. I would appreciate it if you could point out to …….. that for the treatment to reach a successful conclusion it will be necessary for……. to improve the level of…….. cooperation.
5. Please attend together with…….. at ……next appointment on……. to discuss the discontinuation of …….. treatment.

Yours sincerely

Dr …….

Select paragraphs 1 to 5 where relevant

LETTER TO PATIENT / PARENT FOLLOWING FAILURE TO RETURN FOR APPOINTMENTS

Dear …….

It has become apparent that …… failed to attend for …… regular appliance adjustments since the …….

I must point out to you that as mentioned in our original letter dated ……, it is essential for us to have full cooperation and to adjust …… appliances regularly in order to achieve a satisfactory result. Failure to monitor and adjust appliances can result in permanent damage to ……'s teeth, gums, and supporting bone. Under these circumstances I must point out to you that we cannot accept any responsibility for damage that will occur to …..'s teeth, gums or bone due to ……. failure to attend for regular maintenance.

Should you prefer to discontinue …… treatment it will be necessary for you to make an appointment at your earliest possible convenience to arrange for the removal of . . . . .'s braces.

If you have any queries I would be pleased to discuss them with you.

Thanking you

Yours sincerely

Dr …….

POTENTIAL RISKS AND LIMITATIONS OF ORTHODONTIC TREATMENT

To our patients

As a rule excellent orthodontic results can be achieved with informed and cooperative patients. The following information is routinely supplied to anyone considering orthodontic treatment in our office. While recognizing the benefits of a pleasing smile and healthy teeth you should also be aware that orthodontic treatment, like any treatment of the body, has some inherent risks and limitations. These are seldom enough to contraindicate treatment, but should be considered in making the decision to wear orthodontic appliances. Please feel free to ask questions about this at the pre-treatment consultation.

Decalcification (permanent markings), decay, or gum disease can occur if patients do not brush their teeth properly and thoroughly during the treatment period. Excellent oral hygiene and plaque removal is a must. Sugars and between meal snacks should be eliminated.

Teeth have a tendency to rebound towards their original position after orthodontic treatment. This is called relapse. Very severe problems have a higher tendency to relapse and the most common area for relapse is the lower front teeth. After band removal a positioner or retainers may be placed to minimize relapse. Full cooperation in wearing these appliances is vital. We will make our correction to the highest standards and in many cases over-correct in order to accommodate the rebound tendencies. When retention is discontinued some relapse is still possible.

A non-vital or dead tooth is a possibility. A tooth that has been traumatized from a deep filling or even a minor blow can die over a long period of time with or without orthodontic treatment. An undetected non-vital tooth may flare up during orthodontic movement requiring endodontic (root canal) treatment to maintain it.

In some cases the root ends of the teeth are shortened during treatment. This is called root resorption. Under healthy circumstances the shortened roots are no disadvantage. However, in the event of gum disease in later life the root resorption could reduce the longevity of the affected teeth. It should be noted that not all root resorption arises from orthodontic treatment. Trauma, cuts, impaction, endocrine disorders or idiopathic reasons can also cause root resorption.

There is also a risk that problems may occur in the temporo-mandibular joints (TMJ). Although this is rare, it is a possibility. Tooth alignment or bite correction can improve tooth related causes of TMJ pain but not in all cases. Tension appears to play a role in the frequency and severity of joint pains.

Occasionally a person who has grown normally and in average proportion may not continue to do so. If growth becomes disproportionate, the jaw relation can be affected and original treatment objectives may have to be compromised. Skeletal growth disharmony is a biological process beyond the orthodontist's control.

The total time for treatment can be delayed beyond our estimate. Lack of facial growth, poor elastic wear or headgear cooperation, broken appliances and missed appointments are all important factors which could lengthen treatment time and affect the quality of the result.

Headgear instructions must be followed carefully. A headgear that is pulled outward while the elastic force is attached can snap back and poke into the face or eyes. Be sure to release the elastic force before removing the headgear from the teeth.

So please, lets make every effort to do it right. This takes cooperation from everyone, orthodontist , the staff, your family and most of all the patient.

Dr ……..

Appendix B

Laurence Jerrold: Specimen forms and letters

Specimen forms and letters published with permission from Dr Laurence Jerrold, Programmme Director—School of Orthodontics, Jacksonville University, 2800 University Blvd North, Jacksonville, FL 3221, USA

REFERRAL FROM DENTIST—THANK YOU

Dear Dr

This is to acknowledge, with thanks, your referral of (Patient's Name) to our office. It is a pleasure to assist you in (Patient's Name) overall dental treatment.

Insert appropriate paragraph 1–4 below

If Option #1 from below insert following paragraph:
An appointment has been made for (Patient's Name) and complete records will be taken. We will furnish you with a synopsis and orthodontic treatment plan as soon as possible.

If Options #2 or #4 from below insert following sentence:
When (Name) is ready to initiate active orthodontic therapy, we will furnish you with a synopsis and treatment plan at that time.

Thanks again for your expression of confidence and support. We will do our utmost to have this referral reflect favourably upon your choice of an orthodontic specialist.

Cordially

Dr Straighttooth

1. We fully agree that now is an opportune time to begin orthodontic therapy. Please let us know your usual office procedure with regard to periodic examination and prophylaxis. We shall be happy to cooperate with you in every possible way.

2. We have recommended that (Patient's Name) be kept under periodic observation until such time as treatment is indicated. We sincerely feel that postponing treatment at this time is the procedure of choice in this type of malocclusion. Due to your early diagnosis and referral (Patient's Name) will benefit from our being able to monitor his/her growth and development and institute appropriate timely therapy.

3. After preliminary examination, we feel that the risk/benefit ratio in this particular case is such that orthodontic treatment is unwarranted. We will be happy to discuss this matter with you at your convenience.

4. We fully agree that now is an opportune time to begin orthodontic therapy.
   A. (Patient's Name) is considering undergoing treatment.
   B. However due to undisclosed reasons (Patient's Name) wishes to delay the start of treatment.
   C. However due to financial considerations (Patient's Name) wishes to delay the start of treatment.
   D. (Patient's Name) has indicated however that he/she wishes to forego the benefit of orthodontic therapy.
   E. Ideal treatment for this patient may involve both orthodontic therapy and orthognathic surgery. The patient is considering this option.

THANK YOU FOR REFERRAL FROM PATIENT

Date

Dear

Thank you for the courtesy extended in referring (Patient's Name) to our office for orthodontic treatment.

We will strive to treat (Patient's Name) with the same professional concern that has been shown you/your family. Your expression of confidence in us is sincerely appreciated.

Respectfully

Dr Straighttooth

LETTER TO DENTIST WHO DID NOT RECOMMEND PATIENT BUT IS THE PATIENT'S DENTIST

Date

Dear Dr

Your patient, (Patient's Name) , is under our care for orthodontic therapy. An appointment has been made for (Patient's Name) and complete records will be taken. We will provide you with a synopsis of his/her clinical findings and a treatment plan as soon as possible. Please let us know your usual office procedure with regard to periodic examination and prophylaxis; we shall be happy to cooperate with you in every possible way.

It is a pleasure to assist you in the provision of ideal comprehensive dental treatment for (Patient's Name) .

Cordially

Dr Straighttooth

SYNOPSIS LETTER TO DENTIST

Date

[Dentist's Name]
[Dentist's Address]

If you use digital photography this is a good place to insert a composite photograph of the patient's extra- and intra-oral photographs and or radiographs

re: Patient's Name

Dear Dr

(If the doctor referred the patient, start the letter with a sentence thanking him/her for the referral then begin with the following sentence. If the patient's dentist was not the one who referred the patient, start the letter with the following sentence.) We examined (Patient's Name) on (date) at which time orthodontic records consisting of a comprehensive history and examination, extra- and intra-oral photographs, cephalometric and panoramic radiographs (and any others), and models of the patient's dentition were taken. Upon review of these data, we have formulated the following diagnosis and treatment plan. (Patient's Name) malocclusion is characterized by:

– Note any aspects of the patient's history that might affect treatment
– Facial Balance (concisely describe facial balance, symmetry and muscle tone)

- Profile (concisely describe the profile, lip competency, naso-labial angle, etc.)
- Dental Classification (include a brief differential characterization) in the (insert the appropriate dentitional stage)
- Overbite and Overjet (state findings in mm)
- Arch Form (describe both upper and lower)
- Midlines (describe both upper and lower in relationship to the facial midline)
- Crowding or Spacing (state findings of each arch in mm)
- Enamel Defects, Hard or Soft Tissue Anomalies (state all that are present)
- Radiographic Findings (state any abnormalities and include status of M3's)

The orthodontic objectives for ___(Patient's Name)___ involve correcting the above mentioned clinical manifestations, thus providing our patient with the most optimal esthetic, functional, and stable occlusion possible. Treatment should take approximately 'X' months, however there are many factors that influence this estimate such as the rate of exfoliation of the remaining primary teeth, the eruption of the succedaneous teeth, the magnitude and direction of any remaining dentofacial growth and development, the patient's compliance and most importantly, one's individual response to treatment.

We will be using (state the type[s] of appliances) in conjunction with (a non-extraction approach OR extraction of [state the teeth to be extracted]). On occasion, this approach presents the following problems (at this point, insert any potential problems that have a reasonable possibility of occurring). Should any of these arise, we will keep you informed of their development and our approach to dealing with them. (If there are adjunctive services that will be necessary such as canine exposures, implant anchorage, transplantations, periodontal procedures, etc., state them here.)

Retention in this case is best addressed by (insert the types of retainers that will be placed and any adjunctive procedures relating to retention such as fiberotomies, frenectomies, third molar extraction/enucleation, etc.). In addition, the patient will require (insert any restorative needs here such as build ups of peg laterals, permanent crowns or bridges, etc.).

It is our policy to strongly recommend to all of our patients that they see their general (paediatric) dentist at least (semiannually, quarterly, etc.). If your recall philosophy is different, please let us know and we will be happy to work with you in this regard. We will make every effort to join with you in providing all of our mutual patients with optimal oral health from both a prophylactic and therapeutic perspective during their orthodontic therapy.

The prognosis in ___(Patient's Name)___ is (excellent, good, guarded, poor, compromised, etc.) and is based on reasonable patient cooperation and average remaining dentofacial growth and development. We look forward to working with you both now and in the future. If you have any questions about this or any other patient we have in common, please don't hesitate to call.

Respectfully

Dr Straighttooth

COMPLETION LETTER OF PHASE I TO PATIENT'S DENTIST

Dear Dr

Just a note to let you know that (Patient's Name) has recently completed his/her first phase of orthodontic treatment. Through early intervention we have sought to maximize (Patient's Name) potential for proper dental and orofacial development.

(Patient's Name) has now been placed under periodic observation. He/She will be monitored at regular intervals to determine if a second phase of treatment is indicated and if so, the extent and timing of such intervention.

We have recommended that (Patient's Name) call your office to make an appointment for routine dental care. If you have any questions regarding his/her treatment to date, specific present or future concerns, or questions in general about the philosophy of interceptive orthodontics, please feel free to call us.

Respectfully

Dr Straighttooth

COMPLETION LETTER TO PATIENT'S DENTIST

Date

Dear Dr

Just a note to let you know that (Patient's Name) has recently completed active orthodontic treatment. We were happy we could provide him/her with all of the benefits that contemporary orthodontics has to offer. Every effort has been made to address our original treatment goals regarding the establishment of good function, optimum aesthetics and maximum stability.

(Patient's Name) will now enter the retention phase of therapy.

(Patient's Name) has been told to call your office to make an appointment for routine dental care. Should you have any questions concerning his/her treatment or orthodontics in general please feel free to call us.

Respectfully

Dr Straighttooth

REQUEST FOR RECORDS

Date

Re

Dear Dr

(Patient's Name) will be coming to our office soon for an orthodontic evaluation. We would appreciate the transfer of all his/her diagnostic and pertinent treatment records as soon as possible.

++

I (Patient's Name) hereby request (Former Doctor) to transfer any and all medical/dental information in his/her possession regarding me/my child to (New Doctor) . By my signature below, I fully release (Former Doctor from any and all liability stemming solely from the transfer of this information to (New Doctor) .

_____

Signature of Patient or Parent

CARIES NOTE

Date

re

Dear Dr

Please examine the following surfaces for caries and/or appropriate restorations:

Some of these surfaces may be small, however, these teeth will have orthodontic appliances placed on them, and therefore we leave it to your judgement as to whether you wish to restore them at this time. This exam was done with/without the benefit of radiographs.

Remarks: _____
_____
_____
_____

Thank you for your cooperation. If you have any questions please feel free to call.

Respectfully

Dr Straighttooth

LETTER TO DENTIST REGARDING POOR PATIENT COOPERATION / RESULT

Date

Re

Dear Dr

As you know we are currently providing orthodontic care for (Patient's Name) . Even though we are giving our closest attention to (Patient's Name) case, his/her response to treatment has been slower than normally expected. The problem(s) to date appear to have been * (insert from categories below) .

We will continue with (Patient's Name) treatment as long as it is clinically feasible to do so in order to achieve the best possible clinical result. However, due to the situation as previously described, some limitations or compromises regarding our initial treatment goals may occur.

If you have any questions, please call us. You may wish to recall (Patient's Name) at this time to examine him/her and re-enforce to him/her and his/her parents, the positive benefits of orthodontic therapy and the cooperation levels needed to achieve these ends. We have discussed this with (Patient's Name) parents, thus they are aware of the situation.

Respectfully

Dr Straighttooth

*i.e
– not wearing headgear or elastics as instructed
– not complying with oral hygiene instructions
– not keeping appointments
– repeated breakage or loss of appliances
– poor skeletal growth/response
– slow dental development
– other: _____

PERIODONTAL EVALUATION REQUEST

Date

Re

Dear Dr

Please evaluate (Patient's Name) periodontal status prior to the initiation of orthodontic therapy. After your periodontal treatment has been rendered, please let our office know the periodontal status of (Patient's Name) and how often you would like to see him/her for recall. Also, please furnish us with a copy of your post-treatment re-evaluation of (Patient's Name).

Thanks for your help and cooperation regarding (Patient's Name) treatment. We look forward to hearing from you and working closely with you as we both attend to the oral health needs of our patients-in-common.

Respectfully

Dr Straighttooth

SYNOPSIS LETTER TO PARENT OR PATIENT

Date

[Patient or Parent's Name]
[Patient or Parent's Address]

If you use digital photography this is a good place to insert a composite photograph of the patient's extra- and intra-oral photographs and or radiographs

Re: Patient's Name

Dear Patient or Parent:

We would like to take this opportunity to review some of the aspects of your/ (Patient's Name) orthodontic problem that were discussed at our recent consultation appointment. Upon review of your/your child's comprehensive history and examination, extra- and intra-oral photographs, cephalometric and panoramic radiographs (and any others), and dental models, we have formulated the following diagnosis and treatment plan. (Patient's Name) malocclusion is characterized by:

(**NOTE: ALL OF THE FOLLOWING SHOULD BE STATED BRIEFLY AND IN LAYMAN TERMINOLOGY)**

– Note any aspects of the patient's history that might affect treatment
– Facial Balance (concisely describe facial balance, symmetry and muscle tone)
– Profile (concisely describe the profile, lip competency, naso-labial angle, etc.)
– Dental Classification (include a brief differential characterization) in the (insert the appropriate dentitional stage)
– Overbite and Overjet (state findings in mm)
– Arch Form (describe both upper and lower)
– Midlines (describe both upper and lower in relationship to the facial midline)
– Crowding or Spacing (state findings of each arch in mm)
– Enamel Defects, Hard or Soft Tissue Anomalies (state all that are present)
– Radiographic Findings (state any abnormalities and include status of M3's)

The orthodontic objectives for (Patient's Name) involve correcting the above mentioned clinical findings in order to provide you/your child with the most optimal aesthetic, functional, and stable result possible. Treatment should take approximately 'X' months, however there are many factors that influence this estimate such as how fast the baby teeth fall out, how quickly the remaining permanent teeth erupt, the magnitude and direction of any remaining growth and development of the teeth and/or jaws, the degree of patient compliance with our instructions, and most importantly, a patient's individual response to treatment.

We will be using (fixed and/or removable appliances) in conjunction with (a non-extraction approach OR extraction of [state the teeth to be extracted]). On occasion, this approach presents the following problems (at this point, insert any potential problems that have a reasonable probability of occurring, again in layman's terms). Should any of these arise, we will keep you

informed of their development and our approach to dealing with them. (If there are adjunctive services that will be necessary such as canine exposures, implant anchorage, transplantations, periodontal procedures, etc., state them here.)

Following the completion of active treatment a period of retention therapy is required to help hold the teeth in their new positions. The fee for this phase of therapy is included in your total fee as described below. At the end of this phase of treatment, if you desire continued monitoring of the finished result, a small per visit retention fee will be charged. (If any adjunctive procedures, restorative needs, etc. will be necessary, insert them here stating that the fees for these procedures will be over and above the orthodontic fee and should be discussed with the doctor who will be performing them.)

It is our policy to strongly recommend to all of our patients that they see their general (paediatric) dentist at least (semiannually, quarterly, etc.). Maintaining good oral hygiene and regularly scheduled check-ups and cleanings during orthodontic therapy has been found to prevent or greatly minimize any potential damage to the teeth and supporting gum and bony tissues.

We are enclosing a brochure that covers the benefits and risks associated with orthodontic treatment to remind you of the things we discussed with you at the consultation visit. (Insert whatever informed consent form or information you routinely use.) Please read this information carefully and feel free to discuss any questions or concerns you have about your/your child's treatment with us at your convenience.

The fee for ___(Your or Patient's Name)___ treatment is (state the amount and the terms of payment). Note that there are no interest or finance charges however there may be additional fees imposed for (insert the instances for which they may be applied such as broken appointments without advance notice, bounced checks, excessive breakage, etc.).

We look forward to providing you with a gratifying orthodontic outcome. This expectation is premised upon good patient cooperation and average incremental remaining facial growth and development. We look forward to providing you with the most of what modern orthodontics has to offer. If you have any questions about your/your child's treatment, please don't hesitate to call our office; we are here to serve you.

Respectfully

Dr Straighttooth

RETENTION LETTER

Date

Dear

Now that your orthodontic appliances have been removed we are entering the final phase of treatment, that of retention therapy. Although you may not be aware of it, there are a number of delicate balancing factors that affect the stability of the orthodontic result achieved; some of these are:

– one's future adverse dentofacial growth and development
– the existence of harmful orofacial habits
– one's underlying skeletal makeup
– the development of wisdom teeth
– a discrepancy between the sizes of one's teeth and one's jaws
– the condition of the supporting gum and bone for the teeth, and
– the degree of a patient's cooperation with the retentive aspect of their treatment

It is **IMPORTANT** that you keep your appointments and follow all instructions during this phase of your treatment so that the results that were achieved can be properly maintained and monitored. This is also an excellent time for you to have a complete dental check-up and cleaning. Please call your dentist in this regard as soon as possible. If you have any questions, or if we can be of any help to you, please let us know.

Respectfully

Dr Straighttooth

CARDIOPATHY LETTER

Dear Dr _____

___(Patient's Name)____is under our care for orthodontic therapy.

The patient's medical history reveals that ____(Patient's Name)___ has history of

having had _____(fill in choices from 1–5 below)_ .

Please advise us as to the following:

1. The nature of the cardiac problem.
2. Whether or not you recommend prophylactic antibiotic coverage for SBE.
3. If so, should we follow the American Heart Association regimen or one of your own?

Thank you for your prompt reply.

Respectfully

Dr Straighttooth

++

I authorize the release of the above requested medical information pertaining to

myself/my child as requested by Dr _____.

_____ _____

Signature of patient Signature of parent
if patient is a minor

1 – a heart murmur
2 – rheumatic fever
3 – prosthetic joint replacement
4 – mitral valve prolapse
5 – an unspecified cardiomyopathy

NASO RESPIRATORY LETTER TO PAEDIATRICIAN, ALLERGIST AND/OR ENT PHYSICIAN

Dear Dr

(Patient's Name) has been evaluated by our office for orthodontic therapy. Our examination revealed the presence of:

[ ] steep mandibular plane
[ ] open bite tendency
[ ] excessive lower face height
[ ] mouth breathing
[ ] radiographic large adenoidal tissue mass with obstruction of the nasopharynx
[ ] deviated septum
[ ] engorged turbinates
[ ] history of allergic rhinitis
[ ] high narrow palatal vault
[ ] _____

As you are aware, upper airway obstruction can significantly affect one's dentofacial growth and development. Untreated obstructions can also seriously affect the stability of any orthodontic treatment rendered. Please examine _(Patient's Name)_ regarding the above noted factors and evaluate him/her for any necessary treatment of the airway obstruction since an aggressive early approach has been proven to have beneficial effects regarding a patient's dentofacial development.

If you wish to discuss _(Patient's Name)_ case with us, please feel free to call.

Respectfully

Dr Straighttooth

cc: Allergist
Paediatrician
ENT physician
Dentist

GOOD PROGRESS REPORT TO PARENT

Date

Dear

It is unusual that we write to the parents of one of our patients at this point of time in treatment, but in this instance we feel compelled to emphasize the positive aspects of (Patient's Name) progress.

Orthodontics, unlike any other area of medicine or dentistry, requires a high degree of patient cooperation if one is to achieve a satisfactory result. In light of the current advances in modern science, combined with our extensive educational training, we in orthodontics no longer find ourselves simply treating teeth. Today we are concerned with facial growth and development, in conjunction with dental aesthetics, while we attempt our orthodontic corrections. With a mature, understanding and cooperative patient our potential seems almost limitless.

The excellent result we have achieved so far with (Patient's Name) was a combined effort. He/She quite obviously received the necessary support at home to encourage his/her efforts. You have every right to be extremely proud of (Patient's Name) . It is truly a pleasure to work with you in this combined effort.

We anticipate the same level of cooperation and understanding during the remainder of (Patient's Name) treatment and look forward to providing an excellent orthodontic result.

Cordially

Dr Straighttooth

ORTHODONTIC NON-COOPERATION LETTER TO PARENT

Date

Dear Mr/Mrs …….

Certain circumstances have arisen regarding (Patient's Name) treatment that require your attention at this time. Recently, (Patient's Name) cooperation concerning certain aspects of his/her treatment has deteriorated to the point where it may result in less than a desirable orthodontic outcome. The areas of concern to us are:

[ ] not brushing teeth, gums and appliances as instructed.
[ ] not wearing rubber bands as required.
[ ] not wearing Head Gear the number of hours required each day.
[ ] not wearing or caring for the removable appliances as instructed.
[ ] eating foods or engaging in activities that repeatedly break, loosen or cause the loss of his/her orthodontic appliances.
[ ] not keeping regularly scheduled appointments.
[ ] other: _____

Parental reinforcement concerning these issues can substantially aid in obtaining the best possible orthodontic result. If you wish to discuss this matter with us, please feel free to call. If this behaviour continues to the detriment of Patient's Name) overall dental health, we may have to consider terminating his/her orthodontic treatment prematurely.

Respectfully

Dr Straighttooth

BROKEN APPOINTMENT LETTER

Date

Re

Dear

Successful orthodontic therapy requires both the timely periodic monitoring of previous therapy rendered, as well as appropriate intervention as the needs of each case dictates. The periodic adjustments we make to your appliances are designed to ensure that what we expect to happen happens. However if treatment continues in an unmonitored fashion, undesired tooth movement can occur. We cannot be responsible for adverse results if you do not keep your appointments as scheduled.

Broken appointments may not only jeopardize one's orthodontic result; they are also inconvenient to us and to other patients who would have preferred the appointments that you did not keep. To date you have missed ____appointments. Any further broken appointments without providing us with 24 hour notice will necessitate imposing a $_fee for each occurrence.

We know you understand our position in this regard and expect that you will cooperate with us in the future. If you need to speak with us concerning this policy, please feel free to call our appointment coordinator.

Respectfully

Dr Straighttooth

RELEASE OF RECORDS TO INSURANCE COMPANIES

Date

To Whom it may concern:

You have requested our office to release ___(Patient's Name)___ diagnostic records. Our office policy regarding requests of this type are as follows:

1 – We require a written release signed by the patient conforming with the laws governing confidentiality of medical records.

2 – We will release this information only to qualified health care professionals who have the background to interpret the requested diagnostic materials.

3 – We will gladly release the diagnostic records to these doctors upon receipt of their:
- Name
- Licence number
- State where the consultant is licensed

4 – Please provide us with a self-addressed stamped envelope to facilitate transferring the requested material to consultant.

5 – Should you prefer, the records are available for review by your consultant at our office.

6 – Please enclose a duplication of records fee in the amount of $ _____ payable to (Dr's Name) .

Upon receipt of the above requested information and fee, we will be happy to comply with your request.

Respectfully

Dr Straighttooth

OTHODONTIC INSURANCE REJECTION LETTER

Date

Re

To whom it may concern:

Regarding your denial of the recent claim submitted for __(Patient's Name)__ orthodontic care, you state that you have rejected this claim ostensibly because the patient's condition did not amount to what you refer to as a handicapping malocclusion. In this regard our office has several questions we would like answered.

1) What are your criteria for determining handicapping malocclusions?
2) Why is a (insert Class or type of malocclusion) not considered handicapping?
3) When a case is submitted for pre-authorization, who reviews the diagnostic material and what are their educational qualifications to do so?
4) If the reviewer is either a secretary, clerk or general dentist, we request that the case be re-reviewed by a qualified specialist in orthodontics and dentofacial orthopaedics.
5) If after the above you still find that this case is not amenable to receive the orthodontic benefits, we wish to speak to the reviewer personally and also receive in writing the specific basis on which you are choosing to deny benefits.

If you require any further information or if we can be of any assistance please feel free to call us.

Respectfully

Dr Straighttooth

DELINQUENT ACCOUNT LETTER – I
(To be sent when the patient's account is sixty days past due)

Date:

Dear Mr/Mrs

A periodic review of our patient accounts has just been completed. Our accountant advises us that your account is behind $__.

IF THE ACCOUNT CONTINUES TO REMAIN IN ARREARS, WE WILL HAVE TO CONSIDER WITHDRAWING AS YOUR ORTHODONTIST OF RECORD.

Please remit the above amount in the enclosed envelope. If there is a problem that is preventing you from keeping up with your financial obligation regarding your treatment, please contact our office so that suitable arrangements can be made. If you feel an error has been made, please let us know so we can correct our records.

Respectfully

Dr Straighttooth [or Account Manager]

DELINQUENT ACCOUNT LETTER – II
(To be sent when the patient's treatment is soon to be completed and is sixty days past due)

Date

Dear Mr/Mrs

(Pts. Name or You) has/have been scheduled to have his\her\your orthodontic appliances removed in the near future.

IT IS THE POLICY OF OUR OFFICE THAT ALL ACCOUNTS BE CURRENT PRIOR TO THE COMPLETION OF ACTIVE TREATMENT.

Please contact the office to rectify this matter so that we can proceed with the timely removal of (Patient's Name or your) appliances at the scheduled time.

Respectfully

Dr Straighttooth [or Account Manager]

NICE COLLECTION LETTER

Date

Dear

We don't like collection agencies, really. In the end they cost us money, hurt your credit standing, and make us look like the bad guys. The truth of the matter is that in the first place we rendered professional services to you at a fee you agreed to. Secondly, for whatever reason, you are extremely delinquent in honouring your financial obligation. Lastly, we would like to continue to treat you provided suitable financial arrangements can be made. We sincerely hope we can reach an equitable solution to this problem.

If you honestly believe a reason exists justifying not paying your account, please tell us. If you are not happy with something we have done then chances are someone else is also probably unhappy and we want to know what we are doing wrong so that whatever the problem happens to be, our office can work to correct it.

If you just can't afford the treatment because of a temporary hardship, let's work something out to the mutual satisfaction of everyone concerned.

If on the other hand, you merely want to get something for nothing, that's fine too. Let us know and we will cease our collection efforts as well as your treatment.

Hope we hear from you soon.

Respectfully

Dr Straighttooth

WARNING LETTER FOR ACTIVE TREATMENT OR DISMISSAL IN RETENTION

Dear

We have not seen (Name) since (date) . **We have made several attempts to reschedule (Name)** appointments but SO FAR WE HAVE BEEN UNSUCCESSFUL in this regard.

We cannot assume any responsibility for any problem that may occur if we do not treat (Name) in the near future.

If we do not hear from you by (date) we will assume that you are no longer interested in continuing on with treatment and will consider (Name) dismissed as a patient from our practice.

Respectfully

Dr Straighttooth

DISMISSAL LETTER FOR ACTIVE PATIENTS

Date

Dear Mr/Mrs

Due to the fact that (choose from category 1–5 below), we must inform you that we are withdrawing as your orthodontist of record and will no longer provide further professional attendance to (Patient's Name or Your) orthodontic needs.

Since her/his/your dental condition still requires further treatment, we urge you to continue your treatment with another orthodontist without delay.

If you wish, we will be available to attend to (Patient's Name or Your) orthodontic needs for the next (30, 45, 60) days for emergencies or referrals only. This should give you ample time to select another orthodontist.

Should you authorize the release of (Patient's Name or Your) records, we will be happy to forward them to the orthodontist of your choice along with any other clinical information concerning the diagnosis and treatment rendered by this office. (If you are going to charge a fee for the duplication of the records, state that amount here).

We regret having to take this action but the situation as noted above has left us no other option.

Respectfully

Dr Straighttooth

(1) there has been a lack of cooperation on (Patient's Name or Your) part which has been very detrimental to her/his/your dental health and/or the achievement of an adequate orthodontic result
(2) we are unable to coordinate appointments and treatment with you and have been unable to do so for some time now
(3) you have not kept up with your financial obligations as previously agreed to
(4) you have not been honest and forthright in dealing with our office regarding the professional services rendered
(5) there are significant interpersonal differences and problems between you and members of our office staff which have created disharmony or disruption to our office routine and activities

RELEASE FROM LIABILITY FOR PREMATURE REMOVAL OF ORTHODONTIC APPLIANCES

FOR AN ADULT

I, (Patient's Name) , request the removal of my orthodontic appliances and the termination of my orthodontic treatment. I have been informed that treatment has not been completed and that Dr _____ has recommended the continuation of treatment in order to obtain the best possible result. I have also been informed of the probable negative consequences that may result from my actions.

I hereby release Dr _____ from any responsibility and from all injury or damages resulting from my terminating treatment against the sound medical advice of my orthodontist.

_____ _____
Signature of Patient Date

FOR A CHILD

This is to certify that I, (Parent's Name) , voluntarily request the removal of my child's (Patient's Name) orthodontic appliances and the termination of his/her orthodontic treatment.

I have been informed that treatment has not been completed and that Dr. _____ has recommended the continuation of treatment in order to obtain the best possible result. I have also been informed of the probable negative consequences that may result from my actions.

I hereby release Dr _____ from any responsibility and from all injury or damages resulting from my terminating my child's treatment against the sound medical advice of my orthodontist.

_____ _____
Signature of Parent or Patient Date

GENERAL RELEASE

This agreement between [(Parent) as legal guardian for (Patient's Name)] or [(Patient's Name)] and (Dr's Name) * is being executed to resolve a dispute regarding orthodontic services rendered. It does not imply nor constitute an admission of liability on the part of (Dr's Name) *, or his/her employees, agents, or contractors.

In consideration of $_ paid by (Dr's Name) * to (Patient or Parent's Name) ; (Patient or Parent's Name) , his/her heirs, executors, administrators, assigns, and/or guardians hereby fully releases (Dr's Name) *, his/her employees, agents, his/her professional corporation (and if you use an independent contractor include name here) from all claims and causes of action stemming from any injury suffered, sustained presently, or to be sustained in the future as a result of the orthodontic treatment rendered between (dates of treatment) .

I (Patient or Parent's Name) have read and fully comprehend all of the foregoing agreement, I also understand the rights I am waiving, I have had the opportunity to consult with an attorney, and freely agree to the terms and conditions of this letter. This agreement dated (Date) was executed at (Dr's address) .

(Patient or Legal Guardian)
Signature

(Doctor*)
Signature

(Witness)
Signature

*If the doctor is a Professional Corporation or other legal entity, list both names (corporate and personal).

Appendix C

Dr Brett Kerr: Specimen forms and letters

Specimen forms and letters published with permission from Dr Brett Kerr, 256 Waterworks Road, Ashgrove, Q 4060, Australia.

LETTER TO PATIENT/PARENT—PRIOR TO FIRST CONSULTATION

Dear Mr & Mrs……

This letter will explain……' s appointment, please take a few moments to check it.

1. We wish to confirm your consultation appointment on……at……. at the……..rooms.

   At that appointment …….. will be fully assessed, the problem and likely treatment will be outlined in general, and you will have the opportunity to ask any questions. We have enclosed a questionnaire and referral for orthodontic x-rays. Please bring the completed questionnaire and x-rays to this appointment.

   The fee for this consultation appointment is $. . . .

2. To achieve a full diagnosis study casts (moulds), computer analysis of the x-rays, and clinical intra- and extra-oral photographs are required. A further appointment is sometimes necessary to explain the problems with the aid of these records.

   The fee for these records is $. . . . If you are covered by a health fund, you are likely to receive a refund of 50–75% of this fee.

3. You will receive a written report on any treatment recommended, applicable fees, appointment details, and other important information.

If you have any questions please call the above number

Yours sincerely

Secretary

Please note: We have allowed forty minutes for the consultation appointment. If you are unable to keep this appointment, please notify us as soon as possible so we can allocate it to another patient on our list.

LETTER TO PATIENT/PARENT FOLLOWING AN INITIAL CONSULTATION

Dear Mr & Mrs…….

As was discussed on the…….. the suggested treatment for…….'s malocclusion would involve:

1. Taking records to review the treatment plan i.e. study casts (moulds), clinical intra- and extra-oral photos, and computer analysis of x-rays.

   The current fee for records is $. . . .

2. Referral to your general dentist for extraction of…….. teeth, and a check-up and fluoride treatment if considered necessary.

   Your dentist will quote a fee separately for this treatment.

3. Fixed 'braces' on the upper and lower teeth.

   The fee for this treatment is $. . . . *Unless other arrangements are made, the usual payment schedule is an initial amount of* $. . . *at the commencement of treatment, followed by eighteen monthly payments of* $. . . . *These payments are not in any way related to the number of times the patient is seen during treatment, but merely spread the fees for convenience of payment.*

   If preferred this amount may be paid in full at the commencement of treatment.

4. On removal of the appliances, we will provide one set of retainers which will be supervised for a further year. To keep the teeth straight, continued part-time wear of retainers would be essential after orthodontic supervision is complete.

   The fee quoted for the fixed braces includes provision of one set of retainers, and one year's supervision.

During treatment time these appliances would need to be checked and adjusted at regular intervals usually about every six weeks. Full patient cooperation is essential to successful orthodontic treatment.

If you wish to discuss……' s treatment further, or if there is any aspect of the treatment plan that concerns you or is unclear, please call the above number or make a further consultation appointment. It is possible that there may be alternative treatment plans if the above is unsuitable, but on the information obtained so far, I believe that this would give the optimum result.

Yours sincerely

INFORMATION SHEET FOR PATIENT/PARENT

General dental treatment
As ours is a specialist orthodontic practice, you must continue visits to your regular dentist for general dental check-ups.

What to do if you wish to go ahead with orthodontic treatment
If you wish to go ahead with treatment, you should contact this surgery for banding appointments, then arrange an appointment with your general dentist for the extractions, a check up and fluoride treatment as necessary.

Fees
The fees quoted cover all routine orthodontic treatment over several years including fitting, adjustments and removal of fixed braces, provision of one set of retainers and their supervision for a further year.

This fee is fixed if treatment commences now and is based on both the difficulty of treatment and its expected duration. Extra charges would only be incurred for repeated damage to appliances, or poor cooperation resulting in extended treatment time, or if retainers have to be replaced because of loss, damage or poor cooperation.

If you wish to discuss fees, please contact the secretary at the above number.

Types of braces
The fees quoted are for the normal stainless steel (silver) braces. Clear braces can be fitted to the upper front teeth, or gold braces to upper and lower front teeth for a further fee of $... (paid at the commencement of treatment). NOTE we normally fit stainless steel braces (please read the enclosed leaflet). If you wish to have clear or gold braces, please let us know in advance.

Credit card payments
We can accept credit cards (Visa/Bankcard/Mastercard) and if desired can bill monthly installments directly to your card.

Appointment scheduling
The first one or two appointments require up to two hours for the appliances to be fitted and instruction and explanations given. These appointments are scheduled late morning or early afternoon.

After the initial one or two long appointments, we make every effort to schedule regular short appointments before or after school. To enable us to book these short visits after school, longer appointments have to be scheduled during school hours or school holidays. We will endeavour to schedule any longer in-school appointments during a study period or some other time, which will not result in the patient having to miss work, which has to be made up. We work with the child and their school schedule on an individual basis and will co-operate in every way possible to minimize any inconvenience. With mutual understanding of each other's problems, appointment scheduling does not, as a rule, present problems. In order to be fair to every patient, we are unable to make exceptions to our scheduling requirements.

Beginning with the first active treatment appointment for your child, it is not necessary for a parent to accompany the patient into the treatment room. We want the child to feel responsible for their treatment. Your child needs to get to know us, and we need to get to know them. Experience has taught us that the patient is more receptive and more self-expressive without a

parent present. Strange as it may seem, this is particularly true in the case of children who are of a nervous disposition. This lends itself to a happy, relaxed atmosphere, which we strive to maintain at all times.

You will, at all times, be kept up to date with progress.

Dr ……..

LETTER TO PATIENT/PARENT PRIOR TO FITTING APPLIANCES

Dear Mr & Mrs……

We would like to confirm…….'s appointments on the……at……., and ……at…., at the……rooms.

Having braces fitted requires two appointments. This letter will explain what to expect at these visits.

The first appointment involves placing separators between the back teeth. These little elastics are extremely important as they create small spaces where the molar bands will be fitted.

Having separating elastics placed does not hurt. It feels just like floss going between the teeth. They will usually make the teeth feel tender for a couple of days afterwards. If necessary NSAIMs (non-steroidal anti-inflammatories) such as Nurofen, Brufen, Advil, etc., may be taken, as you would for a headache.

PLEASE NOTE: NSAIMs are not recommended for asthmatics, or if allergic to Aspirin or NSAIMs. If in any doubt ask your doctor.

At this appointment, impressions (moulds) of the teeth and photos will also be taken. You will be given an information pack, and a set of videos to take home and watch. These will explain how the braces are fitted, and how to floss and brush the teeth with braces on. Please return these videos to us at the second appointment when the braces are fitted.

You should allow approximately half an hour for this visit.

The braces are then fitted at the second appointment, which takes about 1 hour. Approximately another half hour is spent giving instructions on how to take care of the braces (diet, oral hygiene, elastics, etc.), and you can ask any questions you may have.

This again does not hurt, but again, the teeth may be sore for a couple of days. Studies have shown that taking NSAIMs 1 hour before the second appointment can reduce the level of soreness considerably.

Should you have any questions at any time, please call us on the above number.

Yours sincerely

Secretary

LETTER TO PATIENT AFTER REMOVAL OF FIXED APPLIANCES

Dear……..

We're sure that it feels really great now that you've got your braces off – and we're sure you would never want to go through that again. The retainers you have been fitted with will make sure that your teeth don't move *– if you wear them as we tell you to.*

Unfortunately some patients don't wear their retainers, and their teeth go crooked again. We don't want this to happen to you. Because of this we decided to write you a note to make things as clear as possible.

Usually you will have to wear the retainers for one week, night and day, then every night for one year (twelve hours per night).

After that, if you want your teeth to stay straight, you will have to wear them for the rest of your life (enough so that the retainers fit perfectly and the teeth stay put).

As we arranged at the start of treatment, we provide one set of retainers and supervise these for another year. With care a retainer should last for five years or more. If you lose or break the retainers (or, worse still, need braces again), you should expect to pay for this out of your pocket money or savings.

We hope you get the idea that we want you to wear your retainers, so that all of your hard work with the braces isn't ruined.

Remember we are always here to help. If the retainers don't fit, they get stolen by Martians, or the dog eats them, let us know straight away.

Also remember you must see your general dentist soon for a check up.

If you have any questions we would be delighted to help you.

Keep Smiling

LETTER TO PATIENT/PARENT – FOR RETENTION FOLLOW-UP

Dear Mr & Mrs…..

We note that…….. has no further appointments made with us.

The fee quoted for treatment included one year of supervision of retention. This period has passed, and orthodontic treatment is now considered complete.

When our patients complete their treatment we give them the following information at their last appointment.

PLEASE ASK …….. TO READ CAREFULLY

It is important to remember that teeth move throughout life. This is normal, and it happens at any age – whether you have had braces or not.

You will therefore need to continue to wear the retainers enough to keep the teeth straight.

The retainers must be tried in **every** night. If they feel tight, but still fit, they must be worn that night. If they fit, but are loose, they don't have to be worn that night, but must be tried in again the next night.

This must be continued as long as you want the teeth to stay straight.

If you stop wearing the retainers, the teeth will move. This movement may only be a small amount, we do not know. However they could move a lot, and braces would then be needed again.

With care the retainers should last up to 5 years. If they become worn out/cracked/too disgusting to wear, or if they are lost, contact the surgery as soon as possible, as it's time for new retainers.

Currently the cost of new retainers is $… each, depending on the type needed. If you wish us to continue to supervise retention, normal consultation fees will now apply, since the period of supervision covered by the original quote has now finished.

Remember we are always here to help. If you have any questions please phone.

Yours sincerely

Secretary

LETTER TO DENTIST FOLLOWING FIRST CONSULTATION

Dear ……..

Re

Thank you for referring…… I examined…….on the…….

Occlusion:

Overbite:

Overjet:

Upper arch:

Lower arch:

Other findings:

Suggested orthodontic treatment plan:

I have recommended a treatment plan involving upper and lower fixed braces, probably with extractions. I estimate an active treatment duration of approximately eighteen to twenty four months, followed by long term retention.

Prior to commencing treatment I would take clinical records of…….. and assess these. I would then contact you again to confirm the treatment plan.

I have asked them to consider orthodontic treatment and am waiting for them to contact me with their decision.

I will keep you informed of developments.

Best wishes

LETTER TO DENTIST – OUTLINING TREATMENT PLAN

Dear Dr…….

Re…….

Thank you for referring …… I examined him on . . . (date).

He has a Class II tendency with an increased overbite and overjet, and some upper and lower crowding. 12 is peg shaped and 22 congenitally absent. His OPG suggests a possible odontome in the 22 region near the apex of 21, and 13 is delayed in its eruption, which is suspicious. The 62 is retained but may not last much longer.

I have recommended a treatment plan involving full braces, holding space for future prosthodontic replacement of 22 and build up of 12.

Prior to this I have asked them to return to you for periapical x-rays of the 13 and 22 regions. Could you please let me know of any pathological problems in either of these areas.

I have asked them to consider and am waiting for them to contact me with their decision.

I will keep you informed of developments.

Best wishes

LETTER TO DENTIST CONFIRMING START OF TREATMENT

Dear …….

Just a note to advise that the…….s have made appointments to go ahead with……..'s treatment in …….

I estimate an active treatment time of approximately…… months, followed by long term retention.

I will keep you informed of any developments.

Best wishes

LETTER TO DENTIST REQUESTING EXTRACTIONS

Dear ……

Re …….

We have reached a stage in……'s treatment where extractions have proved essential.

Would you please extract ……...

Don't worry if any damage occurs to the archwires. I will repair this at…….'s next appointment.

Thank you for your assistance with……

Best wishes

COMPLETION LETTER FOR DENTIST

Dear Dr……..

……'s active treatment has been completed and ……..has been requested to return to see you.
……..'s treatment summary is:

Problem…….

Treatment:……

Oral hygiene:……

Cooperation:…….

Treatment time:……..

Retention:……..

I will be keeping ……..under observation for at least another year. Please let me know if……..has any orthodontic problems either now or in the future.

Here are ……..'s before and after photographs.

Regards

Appendix D

Winston B Senior: Specimen forms and letters

Specimen forms and letters published with permission from Winston B Senior, Northenden House, Sale Road, Northenden, Manchester M23 0DF, United Kingdom.

EXAMINATION AND TREATMENT REPORT TEMPLATE

GENERAL INFORMATION

Date of birth……., referral……,

Relevant medical history……

EXTRA-ORAL EXAMINATION

En face – noting asymmetries, scars, facial heights……..

Profile …….

Soft tissues…….

Morphology. Muscle tonus, lip competence……..

Behaviour, lip chapping, sucking habits……..

INTRA-ORAL EXAMINATION

Teeth present……

Oral hygiene condition…….

Periodontal condition……..

Caries condition……..

Observed Dental and Orthodontic Abnormalities. These are listed……

TREATMENT

This is left blank to be 'filled in' after the Second Consultation.

DRAFT OF A LETTER SENT TO A PATIENT FOLLOWING A SECOND CONSULTATION

Dear ……

I am writing as promised to confirm that a report outlining the treatment explained to you today has been sent to your dental surgeon ————————-, I have suggested that your treatment should be considered under the following phases.

Phase I
You should have two upper and two lower teeth extracted by your dental surgeon. These are marked as the number 4's on your study casts. You would then have an upper removable appliance, which would not show. It would be directed towards moving the canine teeth – (marked as number 3's on your study casts) back into the spaces created by the extractions. A lower appliance would be introduced later, which would not show, to move the lower canine teeth (marked as number 3's).

Phase II
This would be directed towards the precise alignment and the correction of the relation between the upper and lower front teeth. This appliance would show but would be fabricated from transparent materials and therefore not as conspicuous as the traditional metal appliances.

Phase III
This would be a retention phase directed to holding and consolidating the new positions of the teeth created during the phases I and II described above. During this phase, you will need to wear upper and lower retainers. The upper would need to be worn all the time for a brief period and then 'tapered' to wearing at night only until the teeth become stable. The lower will probably take the form of a wire bonded behind the lower front teeth. Because the lower front teeth are notoriously bad at remaining in perfect alignment, this lower fixed retainer may have to remain *in situ* for many years. These lower retainers do not show, are comfortable and hygienically designed.

My fees for treatment will be as follows.
Phases I and II – £X per month. This covers all appliances, total supervision, and the provision of any special cleaning materials such as special toothbrushes, and special orthodontic sports guards. I anticipate these phases will last Y months. All will be done to reduce the duration of these phases of treatment.

Phase III. During a retention phase I will need to see you two or three times a year and will charge a fee per visit. I would prefer to discuss this fee per visit with you when and if such visits become appropriate.

If you find this arrangement acceptable, I would be grateful if you would:

Contact your dentist and arrange the necessary extractions with him.

Phone my secretary giving her the extraction dates so that she can give you an appointment shortly afterwards to have your first brace started. This could be made ready for fitting approximately one week after the first appointment.

Yours sincerely

DRAFT OF A LETTER SENT TO A REFERRING DENTIST FOLLOWING A SECOND CONSULTATION

(Sent together with the report completed after the 2nd Consultation)

Dear Dr……

Re: Name

Enclosed is a report following a clinical and radiographic examination of your patient……..

The treatment has been carefully explained to (both) the patient (and his/her parent/s). I have given them a set of study casts and confirmed my recommendations to them by letter.

I have suggested that if they find the arrangements acceptable they should:

Contact your practice to arrange for the extractions of…….

Let my secretary know when these extractions will be carried out so that a further appointment can be arranged for them, shortly afterwards, to commence the fabrication of their first orthodontic appliance.

Thanking you once again for referring …… to me and for your help.

Yours sincerely

Appendix E

Kees Booij: Specimen letter

Specimen letter published with permission from Dr Kees Booij, Gezellelaan 11, 9721 WJ Groningen, Netherlands.

EXAMPLE OF LETTER TO A PATIENT DESIGNED TO AVOID FALSE ACCUSATION OF NON-COMPLIANCE

Dear .....

I am writing to you in person because I am somewhat uneasy about the progress of your orthodontic treatment.

We have been working on your teeth for some months now and I know that you are doing your best, however, in other cases like yours we see more progress over a similar period of time. At the last visit I again checked all the points where things could have gone wrong and I have really done my best to find a reason for the delay in your treatment. Unfortunately I cannot find the cause, I have thought things over, and it might be that there is some shortcoming or misunderstanding on your side of our partnership, perhaps you are having some difficulty following my instructions.

As I stressed before, for the treatment to progress smoothly and rapidly, and to achieve a good result, we need close cooperation between the two of us.

Please think this over and tell me at your next appointment how we might improve your participation. Please forgive me if I am mistaken in my judgement.

With kindest regards

Yours

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