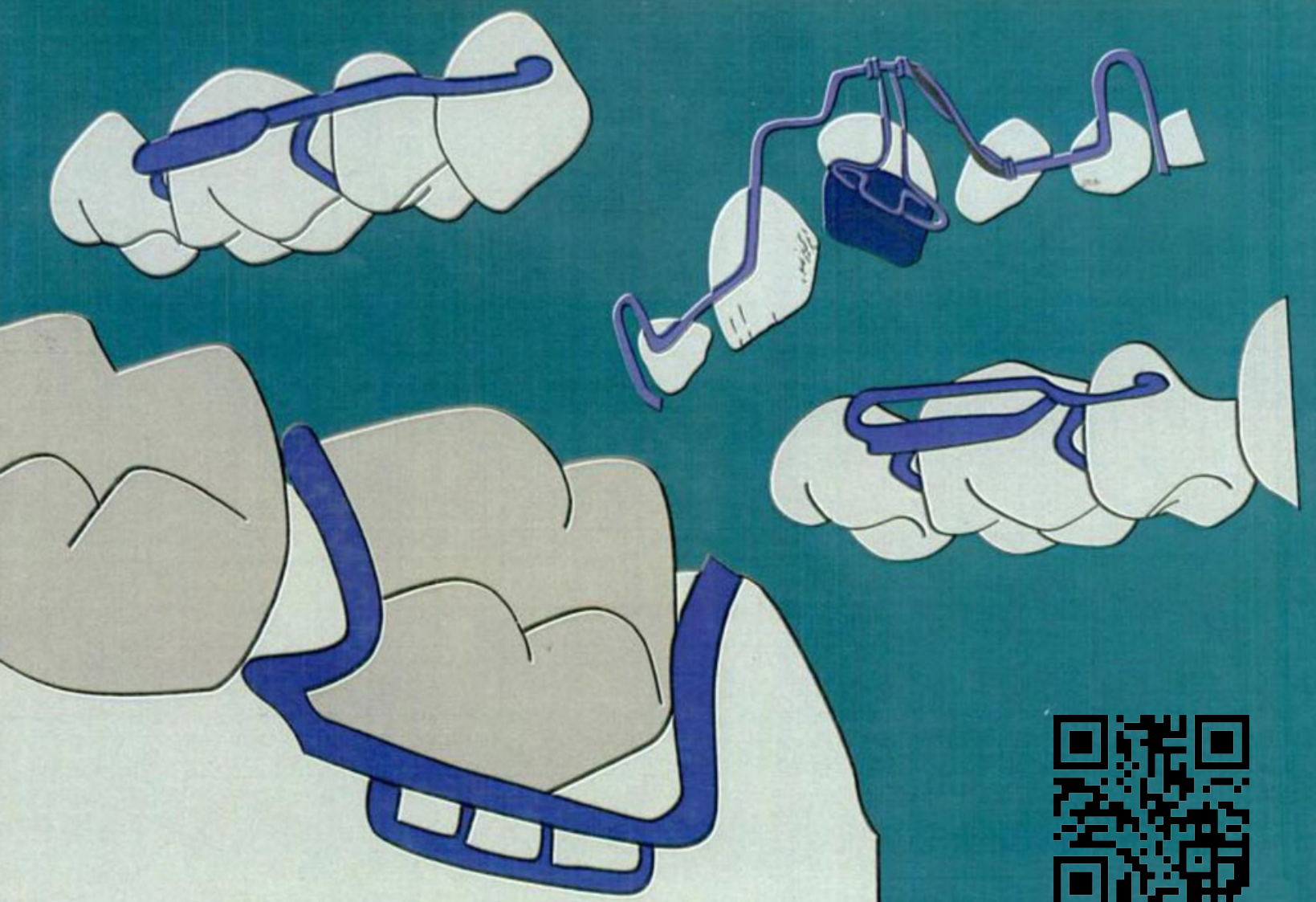
ORTHODONTIC REMOVABLE APPLIANCES

Sandhya Shyam Lohakare (Talmale)



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Sandhya Shyam Lohakare (Talmale) MDS (Orthodontia)
VSPM Dental College and Research Centre
Digdoh, Hingana
Nagpur, India

JAYPEE BROTHERS MEDICAL PUBLISHERS (P) LTD
New Delhi • Ahmedabad • Bengaluru • Chennai • Hyderabad
Kochi • Kolkata • Lucknow • Mumbai • Nagpur

Published by

Jitendar P Vij
Jaypee Brothers Medical Publishers (P) Ltd
EMCA House, 23/23B Ansari Road, Daryaganj, **New Delhi** 110 002, India
Phones: +91-11-23272143, +91-11-23272703, +91-11-23282021, +91-11-23245672
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  e-mail: nagpur@jaypeebrothers.com

Orthodontic Removable Appliances

First Edition: **2008**

ISBN 978-81-8448-289-8

Typeset at JPBMP typesetting unit

Printed at Ajanta Offset

To
my beloved husband CA Shyam Lohakare,
my daughters Soumya and Sara,
parents and in-laws, brothers and sisters and
dear friend Ashwini

Acknowledgements

My concrete source of inspiration is Dr (Mrs) Pushpa Hazarey Madam and Dr Vinay Hazarey Sir.

I am always getting blessings from Dr Nainani Sir, Dr (Mrs) Vasundhara Bhad Mam, Dr Toshniwal, Dr Vyas.

My regards goes to Dr Deoghare Dr Karia Sir and Colleagues.

I am thankful to VSPM DC and RC management members honourable Shri Ranjeetji Deshmukh (Ex Agri MLA), Shri Ashish Deshmukh, Project Director Mr Bhagade.

In my project of book making, the most strong pillars are Dean Dr Usha Radake and Vice-Dean Dr Shenoy.

I express my sincere thanks to publishers, who are making a pioneer effort in encouraging Indian authors who have readily accepted to publish this book.

At last I would like to thank **GOD GANPATI.**

Preface

Orthodontics is one of the important clinical branches of dentistry. It starts from the prenatal stage and continues throughout your life. It is the base of cosmetic dentistry.

Malaligned teeth give ugly look to the face and the smile does not feel heart warming. To correct these crooked teeth, we are using some mechanical means in the oral cavity. They are called as removable appliances. Because it is used by the patient, so it is considered as removable.

The other branches of dentistry deals with management of loss of vitality of teeth, enamel chip off, loss of bone and periodontal tissue for good facial look while smiling. But in orthodontics we are conserving the whole structure with redirection of tooth of new perfect position.

Removable appliances are the major culprit for preventive, and interceptive and corrective orthodontics. These appliances are simple to manage, economic and time saver, i.e. there is less time involvement of an orthodontist.

This book includes all retentive parts, active parts, technique of wire bending, biomechanical considerations, modification for different malalignments.

I sincerely hope that this book will prove useful for students and practitioners.

Sandhya Shyam Lohakare (Talmale)

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CHAPTER

History and Review of Literature

1

INTRODUCTION

The first law of success is … concentration to bend all the energies to one point and to go directly to that point.

Removable mechanical appliances used to move a tooth has same principle. Regardless of the number of trained specialists and the popularity of fixed appliances it seems that much treatment will be carried out by general practitioner rather than specialist. Removable appliances make a valuable contribution in orthodontic service. If used in selected cases with perfection it gives good results.

In order to use any appliance to the best advantage, it is essential, for the operator to match appliance design to the required tooth movement and to maintain effective control of clinical treatment.

A removable appliance will only perform their tasks satisfactorily if they are worn continuously. For this not only the patient should be enthusiastic and co-operative but the operator also has a duty to design and construct the appliance that they can be readily tolerated by such a patient.

Simple tilting movements can be easily carried out and teeth may be tipped mesially, distally, buccally or lingually.

Removable appliances can correct the rotations upto 45°. Extrusive and intrusive teeth movement for correction of the bite also can be carried out.

Good anchorage is provided by removable appliances usually it is obtained from the same arch, i.e. intramaxillary.

Scope of removable appliances is much better than fixed appliances because patient has a much happier attitude, it requires less time to prepare and adjust, patient gets less pain which is important for cooperation. It can be said that results achieved with removable appliances are simply:

- Beautiful with facial esthetics
- Full complete smile
- Healthiest temporomandibular joints and best stability

To enhance the field of removable appliances it is necessary to invent the new ideas and new designs to make it more convenient and faster.

Horse power has to put it on the ground to do any good for the dentist who wants to "Put it in the mouth" the hundreds of design and fabrication aid in reaching the goal.

As early as first century *AD Celsus* reported that erupting first malposed teeth could be directed into their proper place by pressure from finger.

First advocate of removable appliances in the Modern sense was given by *F Ch Kneisel (1836)* at Berlin, who wrote *DER Schiefstand der Zahne (Malposition of the teeth)* described about chin cap for C1 III, modern impression trays and appliances for teeth movement.

John Tomes (1845) used first removable plate. It was made up of metal and equipped with elastic springs. This is available at famous collection of Academy of Medicine in New York(Fig. 1.1).

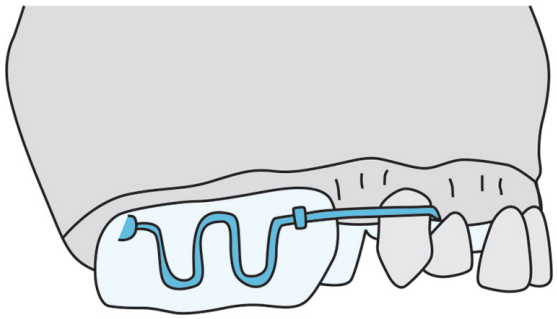

Fig. 1.1: Canine retraction

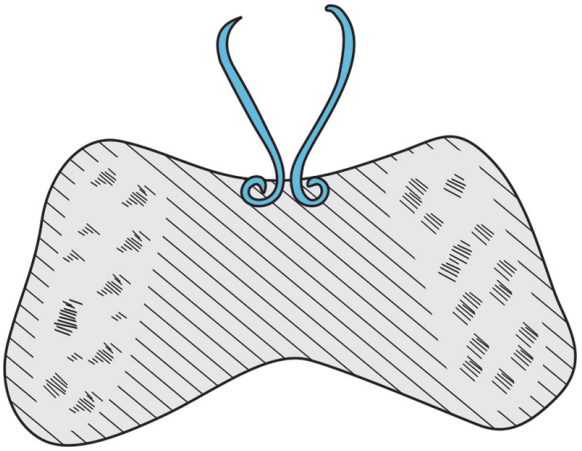

Fig. 1.2: Piano wire springs and molar capping

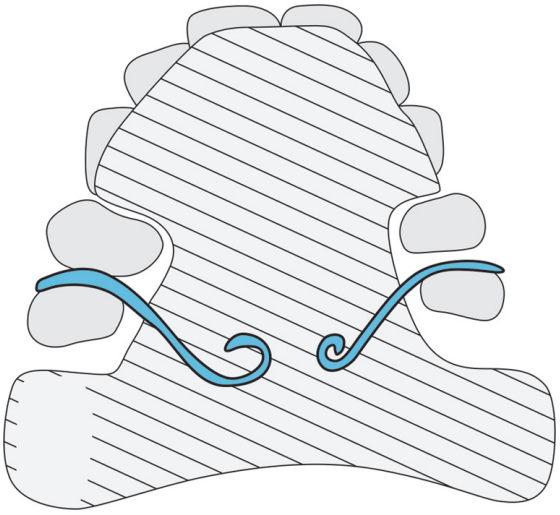

Fig. 1.3: Retraction of premolars

JD White (1854) developed early removable plate of rubber or vulcanite.

Coffin (1881) used upper expansion spring for the first time. It consists of a vulcanite base plate with molar capping incorporating a spring of piano wire bent in shape of letter 'W' (Fig. 1.2).

Talbot (1888) used lower appliance using same principle but with the wire bent in a 'U' shape.

Robin (1902) was first to use modern stabilized expansion screw instead of the coffin spring.

Kingley (1880) pioneer of modern functional jaw orthopedics used bite plate with an inclined anterior plane to move the mandible forward by jumping the bite.

CA Hawley (1919) used his plates for minor teeth movement and as a retainer.

VH Jackson (1911) designed a skeletal like removable appliance.

JF Colyer's (1908) in United Kingdom used piano wire for appliance. Appliances consists of a vulcanite base plate covering the palate and capping the molars and premolars for retention. Lower teeth are allowe to bite into the vulcanite, bite being registered with an articular (Fig. 1.3).

Bennett (1914) published The Science and Practice of Dental Surgery. He had mentioned about removable appliances. Vulcanite or metal base plate is used. Metal plate being preferred since they were less bulky. Cast silver or gold or struck nickel were used clasps of platinized gold wire were used for retention.

Bedcock (1911) introduced his screw expansion plate in British Society for Study of Orthodontics. Screw was made of nickel silver. It corrodes slowly in mouth but has germicide property which is helpful in prevention of carrier.

CFL Nord (1929) presented very simple screw split plate meant for treatment at the meeting of the European Orthodontic Society in Heidelberg.

M Tischler (1936) demonstrated quite sophisticated active plate at the Ninth International Dental Congress in Vienna.

AM Schwarz (1938) who is the father of active plates had published his textbook on active plates in Vienna Australia. He introduced tranverse and sagittal appliances.

National Health Service Bill was published in 1946 and came into effect in July 1948 inspiring the rapid development of removable appliances. This is due to introduction of acrylic resin to replace vulcanite and development of Adam Clasps.

Adam (1950) first demonstrated his modified arrowhead clasp. This clasp used mesial and distal undercuts of teeth and can be used to clasp a single tooth, fully or partially erupted. Small, unobstructive which took up little space in buccal sulcus and no

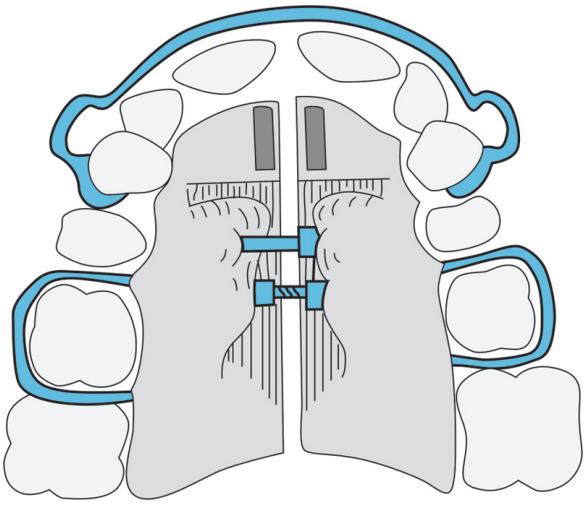

Fig. 1.4: Badcock expansion plate with midline screw

special pliers were required for its construction. Secure and reliable retention of appliance was easily achieved.

Ballard and Wayman (1964) treated majority of malocculesions with removable appliances (Fig 1.4).

Mill and Vig (1974) expressed the opinion that although removable appliances were unsatisfactory to correct rotations or closure or larger spaces. They have advantage that is economical, simple to make providing sufficient anchorage. Useful in treatment of malocclusions where only Hpping is required.

Steadman (1925) advocated planned extractions to avoid need for appliances.

Visick (1929) was also in favour of removable appliances for simple tooth movements.

Marsh (1930) was also using removable appliances.

Culter (1932) reported to the British Society for study of orthodontics or preparations of stainless steel in Germany and Great Britain.[12]

Piano wire was recommended where strength and elasticity were required but problem of corrosion.

Packham (1932) solved problem of corrosion by fining the wire before use.

Gold wire is also used.

A British company Firth were producing an austentic stainless steel which cost 10 shillings per pound while gold was 145 rouble per pound.

Stainless steel was discovered by Brearley of Sheffield which is widely used nowadays. It has got many advantages over gold wire.

Osbourne (1941) reported in the British Dental Journal that acrylic had become available as a liquid monomer and powder polymer.

Hallett (1952) introduced cold curing resin for preparation of base plates.

Cousins (1962) used this cold cure acrylic resin to prepare complete orthodontic removable appliance plate.

Roberts (1976) introduced pressure moulding technique to prepare plates. This process uses hot compressed air to mould acrylic base plate blanks on to a plaster model to which the wire components have been attached.

Victor Hugo Jackson (1887) published lateral expansion appliance for lower arches.

Dr Emest Walker of New Orleans developed appliance made of gold and platinum wires.

Dr George B Crozat (1916) who graduated from Devays School of Orthodontia. *Crozat* designed his appliance in *New Orleans* in 1919.

CHAPTER

Orthodontic Appliances

2

ORTHODONTIC APPLIANCES AND THEIR CLASSIFICATION

ORTHODONTIC APPLIANCES

According to White and Gardener orthodontic appliance may be defined as an appliance by means of which mild pressure may be applied to a tooth or a group of teeth in a predetermined direction.

According to Prof DP Walther orthodontic appliances have been defined as appliances by means of which mild pressure may be applied to a tooth or a group of teeth and their surrounding supporting tissues in a predetermined direction to bring about the necessary reaction processes within the bone which will allow tooth movement.

Classification of Orthodontic Appliances

According to White and Gardener it is classified in two groups.

1. Mechanical Appliances.
2. Functional Appliances.

A *mechanical appliance* exerts pressure on the alveolar bone, through the medium of teeth in a predetermined direction, by menas of screw, spring or elastics.

A *functional appliance* harnesses natural forces exerted by muscular medium which it transmits to the teeth and alveolar bone in a predetermined direction.

Mechanical appliances are further classified in two groups.

1. Removable appliance.
2. Fixed appliance.

Removable appliance: It is the appliance, one which is removed by the patient for cleaning, activation but when it is in the mouth firmly attached to the anchor teeth so that controlled pressure may be brought to bear on teeth to be moved.

Fixed appliances: It is the appliance which consists of bands with brackets which are cemented to the teeth having archwire, elastics, auxillary springs as an active components to move the teeth. These appliances can not be removed by the patient.

Classification of Removable Appliances

According to Graber and Neumann

a. *Active appliance:* It uses forces within the appliance.
b. *Functional appliance:* It uses muscular forces.

According to TM Graber (1975)

a. Appliances that effect actual tooth movement through adjustment of springs or attachments within that appliance.
b. Appliances that stimulate reflex muscular activity which in turn produces desired tooth movement.

According to Haupl and Roux (1983)

a. *Active appliance:* A mechanical force producing elements are necessary to bring in dentoalveolar structure. Example: Labial bow, springs, screws.
b. *Passive appliance:* Mode of transmission of force is passive. Mechanical force producing elements are unnecessary to bring about changes in dento-alveolar structure. For example, myofunctional appliances, habit breaking appliances.

According to functions of Removable Appliances given by JD Muir and RT Reed.

Springs for buccal/labial movements.

1. Cranked palatal springs
2. Z spring

3. T spring
4. W spring
5. S spring
6. Safety-pin springs
7. Flapper spring or mousetrap springs
8. Friel spring

Springs for lingual movements

1. Single incisor spring.
2. Canine and premolar spring
3. Molar spring
4. Soldered auxillary spring.

Spring for Mesial/ Distal movements

1. Finger spring
2. Expansion screw
3. Extraoral traction
4. Canine retractors.

Springs for reduction of overjet and alignment of incisors

1. Heavy wire springs
2. Light wire springs

Springs for expansion

1. Coffin spring
   a. Diamond shaped
   b. Pear shaped
2. Screw appliance
   a. Transverse
   b. Sagittal

Extrusion and intrusion of teeth

1. Anterior bite plane
2. Posterior bite plane
3. Inclined plane.

Retention appliances

1. Wraparound appliance.
2. Hawley appliance
3. Cast retension appliance

Habit breaking appliance

1. Tongue spikes, cribes, rakes for tongue thrust
2. Lip bumper for lip sucking
3. Cheek bumber for cheek biting
4. Oral screen for mouth breathing.
5. Reminder appliance for digit sucking.

Appliances used for rotated tooth

1. Semifixed appliance
2. Hooked appliance

INDICATIONS

1. When skeletal pattern is normal and malocclusion is only due to changes in incisor inclination means dentoalveolar only.
2. When it is possible to treat each arch individually with removable appliances.
3. Malposed teeth should have their apices fairly well in line.
4. Narrow arches, mild crowding, can be treated with simple expansion appliances.
5. Unilateral crossbite, single malpositioned tooth treated with tipping movement using removable appliance.
6. Mild bite correction, intrusion of incisors and extrusion of posteriors is possible with bite plane.
7. To maintain the corrected positions of the teeth.
8. To prevent and intercept the effects of abnormal habits.

CONTRAINDICATIONS

1. If a noticeable skeletal discrepancy exists.
2. There is need to correlate treatment in both upper and lower arches. For example, anchorage problems requiring intermaxillary traction and more severe discrepancies in arch width or shape.
3. Presence of apical malpositions, severe or multiple rotations.
4. Bodily movements are required.
5. Presence of vertical discrepancies such as deep overbite, an open bite or height discrepancies between teeth.
6. Where severe crowding or spaces exist.
7. Bone is very dense and tooth movement requires more time.

ADVANTAGES OF REMOVABLE APPLIANCES

1. Malocclusions which require simple tipping of teeth can be treated by removable appliances.
2. Removable appliances can incorporate bite platform to eliminate occlusal interferences and displacement and bite correction.
3. A few teeth should be moved at any time. Control is less complex than fixed appliances.
4. Removable appliances are manufactured in the laboratory and adjustment take less chair side time thus comfortable for patients.

5. They are relatively inexpensive to construct and the dental practioner using only removable appliances does not need to stock a large range of expensive bands and attachments.
6. They are removed by patients for cleaning both the teeth and the appliances. Thus the difficulties of oral hygiene are not increased.
7. These appliances if damaged then patient can remove it for a short period of time until operator see patient.
8. Less conspicuous than banded appliances.

LIMITATIONS OF REMOVABLE APPLIANCES

1. With the removable appliances force applied to a single point on the crown and so the tooth tips about a fulcrum within the root. Thus tipping of tooth is very easy. Teeth which are unfavourably inclined must be treated with fixed appliances.
2. One or two rotated teeth can be treated with semifixed appliance but multiple rotations can not be readily treated.
3. Lower removable appliances are not well tolerated due to encroachment on tongue space and retention problems.
4. With removable appliances, the complete closure of spaces of extraction cases is not possible and good alignment of proximal contacts is difficult.
5. Multiple tooth movements are carried out a few at a time in complex cases.
6. In uncooperative patient the treatment with removable appliance is impossible.

REQUIREMENTS OF ORTHODONTIC APPLIANCES

According to Walther, orthodontic appliance is an artificial apparatus which is going to remain in oral cavity which is made up of very sensitive neuro-muscular structure, soft and hard tissue. So it is very important that the appliances should be accepted by this oral cavity easily without hampering the normal structure.

They are divided into four categories.

1. Biologic
2. Mechanical
3. Aesthetics
4. Hygienic

Biologic

1. It must not impede normal development or natural improvement.
2. It must be free from inherent qualities which may be harmful to oral tissues and should not be damaged by oral secretions.
3. It should interfere as little as possible with movements of lips, cheeks and tongue.
4. It must not produce movement of teeth already correctly aligned. It must not cause damage to tooth, bone or soft tissue structures.

Mechanical

1. Less bulky, comfortable to wear.
2. Light and inconspicuous but sufficiently strong to withstand the stresses of mastication and general wear and tear.
3. Adequate retention for fixation in proper position.
4. Capable of exerting the correct sufficient force in correct direction and offer sufficient anchorage resistance to induce the necessary bone changes for orthodontic tooth movement.
5. Pressure exerted must be positive and under proper control and operate for as long as possible between adjustments.
6. Stable in mouth so less interference with functions of oral cavity.
7. Easy to construct and repair.
8. Economical.
9. Easy to remove and wear.

Aesthetic

1. Base plate used for appliance should have color matching with individual's mucosa.
2. For functional appliances, since they are bulky with many wire parts transparent resin is used and aesthetically look good.
3. Well trimmed, finished and polished.

Hygenic

1. Easy to clean daily.
2. Avoid depositions of food and calculus.
3. Discoloration due to some habit is possible so get it changed.

CHAPTER

Biomechanics

3

When a force is applied to the crown of a tooth, it will be displaced slightly within confines of the periodontal ligament. Depending on the type of force applied, the tooth may be tipped, moved bodily, or rotated about its long axis.

Three kinds of tooth movements (Fig. 3.1):

a. Tipping
b. Bodily movement
c. Rotation about long axis.

Whenever a force is applied at a point on a smooth surface, it can be resolved into two components, one perpendicular to the surface and other parallel to it (Fig. 3.2)

When the surface is curved, force is resolved perpendicular and parallel to the tangent at the point of contact. If the force is applied at an angle to the surface, tooth movement will be produced by the perpendicular component. Thus the tooth will not move in the direction of the applied force.

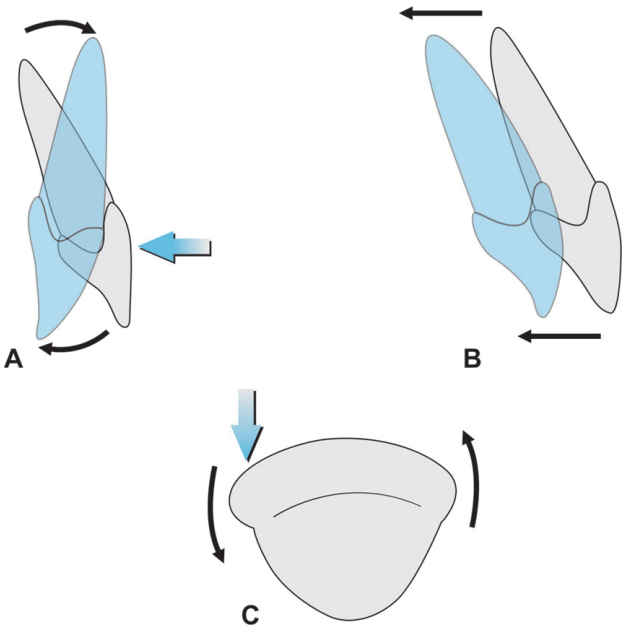

Fig. 3.1: Three kinds of tooth movement: (A) Tipping, (B) Bodily movement, (C) Rotation about the long axis

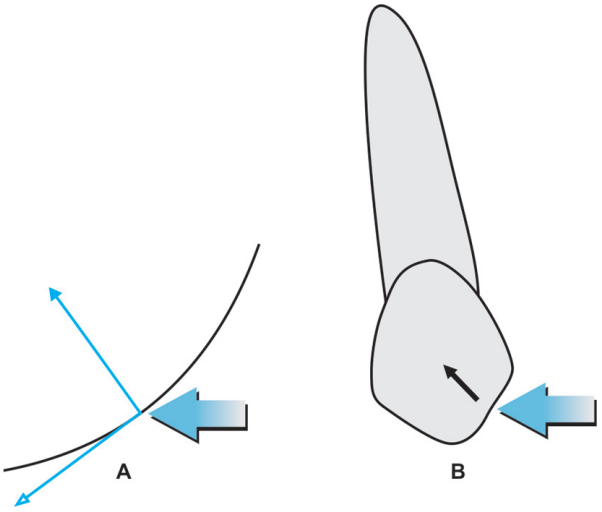

Fig. 3.2: When a force is applied to a curved surface, the direction of the resultant movement is at right angles to the tangent at the point of contact. (B) A partially erupted tooth will be intruded if a spring is applied to the cuspal incline

Initial movement considered in three dimensions, it is convenient to discuss it in two planes.

First plane through long axis of tooth and direction of tooth movement.

Second plane is of cross-section or occlusion.

MOVEMENTS IN THE PLANE OF THE LONG AXIS

Tipping Movements (Fig. 3.1)

A force applied at a single point on the crown will tip the tooth about a fulcrum. Although many texts suggest that tipping takes place about a fulcrum within

te apical third of the root both on theoretical and practical grounds it can be shown that the centre of rotation is usually about 40 percent of the length of the root from the apex. While crown moves in one direction, the apex moves in opposite direction. Level of fulcrum depends on factors which are not under control of orthodontist. These are root shape, distribution of fibre bundles within the periodontal ligament.

Bodily Movements (Figs 3.2, 3.3 and 3.4)

If a tooth is to be moved bodily a couple of forces must be applied to the crown in conjunction with the original force. The use of a couple of forces allows precise control over the position of fulcrum.

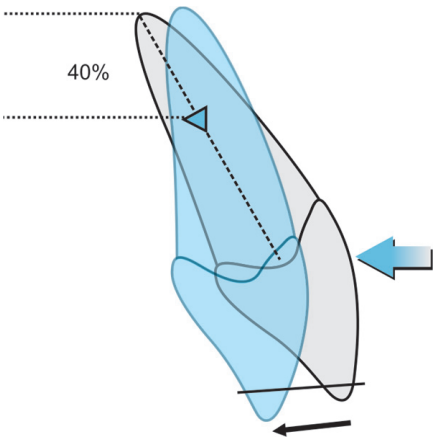

Fig. 3.3: When a tooth is tipped with a removable appliance, the fulcrum of rotation is approximately 40 percent of the length of the root from the apex

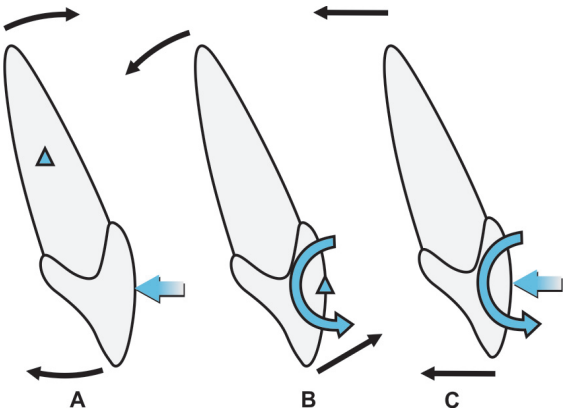

Fig. 3.4: Bodily movement of teeth: (A) A force applied at a single point on the crown results in tipping. (B) A force couple applied to a crown will cause rotation of the tooth about a fulcrum. (C) An appropriate combination of a force couple and a palatally directed force will give bodily tooth movement.

Intrusions

When a bite plane is incorporated in an appliance an intrusive force is applied to the teeth which occlude with it. However the amount of intrusion is small and overbite reduction with removable appliances is largely the result of eruption of the posterior teeth. Where an incisor does not occlude perpendicular to an anterior bite plane, it may be tiped as well as intruded.

MOVEMENTS IN THE PLANE OF THE OCCLUSION OR CROSS SECTION

Rotation of Canine (Fig. 3.5)

The tooth will move in the direction of component of force perpendicular to its surface. It is common to find that the spring is positioned too far posteriorly. So that the resultant force does not lie in the required direction along the line of the arch but it is directed buccally. Thus the tooth will move bucally as well as distally. If the resultant force does not pass through the long axis of the tooth a rotation will be induced.

Tissue Changes During Tooth Movements

Tooth movement occurs due to pressure applied by the active components. Areas of compression and tension are set up within periodontal ligament.

For tipping movement of tooth, pressure being greatest at the alveolar crest and apex.

For bodily tooth movement, the distribution of pressure is more uniform along root length and circumference of root.

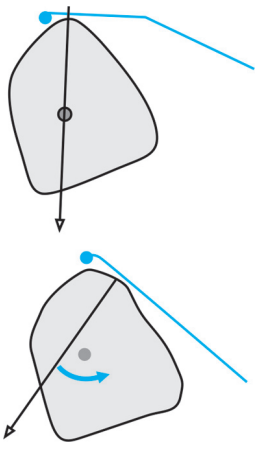

Fig. 3.5: Rotation of canine

AREAS OF COMPRESSION

It is that area of periodontal ligament on which pressure is applied and periodontal fibers get compressed (Fig. 3.6).

Where the capillary blood pressure is not exceeded:

Changes in blood flow but the capillaries remain patent. Increase in cellular proliferation takes place, both in fibroblasts of periodontal ligament and osteoprogenitor cells. Which line the socket cells fuse to form multinucleated osteoclasts. Active resorption progress so that osteoclasts come to lie in shallow depressions (Howship's lacunae) on the bone surface.

Tissue changes are not confirted to the periodontal ligament and socket wall. Within the cancellous spaces of the bone surface periosteal opposition of bone maintains the thickness of alveolar process. Where capillary blood pressure is locally exceeded.

The capillaries are occluded cells in the periodontal ligament die and on a histological level, the area becomes structureless or 'hyalinized'. The 'hyaline' material is merely compressed collagenous tissue. Bone resorption depends both on a blood supply and on a cellular response. Neither of these is present in hyalinized areas and so direct surface resorption of bone is not possible. The areas of hyalinization area. When this has been done, the tooth is free to move. If the force applied is still excessive, a further hyalinized area will be set up against the newly exposed bone surface, but if the pressure is now below, capillary area will be invaded by blood vessels and cells and direct surface resorption will then take place.

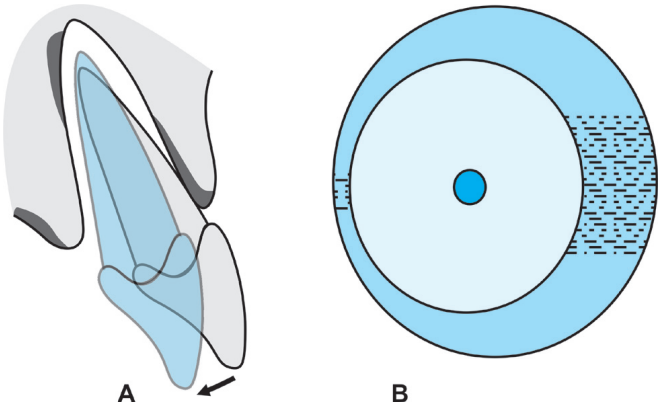

Fig. 3.6: (A) Areas of bone resorption (stipple) and apposition (horizontal shading) associated with orthodontic tipping movement. (B) Pressure in the periodontal ligament varies around the circumference of the root

AREAS OF TENSION (FIG. 3.6)

The width of the periodontal ligament is increased by initial tooth movement. In areas of tension, these osteoprogenitor cells differentiate to become osteoblasts which may lay down bone matrix (osteoid tissue). This osteoid tissue rapidly becomes calcified to form loose, vascular, woven bone. Over a period of months, the woven bone is remodelled to form mature trabaculae. Within the cancellous spaces remodelling of bone takes place and on the external surface of the alveolar process peristeal resorption of bone is found. Thus the alveolar process drifts in the direction in which the tooth is moving. The fibers of the periodontal ligament are lengthened or reformed. Unlike the areas of compression the magnitude of the tension has only minor effects on the pattern of tissue activity. Where the tension is excessive, periodontal fibers may be torn and capillaries ruptured so that there is haemorrhage into periodontal ligament.

THE SUPRA ALVEOLAR CONNECTIVE TISSUE (FIG. 3.7)

The transeptal and free gingival fibers do not rapidly readapt to the new tooth position. Principal fibers become realigned within a few months but the free gingival and supra alveolar connective tissue fibers remain under tension for considerable periods of time. The residual tension in these fiber system contribute to relapse following orthodontic rotation.

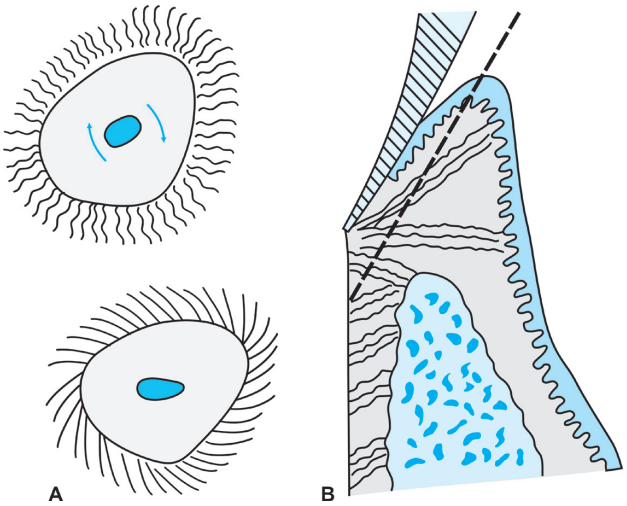

Fig. 3.7: When tooth is rotated about its long axis. (A) The supraalveolar tissue remains under tension (B) line of incision to sever the supra alveolar fibers to reduce rotational relapse

RETENTION

Reitan (1967) has shown that if a tooth is not retained immediately after active movement, tension within the periodontal ligament may be sufficient to reverse the direction of movement for a short period. During retention period, periodontal ligament becomes adapted to the new tooth position. It is normally prudent to retain the tooth with a passive appliance for a period of 3 to 6 months until the remodelling changes are completed. Routinely we recommend for rotations to overcorrect by between 5° and 10° and then retain for 6 months to get long term stability.

FORCES USED IN PRODUCING TOOTH MOVEMENT

Individual bone has different density. Some bones are cancellous and some are dense. In dense bone the rate of resorption is slow and thus only light forces are used to move a tooth.

In adult, periodontal ligament is less cellular than in the growing, so movement takes longer time.

For tipping movements of single rooted teeth, the force should face in the range of 25 gm to 40 gm i.e. 1-1/2 ounces. With a large root area more force required 1 mm per month tooth movement rate is accepted.

MATERIALS USED FOR REMOVABLE APPLIANCES

Stainless Steel Wire[17]

In orthodontic work 18:8 austenitic stainless steel wire is used. Hard stainless steel form for springs clasps, arch wires. Soft stainless steel wire is used for ligatures and separator wire.

This orthodontic wire contains 18% of chromium and 8% of nickel. Thus referred to as 18 : 8 stainless steel. This is called as stainless because chromium contributes resistance to oxidation by forming passive surface layer of chromium oxide on metal. Nickel resists the corrosion.

Stainless steel can not be hardened by heat treatment but by being drawn through a draw plate.

Stainless steel is supplied for orthodontic use is in the form of round wire of diameter from 0.1 mm to 2 mm.

Advantage

Cheap, strong, resilient not affected by oral cavity and fairly easy to manipulate.

Disadvantages

Excessive working causes fatigue and fracture.

Acrylic Resin

Heat cured and cold cured resins used to make base plates. Polymer and monomer are basic components.

Polymer consists of a powder composed of small spherical particles of methyl methacrylate is mixed with polymer. This monomer plasticizes the polymer to a dough like consistency which can be easily molded. Monomer is polymerized and resulting base plate is composed of a solid homogenous resin.

In acrylic resin, benzoyl peroxide is used as initiator, 0.006 percent hydroquinone is used to inhibit polymerization during storage.

Four stages are identified during physical reaction of polymer and liquid.

Stage I: Polymer settles into monomer.

Stage II: Polymer and monomer reacts and gives a stage which is characterized by stringiness and adhesiveness if mixture is touched or pulled apart.

Stage III: Dough or gel stage, if it does not adhere to the walls of jar, consists of undissolved polymer particles suspended in plastic matrix of monomer and dissolved polymer.

Stage IV: Rubbery stage, monomer evaporates plasticity and moulding completely lost. Mass becomes thick and solid.

Working Time

It is the time elapsing between stage II and beginning of stage IV. It is the time that material remains in dough form. Dough should be moldable for at least 5 minutes. Lower the temperature, lower the working time.

Curing Cycle

Curing cycle is the technical name for heating process employed for polymerisation, heat is used to activate the benzoyl peroxide.

In self cure polymerization, a chemical activator is employed so that polymerization is completed at room temperature. The chemical activator is tertiary amine. Such as dimethyl P-toluidine added to monomer.

Color stability of self curing resin in inferior to that of heat curing because of oxidation of tertiary amine.

CHAPTER

Components of Removable Appliances

4

WIRE BENDING TECHNIQUE

Importance

By following the basic guidelines and principles of wire bending, we can accurately influence the desirable treatment that we want to give to the patient.

Approach to Wire Bending Problems

1. Use of one or two basically simple pliers.
2. The study of wire bending methods.
3. Elimination of unnecessary complications from wire work in appliance construction.

Principles and Methods of Wire Bending

1. Always hold the plier using a palm grip. Pliers should be used to hold the wire firmly and still.
2. It is easier to make a bend by pushing the wire, rather than by pulling the wire.
3. Adequate length of wire should be used so that a long end or 'tail' is available for manipulation.
4. Wire should always be arranged in such a way that the free end is held in the thumb which is used to bring pressure on the wire. The other fingers are wrapped around and help in grasping the wire.
5. Precise marking is necessary before making any bends.
6. During the wire bending procedure the plier should be held perpendicular to the floor.
7. The eyes of the operator must be at the level of the wire before giving the bend so as to ensure that the plane of the wire is not disturbed.
8. Sharp bends are made by working the wire as close as possible to the plier with the thumb as it is the only finger which gives a controlled, sustained and strong pressure around the wire.
9. If the wire has been sharply bent at a slightly incorrect position a correction can be made by gripping the incorrect portion in the tips of the plier beaks and then squeezed.
10. Smooth bends are made from a large number of small bends.

REMOVABLE APPLIANCE COMPONENTS

Classification

These components are basically classified into two categories:

1. Active
2. Retentive and anchorage

1. *Active component:* It is the member of appliance which is concerned with tooth movements and exerts force.
2. *Anchorage and retentive component:* These are the members of appliance which are concerned with holding the appliance in place and avoid any displacement of teeth. They are also called as reactive components.

Active components of an appliance are:

1. Springs
2. Screws
3. Elastics

Anchorage and retentive components of an appliance are:

1. Base plate
2. Clasps.

Classification of Springs

According to attachment (Figs 4.1A and B)

1. Attached at one end: cantilever spring
2. Attached at both ends: labial bow, coffin spring

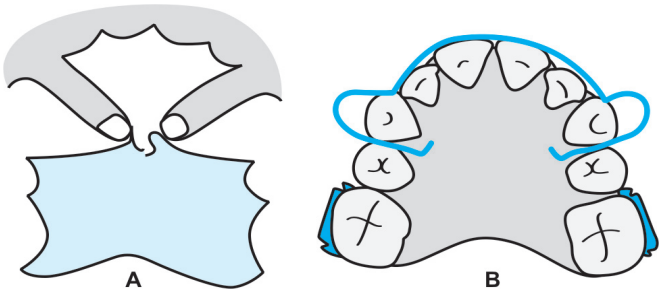

Fig. 4.1: (A) Attached at one end, (B) Attached to both ends

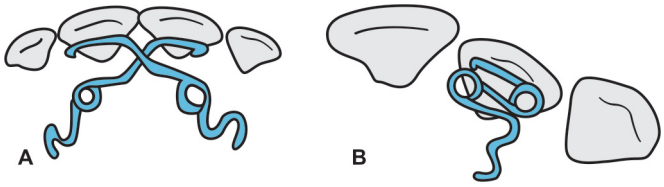

Fig. 4.2: (A) Single palatal cantilever, (B) Double cantilever

Number of arms in a spring (Figs 4.2A and B)

1. *Single cantilever:* The spring has only one arm and one coil.
2. *Double cantilever:* The spring has two arms and two coils. When two teeth are moved in same direction.

According to coil (Figs 4.3A and B)

1. *Spring with coil:* Any spring in which coil is included for its action is called as coiled spring.
2. *Spring without coil:* Any spring in which coil is not included for its action.

According to placement (Figs 4.2 and 4.3)

1. *Buccal/labial:* Spring is placed on buccal surface or labial surface of the teeth to be moved is called as buccal spring.
2. *Palatal/lingual:* Spring is placed on the palatal surface or lingual surface of teeth to be moved is called as palatal or lingual spring.

Palatal/buccal spring engages the mesial or distal surface of tooth to cause the movement in opposite direction.

According to force applied for tooth movement (Figs 4.4A and B)

1. *Push type:* Simple crown tipping by a force exerted against crown of a tooth by simple compressive contact without use of bracket or other attachment. For example, Labial wire of removable appliances is adjusted to exert refractive forces on crowns of upper incisors.

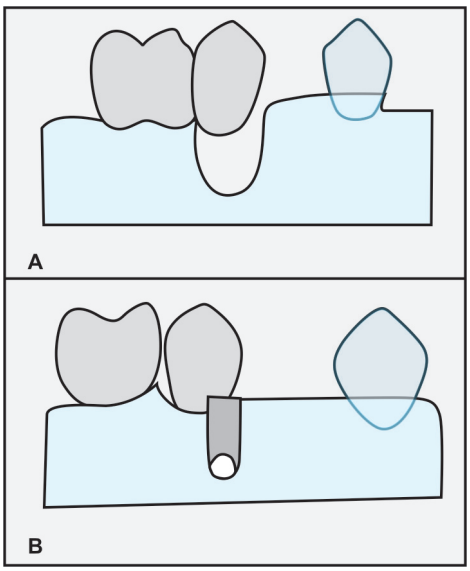

Fig. 4.3: (A) Spring without coil buccal spring (B) Spring with coil

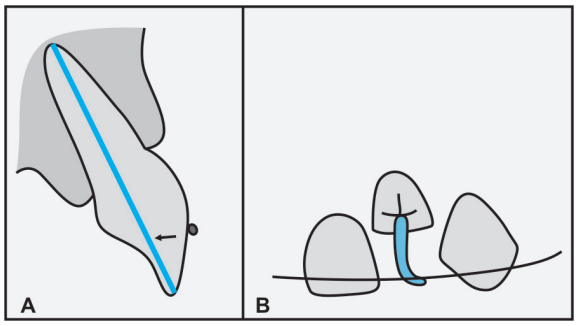

Fig. 4.4: (A) Push type of spring (B) Pull type of spring

2. *Pull type:* Simple crown tipping type force is exerted by one contact with one attachment. For example, retraction ligature.

According to design of spring (Figs 4.5A to C)

1. *Open spring:* Spring used for tooth movement is simply placed on palatal surface of plate (Fig. 4.5A).
2. *Boxed spring:* Spring used for tooth movement is protected inside a waxed chamber and above which acrylic plate is prepared. Thus a box is formed above the spring (Fig. 4.5B)
3. *Guided spring:* For smaller diameter springs, a spring of larger diameter is used to prevent the smaller and active from distortion (Fig. 4.5C)
4. *Self supporting springs* (Fig. 4.5D): Capable of standing of their own accord to the interference of the soft tissues of mouth during speech and

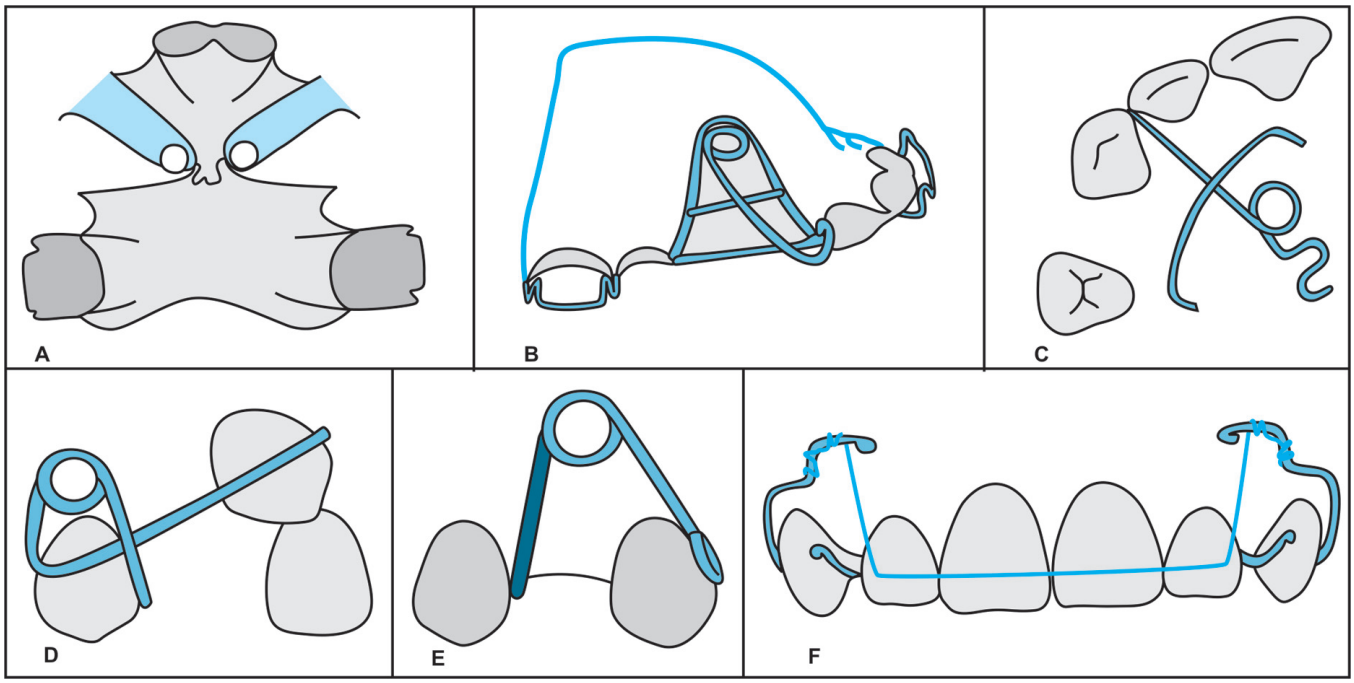

Fig. 4.5: (A) Obvious midline weakness produced by the use of bilateral open springs (B) Boxing in the spring provides protection and strengthens the base plate (C) A correctly sited guard wire is a useful accessory (D) This design may be useful where the sulcus is shallow. In this example a coil has been incorporated (E) This is an example of a well-proportional spring but the supporting arm enters the acrylic at gingival level (F) A light wire spring wound onto heavy supporting arms.

mastication without suffering damage and do not injure the soft tissues which lie against them.

Flexible enough to have useful range of action wire of 0.7 thickness is used.

Indication: when the use of heavy framework with spring is not possible self supporting spring is used. For example, buccal canine refractors (Fig. 4.5D), Palatal finger springs

5. *Supported springs:* The buccal arms of the springs are sheathed from the coil into the acrylic with hard stainless steel tubing of same but slightly larger diameter of spring to provide added strength. For example, Robert's retractor (Fig. 4.5E).
6. Appron's spring: It is a thinner gauge wire around a thicker gauge wire (Fig. 4.5F).

DESIGN OF SPRING (FIG. 4.6)

To design a spring for its action different factors are considered i.e. cantilever spring.

1. *Wire dimension:* Flexibility of wire depends on the length of wire and its diameter. Force generated by a given deflection of a simple cantilever spring is directly proportional to the fourth power of its diameter and inversely to the cube of its length.

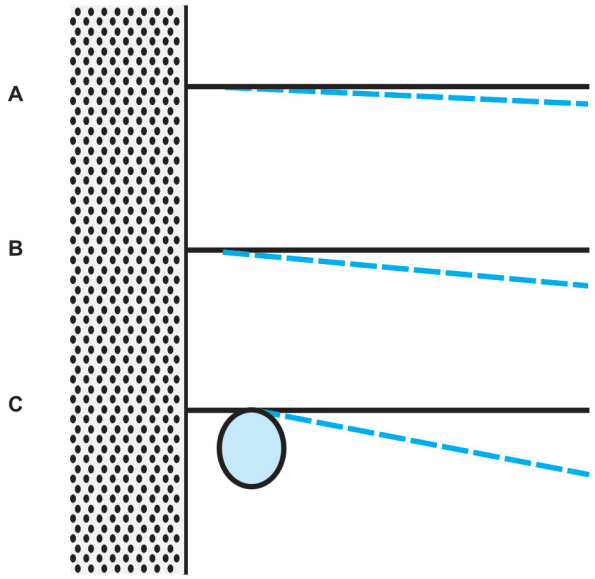

Fig. 4.6: The amount of displacement of a palatal cantilever spring to produce a force of 40 g. (A) Spring of 0-6 mm diameter (B) Spring of 0-5 mm diameter. (C) Spring of 0-5 mm incorporating a coil

$$F \alpha \frac{Edr^4}{l^3}$$

where F = force delivered, d = deflection
l = wire length, r = radius, E = Elastic modulus

2. *Deflection:* The process of bending a wire to give pressure for tooth movement. With layer deflection, patient is liable to insert the spring incorrectly.

   With smaller deflection, the force applied will drop off rapidly; thus, reactivation occurs frequently.

   Rate of tooth movement is 1 mm, so a deflection of 3 mm monthly adjustment is necessary. An activation of about one third of a tooth width will generate a force within the optimal range.
3. *Force:* For a single rooted tooth, it should be in the range of 25-40 gm. Excessive forces delay tooth movement overload anchorage and cause discomfort to patient.
4. *Direction of tooth movement:* This is determined by the point of contact between spring and tooth.

PRINCIPLES OF SPRING DESIGN (FIGS 4.7A TO C)

1. Force should be delivered at right angles to the long axis of tooth.

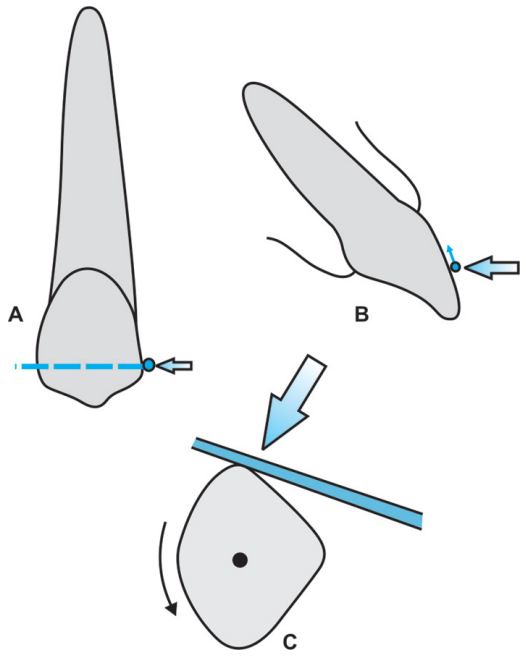

Fig. 4.7: (A) The ideal situation. It is possible to apply the force at almost 90° to the long axis of the tooth (B) Activation of a labial wire will cause it to move gingivally on proclined incisors (C) Activation of this palatal spring will tend to rotate the tooth mesio-buccally as it is retracted

2. As far as possible the force should be applied through a surface which is parallel to the long axis of tooth.
3. The force should pass through the center of resistance of tooth.

Cantilever spring components:

1. Arm
2. Coil
3. Tag

1. *Arm* (Figs 4.8A to C): It is the working end of spring, touches the surface of tooth from mesial or distal, labial or palatal side. Active arm of spring is virtually rigid and coil regarded as center from which arm pivots.

   Movement of arm will always be radial and movement of any point on it will be part of a curve with its center at coil.

   Path of movement of arm away from coil is straight line when it comes near to coil, it will be tight curve. So if the tooth to be moved, needs to travel in straight line, a long arm will be needed and if in a curve line; short arm.

   Gaugue of wire or diameter can be adjusted to suit the length of arm.

   It is necessary to turn the end of anterior arm through a right angle towards the midline of tooth and cut it off to leave 2 mm of spring which will engage the mesial edge of canine.

   Active arm of spring should remain in contact with tooth throughout its movement, so that continuous pressure is applied. It is situated in the gingival 1/3rd of the tooth to ensure bodily movement. Active arm should be long enough to be capable of activation for entire distance through which the tooth has to move.
2. *Coil (Fig. 4.9):* Introduction of a coil into a cantilever spring increases the effective length of the spring and makes it more flexible i.e. for the same activation a lower force is applied to the tooth to be moved. This increase in flexibility depends on the diameter of the coil, the number of turns, its position relative to the fixed end.

   Larger the coil, more flexible the spring.

   Due to inclusion of coil there lies an increase in range of action without increasing dimensions.

   Increase in the effective length of spring reduces the stiffness.

   Internal diameter should be about four times the diameter of wire.

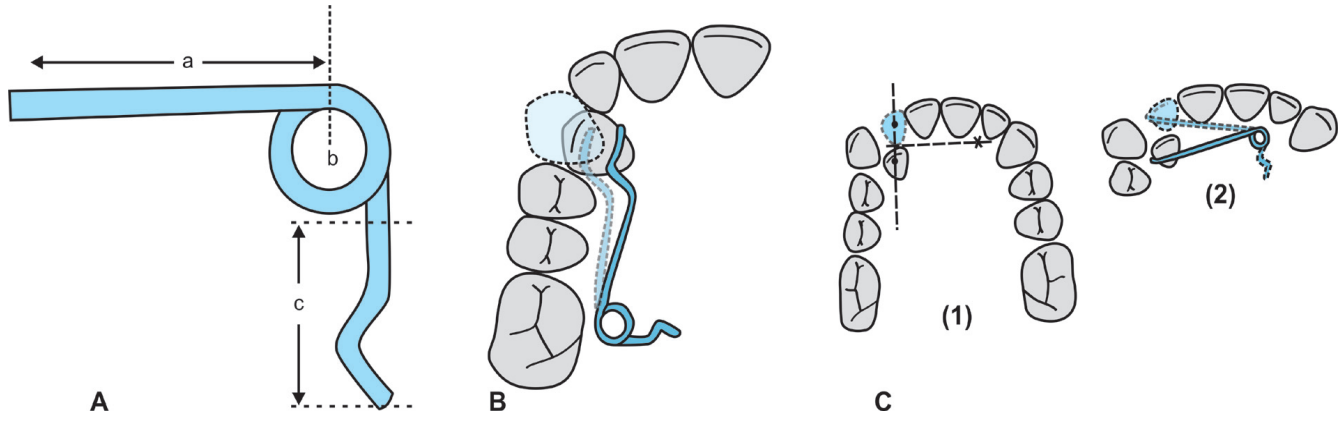

Fig. 4.8: (A) Parts of a finger spring (a) arm (b) coil (c) tag, (B) Spring with kinked arm to avoid contact with adjacent teeth (C) Geometric construction to show determination of position of coil b. Arm then maintains contact with tooth throughout its movement

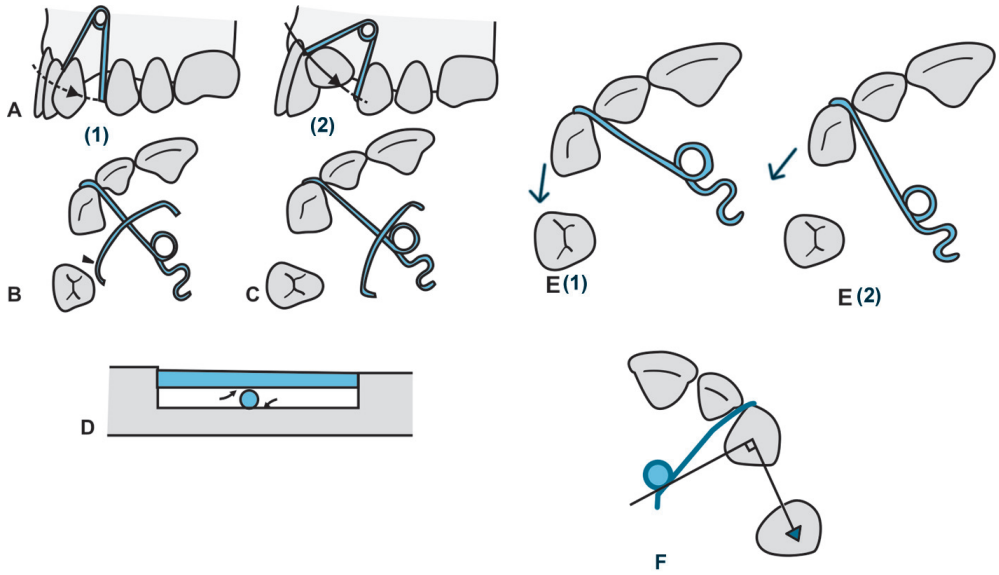

Fig. 4.9: (A) Position of coil for (A1) fully erupted tooth (A2) partially erupted tooth, (B) Incorrect, the guard wire will hinder the later stages of canine retraction (C) Incorrect, the guard wire is too close to the coil to be effective (D) Incorrect, there is insufficient clearance between the guard wire and acrylic to permit free movement of the spring. (E) The coil is correctly positioned to apply a force at right angles to the direction of desired movement (E1). Incorrect coil position is liable to produce unwanted buccal movement (E2). (F) The coil of palatal cantilever spring should lie on a line from the mid crown point on the tooth to be moved, perpendicular to the direction of movement

Spring should be activated in the direction in which the coil opens.

Flexibility of wire increases when the position of coil is close to the anchorage point i.e. at the point of attachment of spring to base plate.

More the number of turns in the coil, more flexible the spring.

Position of coil: A line is drawn joining the present position and desired position of the tooth. A perpendicular bisector is drawn to this line. Coil is placed along this line. It has stored energy and hence continuous action.

3. *Tag arm:* Length of tag should be 1/4th to 3/8th inch long.

It prevents the mesial migration of tooth means anchorage loss is prevented. End of tag is bent to remain in base plate for stability.

Distal tag arm end is bent to the mesial of tooth surface and it should be slightly shorter than mesial one, it is more convenient for base plate shape and extention on palatal surface.

CHAPTER

Active Appliances

5

SPRING FOR BUCCAL OR LABIAL MOVEMENTS

Cranked Palatal Spring (Fig. 5.1)

Palatal finger spring made of 0.5 mm wire is used to move an individual tooth bucally. A crank is bent into the spring so that during the later stages of activation it does not contact neighboring teeth.

Retention

Clasps on 6/6.

Anchorage

Base plate and bite plane posteriorly.

Advantage

Used in anterior teeth. Two springs crossed for two incisors which are used to proclinate the teeth.

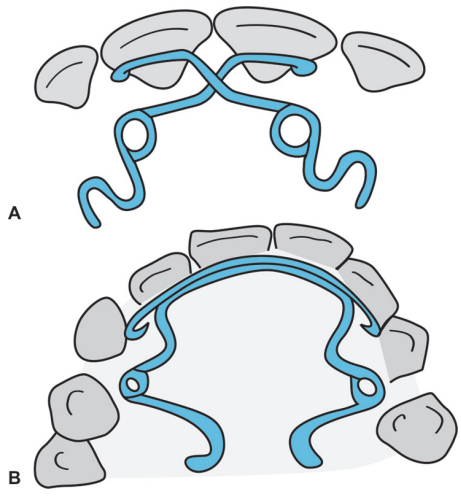

Fig. 5.1: (A) The spring can be used singly or in pairs as in this example. (B) Crossed cantilever springs are an effective way of proclining all four upper incisor teeth

Disadvantage

Not used in posterior teeth because of vertical lingual surface.

Z Spring (Fig. 5.2)

Single or Double cantilever spring. Spring is bent into a shape of Z with two coils and modification of palatal spring.

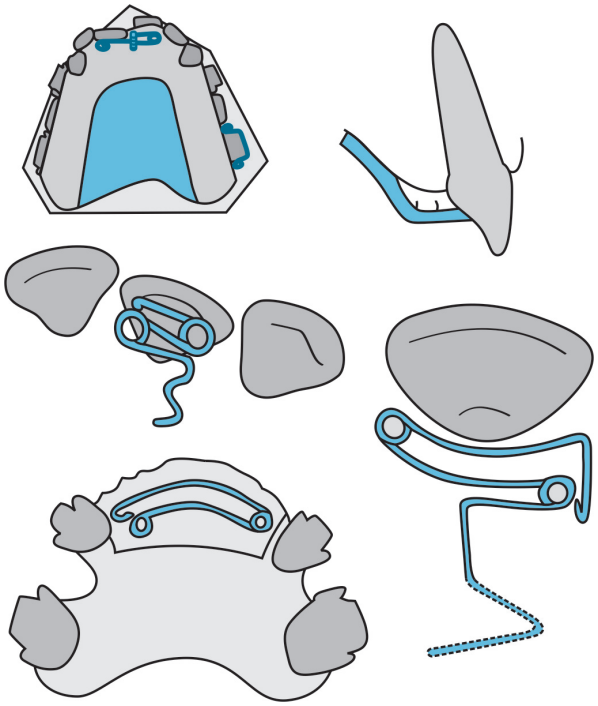

Fig. 5.2: (A) A single arm finger spring kept in position by means of a wire guard. Note the posterior bite planes. (B) The boxed in 'Z' spring aligned as near as possible at 90° to the long axis of the tooth. (C) The 'Z' spring may be used singly as in the example or made larger to move two adjacent teeth simultaneously. (D) A double cantilever or Z spring with coils boxed in under the plate

Spring is made up of 0.5 mm wire. Spring is so constructed that force is delivered in a straight line perpendicular to the surface of tooth. Active arm should lie above the coil. It is boxed type of spring to protect the spring.

Advantage

Single or two teeth are palatally placed; can be pushed labially.

Disadvantage

Not suitable for posterior teeth because it is readily trapped on occlusal surfaces of teeth during insertion.

Activation

Wire is gripped in pliers and pulled upwards and forwards from acrylic by flexing the spring. In this manner appliance is self activating.

Posterior bite plane is added with 'Z' spring to free the occlusion before attempting to move the misplaced tooth. If locked incisor is pushed labially without freeing the occlusion the intermittent impact of occlusion against a steady forward pressure on the tooth soon produces marked loosening of the tooth. Thus it is advisable to free the interlock of upper and lower incisors be means of bite planes.

'T' Spring (Fig. 5.3)

Shape of the spring is like 'T', 0.5 mm stainless steel wire is used. T shaped loop are made. Both arms of spring are embedded into base plate and cross piece rests on the palatal surface of the tooth to be moved. Boxed spring.

Advantage

Buccal movement of buccal teeth. Extra loops extends its range of activation movement of premolar with other movements.

Disadvantage

Not used on anterior teeth.

Activation

Activated by simply seizing the cross piece of 'T' and pulling the spring outwards and slightly away from the fitting surface of the acrylic so that it binds on the tooth during insertion.

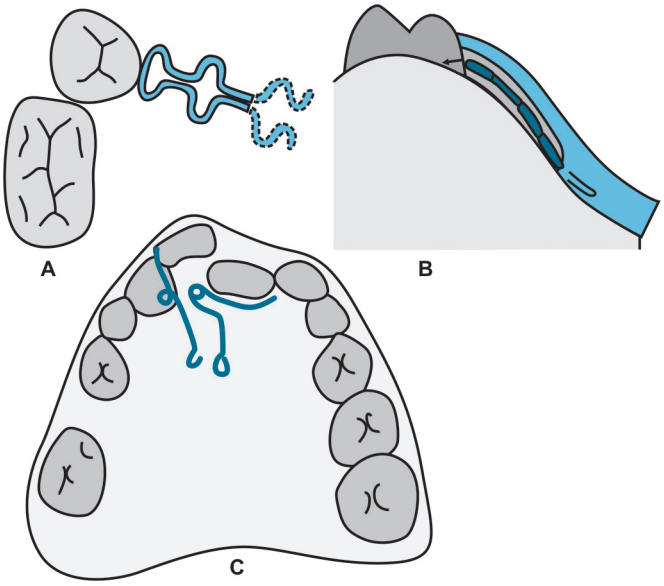

Fig. 5.3: (A) The most useful spring for buccal movement of premolars and canines. (B) Palatal view of boxed in 'T' spring. (C) Two types of anterior helical springs. The one on the right is used to labialize an anterior tooth. The one on the left can be adjusted to move an anterior tooth toward the midline.

'W' Spring (Fig. 5.4)

Universal lingual arch pliers (ULAP) are used to compress the 'W' spring and increase the effective force of spring to labilize the incisor.

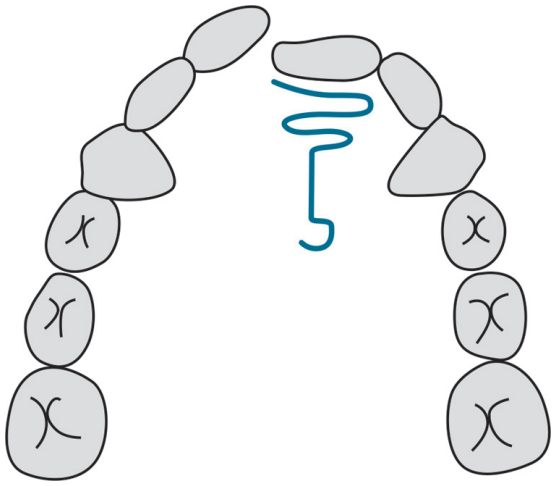

Fig. 5.4: W spring

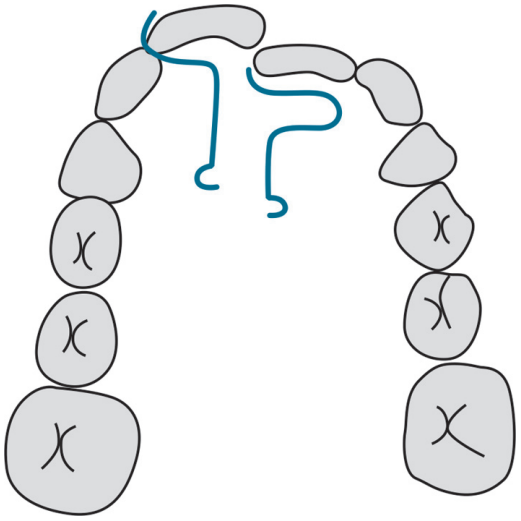

Fig. 5.5: S spring

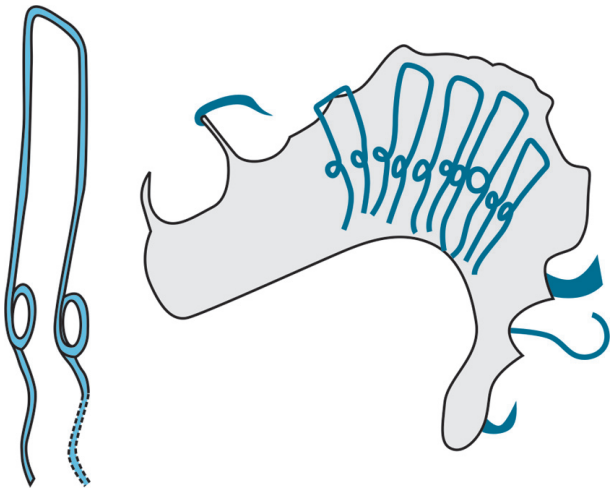

Fig. 5.7: (Left) "Flapper" spring. (Right) several springs on lower appliance

'S' Spring (Fig. 5.5)

For labialize incisor, it may be modified to act as a diastema closing spring.

Safety Pin Spring (Fig. 5.6)

It is used to move two upper central incisors labially. For example in class II dir 2, it is made up 0.5 mm wire and is boxed in.[4]

Spring may be incorporated in an expansion plate two being embedded in different halves of the appliance.

Activation

By opening the coils

Flapper Springs or Mouse Trap Springs (Fig. 5.7)

Used to move lower incisors labially, one spring being used for each tooth.

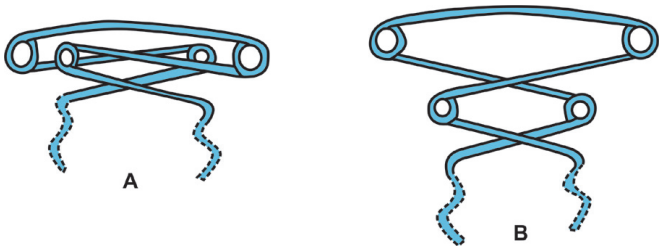

Fig. 5.6: Safety-pin spring (A) in passive position (B) activated

They are made from 0.3mm wire, individual spring is prepared. This spring is not wrapped around a supporting arch but it is embedded in denture base material. Denture base provides maximum support to spring.

Activation

By opening the coil so that it gives continuous light pressure against the teeth.

Friel Spring (Fig. 5.8)

In lower appliance, 0.7 mm lingual arch with 'U' loops act as a basic wire part. To these is added, a fine wire Friel spring in 0.35 mm S.S. wire.

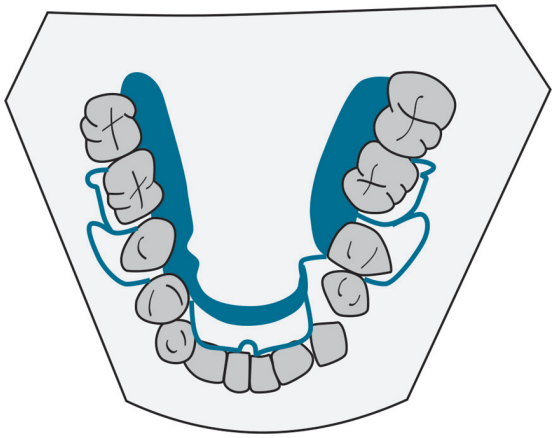

Fig. 5.8: A lower appliance with a lingual arch with U loops carrying a Friel spring to procline the lower incisors

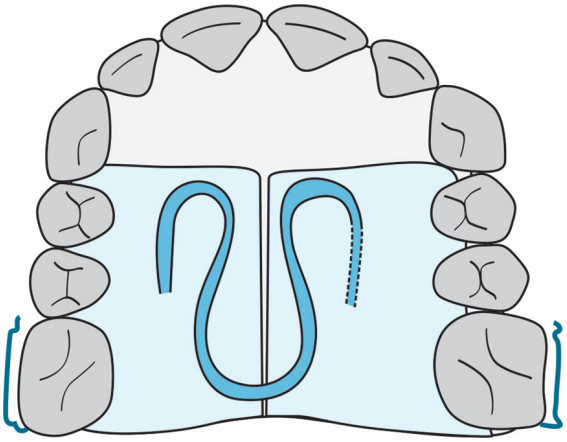

Fig. 5.9: An appliance using a Coffin spring to provide bilateral expansion

Advantage

It is used to proclinate, periodontally compromised teeth to give light pressure.

Coffin Spring (Fig. 5.9)

Shape of spring is like a greek letter Omega.

Indications:

1. Narrow arch.
2. Crowding to teeth
3. Expansion of arch in Anterioposterior and transverse direction.

Design

Coffin spring is made up of 1.25 mm diameter wire or 19 gauge shape of spring is either diamond or pear shaped.

In diamond shaped coffin, posterior arm is of 1 cm and anterior arm of 1.5 cm and tag arms are long enough to embed in the base plate.

Position of Spring

Anteriorly at intercanine region and posteriorly in the first molar region.

Retention

Retention is very important in coffin spring. So four clasps are given. Anterior bends must not be incorporated into acrylic to permit full range of activation.

Activation and adjustment of coffin:

It is done with three pronged pliers or universal pliers.

Anterior and posterior bends are activated to get expansion in anterior and posterior region, reducing the curvature of bends by pliers.

Functions of Spring

1. *Tongue trainer:* It helps to correct the deviant swallowing pattern and tongue thrust by causing the base of tongue to seal against soft palate during swallowing; prevents the anterior tip of the tongue from slamming up against the lingual surface of anterior teeth and premaxillary regua area.
2. Coffin spring can be used as an effective appliance to push buccal teeth laterally so that cross bite correction is possible.
3. Coffin spring gives the appliance strength durability and stability in mouth.
4. Acrylic side plates have interproximal projections of acrylic which face to the teeth. It act as interdental wedges. So by opening the coffin spring the acrylic pushes not only against the teeth but the alveolar bone. It becomes capable of moving the teeth.

Advantage of Coffin Spring

1. Cheap as compared to screw.
2. Permits non-parallel and parallel expansion.
3. Easy to keep clean for patient.
4. Patient does not have to adjust the appliance.

Disadvantage

1. High degree of skill required for preparation.
2. Excellent retention is necessary.
3. It can be easily over activated.

SPRING FOR LINGUAL MOVEMENTS

Single Incisor Spring (Fig. 5.10)

A modification of buccal canine retractor.

Indication

For correction of an outstanding central or lateral incisor. In class II dir 2 type of case is being treated by alignment of upper arch only.

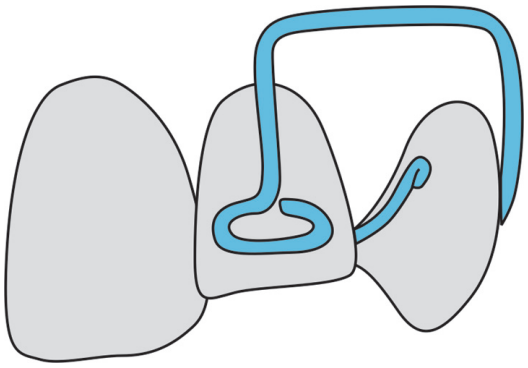

Fig. 5.10: This spring is used for the alignment of a single outstanding incisor

Design

Wire emerges from the acrylic and crosses the mesial surface of second premolar. It then passes up into the sulcus and forwards over the canine eminence before descending to engage the labial face of the lateral incisor with a flattened loop.

Canine and Premolar Spring (Fig. 5.11)

Indication

To push a canine which is outstanding at the end of its retraction.

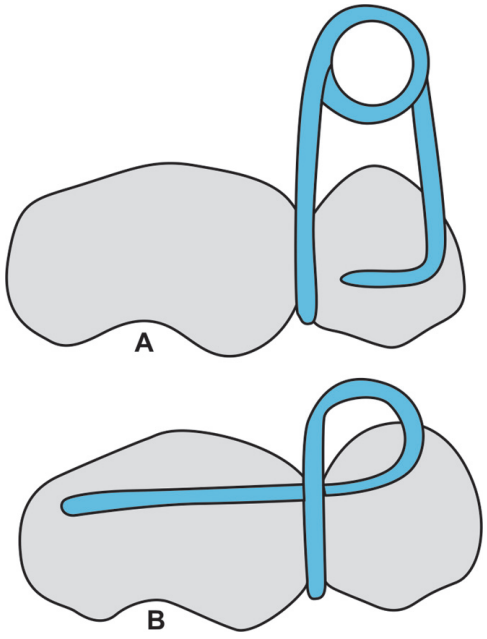

Fig. 5.11: (A) This spring is occasionally used for correction of a buccally displaced molar. (B) A convenient design of spring for the palatal movement of premolars and canines

Design

A loop ended spring.

Molar Spring (Fig. 5.12)

Indication

For lingual movement of bucally placed canines.[6]

Design

It is made up of 0.7 mm wire. A reversed loop is used to allow the spring to press on the buccal surface of buccally placed molar. It moves the tooth by continous pressure applied by wire.

Soldered Auxillary Spring (Fig. 5.12)

Indication

For outstanding canine or premolar.

Design

An auxillary spring may be soldered to bridge of the clasp on first molar.

Advantage

The spring does not cross the embrasure and so does not compete with other wire work. The length and hence the flexibility of the spring can be controlled by

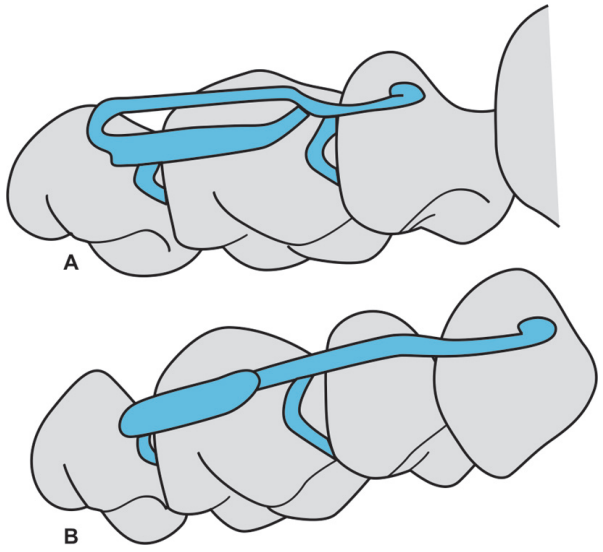

Fig. 5.12: (A) The spring can be recurved to achieve flexibility. (B) This spring has the advantage that it may be added easily to an existing appliance

a choice of the appropriate wire size and where necessary by bringing the wire from distal end of the bridge of the clasp and recurring it forwards. Particularly useful when a second premolar has to be moved palatally.

Disadvantage

It is difficult to add this spring to a clasp which is already carrying a soldered tube for the application of the face bow.

SPRINGS FOR MESIAL/DISTAL MOVEMENT

Palatal Springs (Fig. 5.13)

Indication

The tooth is in the line of arch used to move the incisors, lateral incisors, canines, premolars and molars.

Design Principle

It is cantilever spring. A finger spring is bent in the form of a long arm at the root of which is a coil with an internal diameter of about 3 mm where it emerges from plastic base. The spring should be placed or attached to the plastic base at a point midway between the present position of the tooth to be moved and the position it should occupy when the movement is complete. Hard stainless steel wire of 0.5 mm or 0.6 mm diameter is used to prepare finger spring.

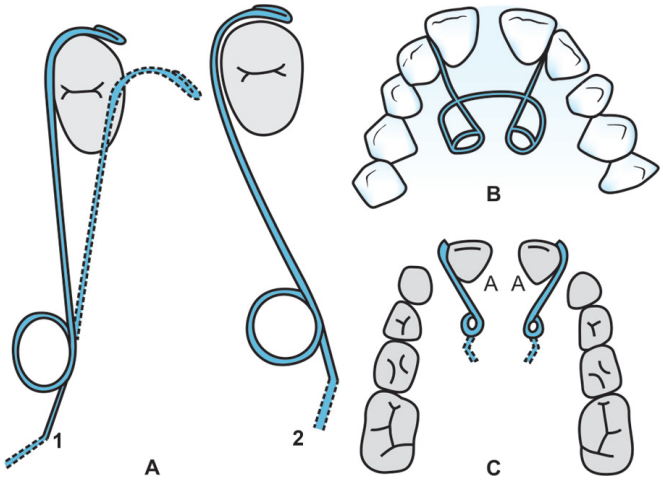

Fig. 5.13: (A) Drawin of the incorrect (1) and correct (2) way to place a finger spring. (B) Springs to move central incisors mesially (C) approximation of central incisors, a labial arch is usually added as a precaution to prevent labial "straying"

Length of spring is about 2 cm from the point of application at the tooth to its insertion into the acrylic. Pressure applied is about 15 gm/square mm.

Placement

The coil is placed so that when activated it is tightened as the appliance is inserted and incoils as tooth moves. The coil lies on the side of the wire away from the direction of tooth movement. Coil of one and half turn is sufficient.

Activation

It is done by opening the coil. It should not exceed more than 2 mm at each time. Spring should not be bent where it emerges from base plate because it is a site of stress.

Concentration and therefore fracture of wire is possible but it should be done at the free arm of spring as close to the coil as possible.

Advantages

1. Spring provides light pressure; therefore well tolerated.
2. Several springs can be added if required to retract the teeth.

Disadvantages

It is not used to correct severe rotation of tooth.

Stability of Appliance

By boxing the spring in acrylic or by applying guard wires.

Modification of palatal spring to close central diastema.

Here instead of having two separate finger springs to move incisors, single wire is modified to move the centrals mesially.

Long fingers spring: (Long arm palatal finger spring)
In long arm palatal finger spring, the coil and the active arm is protected by guide wire. Ends of guide wire are embedded in acrylic base plate from both ends thus the active arm is free to move. It has got more range of action.

Finger spring with labial bow:

To facilitate correct insertion in the mouth, the free end of a finger spring wrapped around the long labial bow.

DISTAL MOVEMENT OF CANINE (FIG. 5.14)

This is commonly called as retraction of canine. Canine is one of the most important tooth in oral cavity. It has got longest root which is very strong. Thus, canine is moved first and then the retraction of incisors is carried out. It is a separate step; sufficient anchorage is must.

Canine Retractors

1. The standard buccal retractor
2. Modified buccal retractor (Hockey stick)
3. Reverse loop buccal retractor (Helical coil)
4. Box type canine retractor
5. Stabilized buccal canine retractor with safety lingature

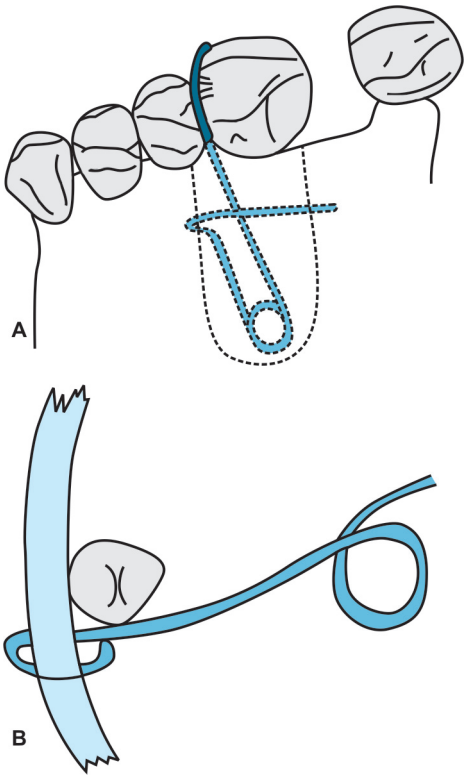

Fig. 5.14: (A) The 'long' finger spring to move an upper tooth distally. The tongue of wire parallel to the midline prevents the spring from being lifted away from the acrylic base. (B) The method of wrapping the free end of wire finger spring around a long labial bow to facilitate correct insertion in the mouth and to avoid distortion of the spring. In order to allow the loop to slide freely along the bow, it should be made oval in shape

6. Rix sliding canine retraction
7. Robert's retractor for canine
8. Spiral spring canine retractor (Leighton's retractor)
9. Elastic retractor

Houston and Waters (1976) discussed the characteristic of buccal canine retraction spring.

Stiffness, is the force generated for a unit deflection. It is expressed in grams per mm of activation. It is the property of hard canine to bend the wire.

Stability ratio is the stiffness in the direction of unwanted displacement divided by the stiffness in the intended direction of tooth movement.

It is the ratio of vertical to horizontal stiffness.

In canine retraction procedure, flexibility of spring is considered. The source of flexibility, is coil which gives the anterior arm of the spring flexibility in an anterior posterior direction. Which is horizontal transverse arm of the spring between the base plate and the origin of the posterior limb induce the active end of spring with a degree of up and down or more or less vertical, flexibility.

Self supporting spring: It is of 0.7 mm diameter wire, it is without supporting tube.

Supported spring: The posterior limb is supported with heavier tube.

Standard Buccal Retraction Spring (Fig. 5.15 A)

Components of Canine Refractor Springs

It consists of:

1. Active arm-a
2. Supporting arm-b
3. Coil-c
4. Height difference between limbs-d
5. Transverse component-e
6. Overall height-h
7. Span-s

For a standard buccal retraction spring the measurement given are

1. Coil radius = 1.85 mm
2. Length of span = 13 mm
3. Transverse component = 4 mm
4. Overall height = 12 mm
5. Height difference = 2 mm

It is standardized for studying the stability of stiffness ratios.

Active arm should engage the mesial surface of canine at gingival level. Placement of coil is same at the center of original and required position os tooth.

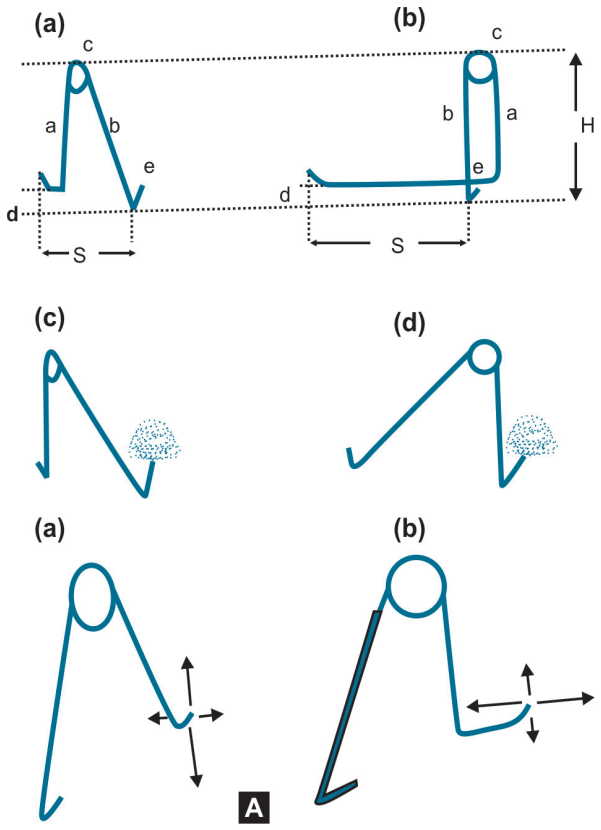

Fig. 5.15A: (a) and (b). Components of the modified and reverse loop buccal canine retraction springs: a–active limb; b–supporting limb; c–coil; d–height difference between limbs; e–transverse components; H–overall height; S–span. (c) and (d). Standard buccal springs with anterior coil position and active limb vertical (c); and with posterior coil position and supporting limb vertical (d). Stability ratio of buccal canine springs: a. The standard buccal canine spring is more flexible vertically than it is mesiodistally b. The supported buccal canine retractor has the advantage that it is more flexible mesiodistally than it is vertically.

Posterior limb should cross the mesial surface of premolar i.e. transverse arm. Used for the highly placed canine in buccal sulcus.

Activation

By closing the coil.

Modified Buccal Retraction Spring (Fig. 5.15B)

A buccal spring with a horizontal extension embracing the mesiobuccal aspect of the tooth. It is more readily controlled than the standard buccal spring. Distopalatal activation is simple due to horizontal extension.

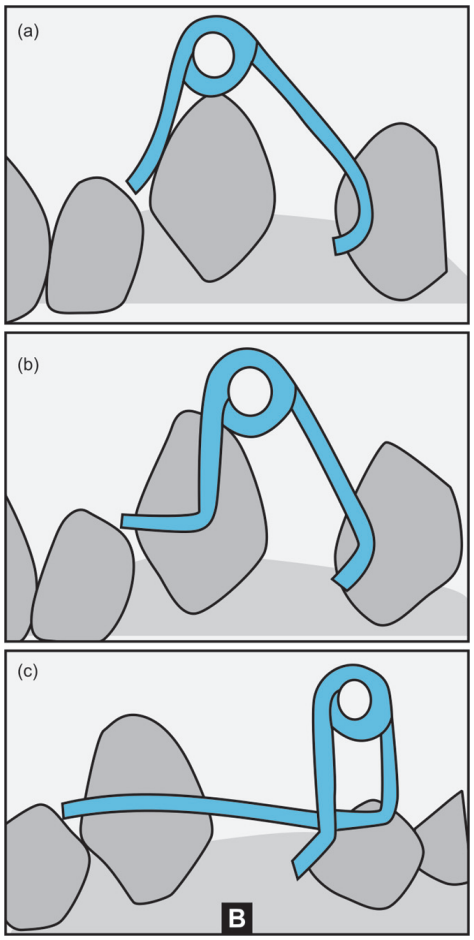

Fig. 5.15B: (a) The standard buccal retraction spring; (b) the modified buccal retraction spring; (c) the reverse loop retractor. In this patient, spring height could have been greater with a corresponding improvement in horizontal stiffness

Reverse Loop Buccal Retractor

Particularly indicated for use in the lower arch where sulcus depth is limited. Horizontal flexibility depends on the vertical limb and the coil. Vertical flexibility comes from the transverse section which connects the springs to the base plate and from the horizontal arm which acts as a long cantilever.

Design

Made up of 0.7 mm wire self supporting spring. A coil is prepared so that both the arms lie parallel to each other. Active arm should lie up in coil. Coil should lie 5 mm below the cervical level of tooth. The arms are bent at right angle to each other. Tag arm should lie 2 mm above active arm.

Active arm engages the mesial surface of canine at its gingival 1/3rd level and perpendicular to the long axis of tooth. The active should lie below the tag arm so it prevents the distortion of active arm from buccal surface. Tag arm should touch at its interstitial ridge. Just above the contact point of tooth wire can prevent complete retraction of canine tag arm also prevents anchorage loss. Coil gives long term action.

Activation

It is done by opening the coil. Adjust the active arm such that it lies at right angle to the tooth surface. As the tooth moves, the end of active arm is slightly cut off and again adjusted so that it gives a pressure 50 gm/mm. 3 mm activation per month is sufficient thus tooth moves by 1 mm per month. Ideal spring have a stiffness of about 15 gm/mm.

Advantages

1. Good control offered by spring during distalization.
2. Better stabilization than palatal canine refractor
3. Accepted by adults

Disadvantages

1. If spring remains unstable, then it can cause unnecessary movement.
2. Trauma to sulcus.
3. Readily distortion.

Stiffness and stability ratio change with the change in standards of components of retractor.

1. *Effect of increasing overall height:* Decrease in stiffness due to increase in height of supported or unsupported spring. Increase in stability ratio.
2. *Effect of increasing coil radius:* Stiffness of spring decreases. Stability ratio virtually constant.
3. *Effect of span length:* Stiffness of unsupported and supported springs remain constant; stability ratio decreases as span is increased.
4. *Effect of altering length of transverse span:* Any increase in the length of transverse arm produces decreased stiffness. If horizontal stiffness is high, there is danger of overloading the canine, causing anchorage loss and delayed tooth movement. If vertical stiffness is low, the spring may be unstable because when it acts on a slopping surface, it may be displaced. If the stability ratio is more than one no slippage, if less than one spring may slip gingivally causing trauma to gingiva, slip on cuspal incline and tend to intrude the tooth.

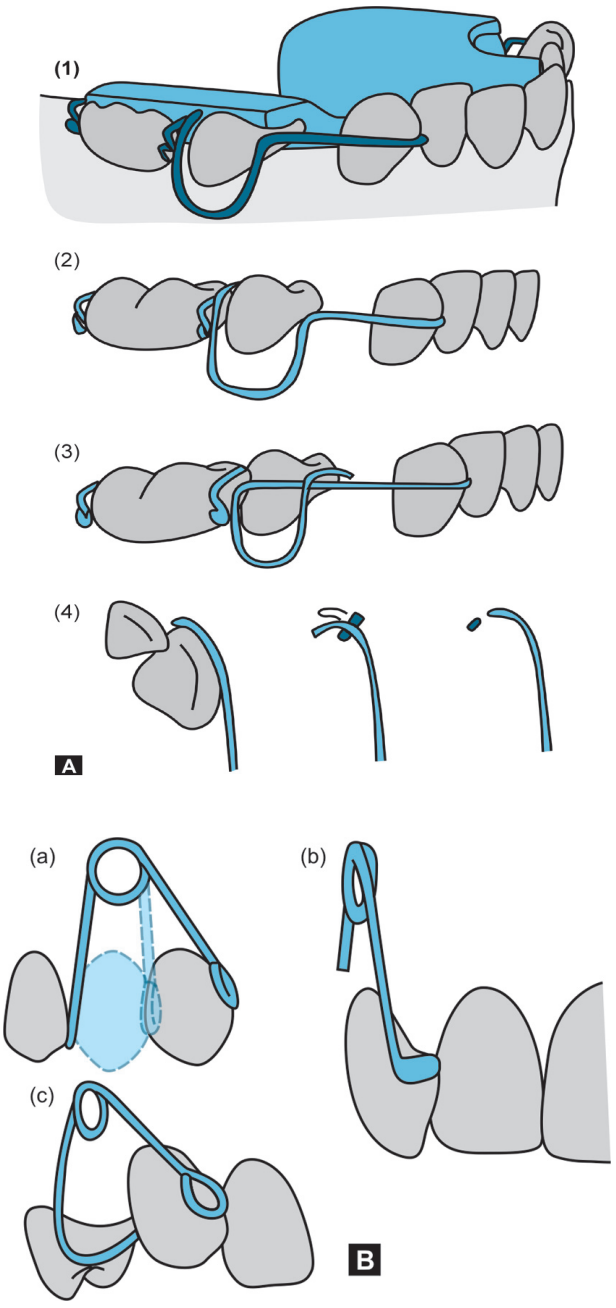

Fig. 5.16: (A) A suitable design of appliance to retract mesially placed canines, buccal springs in 0.7 mm wire are used and retention is provided by single arrowhead clasps in 0.8 mm wire on lower first molars. Shallow posterior bite planes are incorporated to gag the bite and facilitate correction of the canines(1). A suitable design of spring for the retraction of a mesially inclined and buccally placed canine (2). A plain loop emerging from the distal aspect of the second premolar (3). A reversed loop emerging from the mesial aspect of the second premolar (4). The simplest method for activating a buccal canine spring is to curve the end inwards and shorten the wire slightly. (B) A correctly sited coil with both arms of approximately equal length (a). A useful alternative way of engaging the canine (b). A popular design of buccal canine retractor constructed in 0.7 mm wire (c)

Box Type Canine Retractor (Fig. 5.16)

Indication

1. Buccally placed canines
2. To close the space between canine and premolar

Design

0.7 mm hard stainless steel wire is used. A 'U' shaped loop is prepared instead of a coil. Active arm is made at right angle to the loop and it engages the mesial surface of gingival 1/3rd of canine. Tag arm passes transversely, touching the anchor tooth. width of loop is same as premolar width.

Activation

By closing the loop and adjusting active arm.

Stabilized Buccal Canine Retractor (Fig. 5.17)

Houston and waters (1976) and (1982) pointed out the vertical flexibility of standard canine retractor at its acting end. To reduce this vertical flexibility, a stabilizer welded to the posterior limb of the spring just below the coil and to the bridge of clasp that is usually on first molar. It maintains the position of coil. It should be noted that the welds should be made accurately with stabilizing wire bent to cross the limb of the spring and the bridge of the clasp at right angles. Stabilizer should be bowed slightly to clear the alveolar process over the premolar tooth. A safety ligature is used.

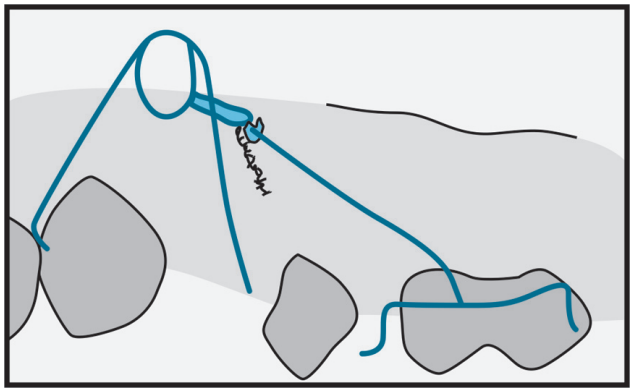

Fig. 5.17: The stabilized buccal canine retractor. The stabilizer is welded as shown and may be made of 0.8 mm wire. The safety ligature is clearly shown. The stabilizer must cross the wire of the spring and of the clasp at 90° and should be accurately welded once

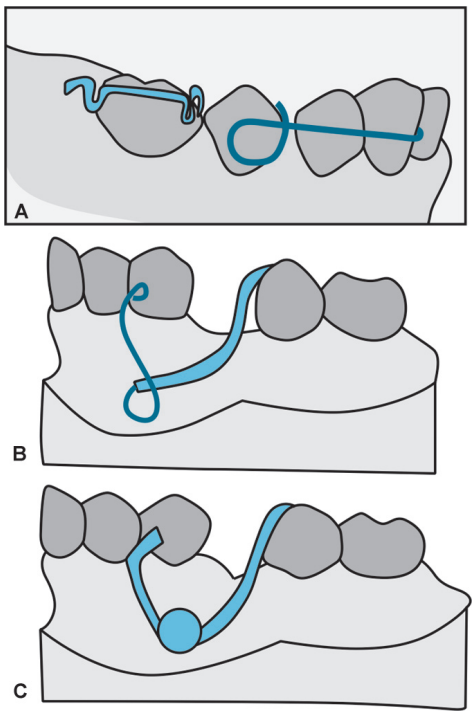

Fig. 5.18: (A) An appliance to retract a lower canine. This design of spring is less liable to ulcerate the buccal sulcus than the type used in the upper arch but it is more difficult to adjust. Robert's retractor. (B) A canine retraction spring having supporting tubing and cross over loop. (C) A similar retraction spring having an coil and supporting tubing

Multiple Spring Appliance or Robert's Retractor (Fig. 5.18)

This appliance is used for distalization of canine. The spring on the anterior is termed a canine retractor and is supported over almost half its length by means of stainless steel tubing which gives adequate support to a fine spring wire. Retentive end should pass over the embrasure so as not to impede distal movement of canine. Active arm of spring should be tapered, smoothed and polished to prevent damage to teeth as it is inserted between canine and lateral incisor.

Procedure

Prepare canine retractor spring from 0.5 mm hard wire. The active end should enter the interdental space at a right angle. Anneal about one and half inches of hard stainless steel tubing, benel the leading edge on a revolving abrasive lathe wheel and polish the section. Push the bevelled piece of tubing on to the active arm of the spring. Adapt distal arm of the retractor (spring wire and tubing) to pass over the embrasure area and severe at required length. Do not allow the tag to

impede movement of canine. Tubing should not touch the tissue at any point and the coil should not extend too deeply into sulcus.

Activation

By closing the coil.

Rix Sliding Retraction Spring Appliance (Fig. 5.19)

Retraction of canines is desired first, followed by the incisors, an appliance having a labial bow with adjustment loops, along with suitable spring or attachments for performing the first part of the task is constructed.

Design

Prepare a molar clasp of 0.7 mm hard wire. Adapt a labial bow soldered to molar clasp's horizontal arm and finish it well.

Using 0.35 mm hard wire, wind it three times round the vertical portion of the 'U' loop then three times round the adjoining horizontal portion of the bow.

After estimating the depth of the sulcus in the canine region, prepare a cross over loop having two coils. Place assemblage on the model at this stage for checking the coil and arms. Mark with ink the spot on the bow where the third group of coils must be wound, remembering that to enable it to retract the canine it must have been extended to its starting point as shown. Remove the bow and cribs and wind one coil on the former, leaving the excess wire horizontal and pointing lingually. Make a 180° bend in the 0.35 mm wire to return it to the bow then bend it round the bow twice. These last bends must be quiet loose.

Wax up the plate, cover the springs with damp tissue paper and invest it in usual way. Process, deflasks and finish.

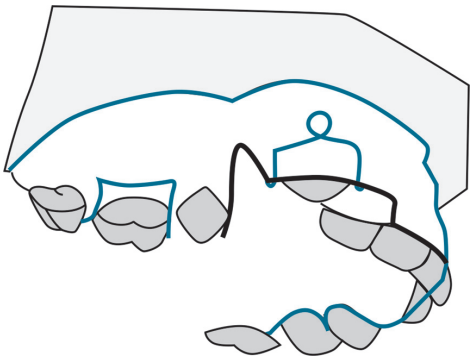

Fig. 5.19: A fine wire rix retractor

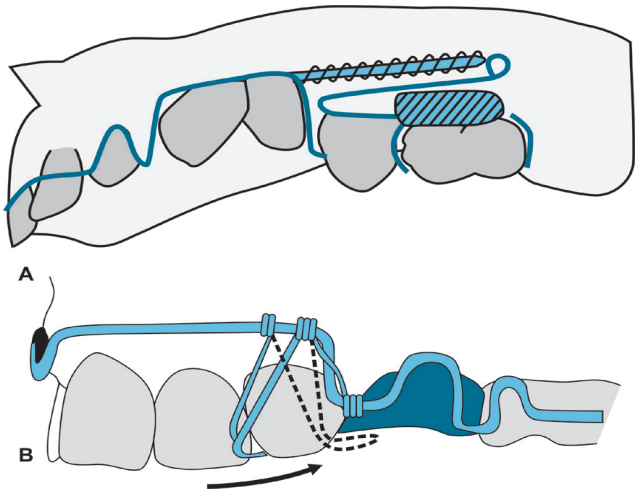

Fig. 5.20: (A) Another method of retracting a canine by means of a compressed-coil spring, as described by Leighton. (B) Showing a fine wire 'golf-club' spring dropped from a high labial bow to retract a canine

Spiral Spring Canine Retractor (Leighton's Retractor)

Canine can be retracted by incorporating a stretched and subsequently compressed spiral spring. The coil is made by winding 0.2 mm hard wire around the shaft of a dental bur whch may be fitted into the end of a lathe check (Fig. 5.20).

Elastic Retractor (Fig. 5.21)

Prepare clasps on molar and premolar. Construct from 0.8 mm wire, the retracting arm to embrace canine fully and extend distally beyond the horizontal arm of clasp and touching it. Cut two pieces of 0.8 mm tubing, one for the clasp and one for the guide. Slip the tubes on to the retracting arm and replace the clasp and arm on the model. Impregnate the tubes and crib with sticky wax and unite the larger tube and the crib. From a piece of 1 mm hard wire, hollowed at the end to receive the small piece of tubing adapt a guide arm, unite the small tube and guide with sticky wax. Carefully withdraw the retracting arm from the guide and clasp and invest the latter for soldering of the tubes.

Assemble units on the model and in the canine region choose the site for wire loop, marking it with ink. Bend a loop using 0.7 mm hard wire, ensuring that the end in contact with the retracting arm completely encircles the arm. Solder the loop to the arm by the free hand method ensuring that there is scope for distal movement of the arm. Stone and highly polish the soldered joints.

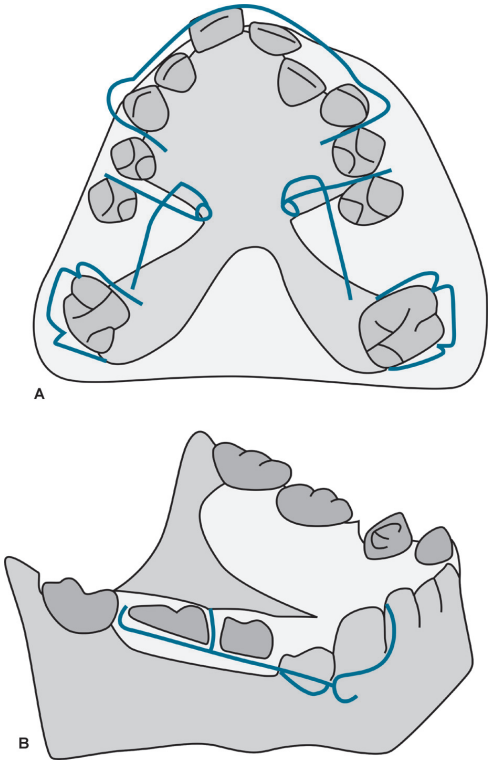

Fig. 5.21: (A) An upper appliance with single straight cantilever springs used to retract upper premolar teeth. (B) Elastic retractor

Elastic passes between the distal end of the molar clasp and molar tube. It is essential that the retracting arm be straight and free sliding in the tubes and that the plate touching the lingual and distal aspects of the canines be cut away to permit traction.

Distal Movement of First Permanent Molars (Fig. 5.22)

It is done by using the screw.

Active component

Screws (Fischer) with the axis parallel to the line of the arch.

Retention

Clasps on 6/6 (0.7mm) plus a clasp on perpendicular or a fitted labial bow. 4/4 should also be clasped.

Anchorage

Anchorage must be reinforced with extraoral traction.

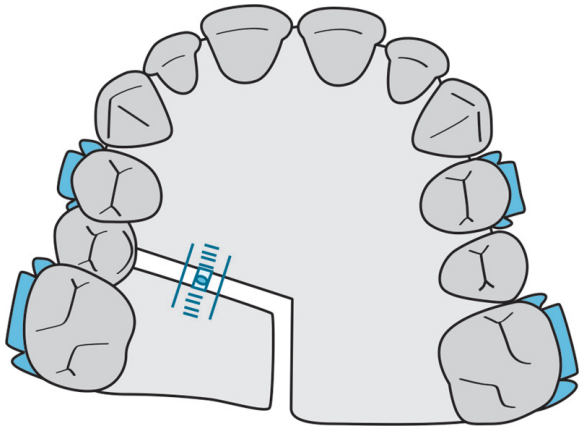

Fig. 5.22: An upper removable appliance to retract 6/6. Adams' clasps on 64|46 (0.7 mm). The screw is parallel to the line of the arch.

Baseplate

Should be split as indicated in the figure. Anterior bite plane may be used to clear the occlusion.

Distalization of molar is very easy if 6/6 are drifted mesially due to early loss of deciduous molars.

Distalization of Upper Buccal Segments (Fig. 5.23)

It is called as En Masse appliance.

Active Component

The elastics of the headgear. A coffin spring in 1.25 mm wire (or screw) should be incorporated to allow the buccal segment to be expanded as they move distally. The arch diverges distally and slight expansion is required to preserve the correct transverse relationship with the linear arch.

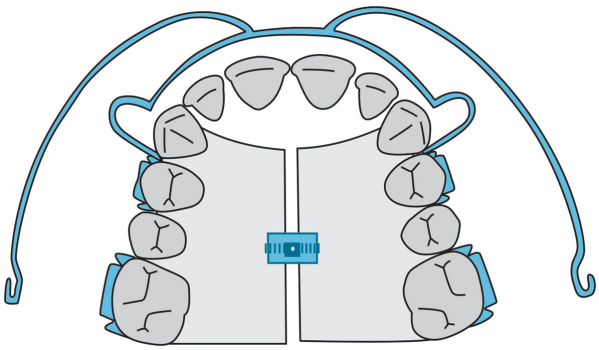

Fig. 5.23 : An upper removable appliance (En Masse appliance) to retract the upper buccal segments by extra-oral traction. Adams' clasps 64|46 (0.7 mm); midline screw; integral extra-oral bow (1.25 mm) with inner bow (1.0 mm)

Rotation of Screw

One quarter turn per week is advised and patient should be checked after every 4-6 weeks.

Extraoral forces are transmitted to the appliance through a face bow. The extraoral part is 1.5 mm wire and the intra oral part which stands clear of the incisors is in 1.15 mm wire. The bow may be inserted directly into the base plate or into tubes on molar clasps.

Retention

Clasps on 6/6(0.7 mm) and 4/4(0.6 mm)

Anchorage

Extraoral

Base Plate

Split in midline and cut away from the upper incisors. To be effective the headgear must be worn for about 14 hours out of 24. Quiet heavy forces- upto 250 gm (about 8 OZ) each side are appropriate because many teeth have to be moved. Face bow should not contact the upper incisors and it may have to be adjusted at the loops to keep it clear as the buccal segments move distally.

Distal Movement of Lower First Molars (Fig. 5.24)

Indication

Teeth have drifted forwards following early loss of E/E and where extraction of premolars is indicated. Movement is more readily achieved before 7/7 have erupted or if they have been extracted.

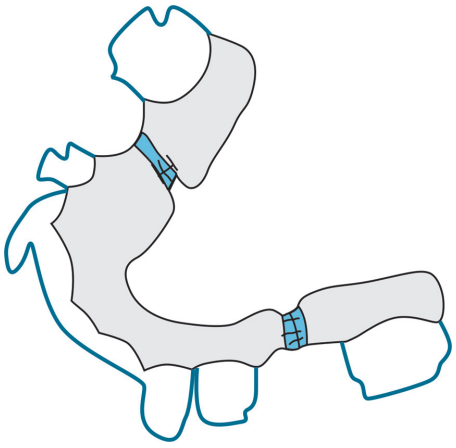

Fig. 5.24: Distal movement of lower molars with a screw plate

Active Component

Narrow screws (e.g. Fischer)

Retention

Clasps on 4/4 (0.6 mm) and 6/6 and fitted labial bow (0.7 mm)

Anchorage

Teeth not being moved and the alveolar process which is contacted by the base plate.

Base Plate

Split at screws. Anchorage may be a problem and it is difficult to avoid proclining the lower incisors. Each screw should be activated once a week but on different days.

SPRING FOR REDUCTION OF OVERJET AND ALIGNMENT OF INCISORS

Labial bow is spring which is attached to both the ends of base plate. It is an active component of removable appliance. It has got different designs according to different functions. The wire which is used to prepare a labial bow is of different dimension according to pressure applied on teeth.

Labial bow consists of:

1. Heavy wire
2. Light wire

Light pressure will move the teeth more rapidly with thinner wire. Hyalinization period is shorter and continuous tension on periodontal fiber bundle will result in tooth movement after few weeks. 0.5 mm to 0.3 mm wire is used for finger springs. These springs wound for support on heavy wire. Very fine wires 0.25 mm or 0.15 mm are used for coil springs.

Heavy wire or wires of larger gauges, 0.6 mm and upwards are of medium hardness. Used for preparatory bows and arches. Force applied is heavy for a slight activation.

Principles of Wire Bending

1. Plier should be in the thumb and pen grip.
2. Take an adequate length of wire to manipulate.
3. The wire should be held at right angle to the plier.
4. Sharp bends should not be given; otherwise wire will break.

5. Use plier for holding wire.
6. Don't bend the wire with plier; bend it with thumb.
7. Smooth bends are made by rounded beak of plier.

Hawley Appliances (Fig. 5.25)

This is a basic and common appliance which is used to retract incisors.

Construction of Labial Bow

0.7 mm wire is used for labial bow preparation with Adams Universal plier. First a smooth curve is made with fingers and wire adapted to labial surface of the upper six anterior teeth.

'U' loop is started by bending the wire up at right angle at the center of the canine teeth. The point is marked with marking pencil. 90° bend is made. Curve of 'U' loop is started, labial bow is on left. U loop is tried on the cast.

Tag is brought over embrasure towards the palate between canine and premolar.

Finishing of tag by bending a loop and keeping 1 mm away from palate. Similarly on the other side.

Adam's clasp or other retentive clasps are made.

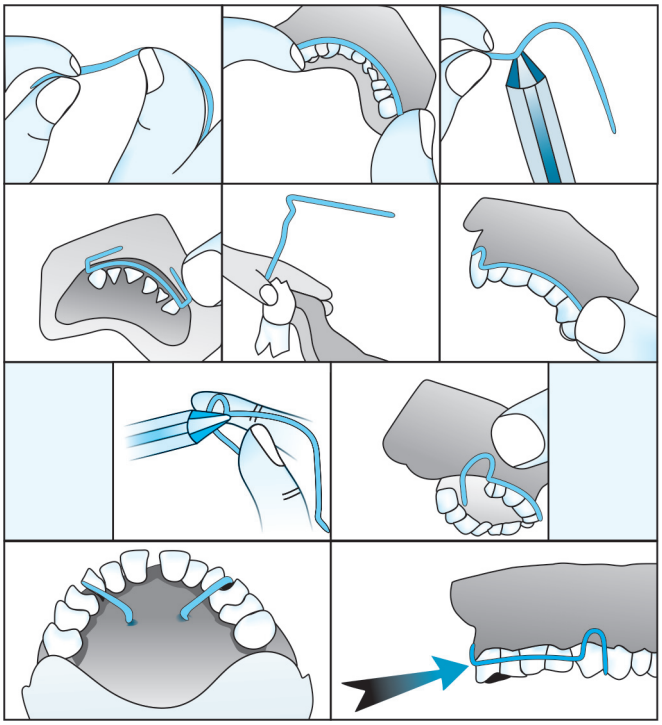

Fig. 5.25: Construction of retainer with anterior labial archwire

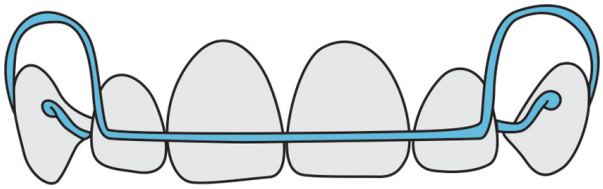

Fig. 5.26: A compromise design of more use on a reainer than on an active appliance

Heavy Wire Labial Bow

1. Labial bow with small loops (Fig. 5.26)

Indication

Small overjet and for squeezing irregular incisors.[6]

Activation

By squeezing the loops of bow so that only 1mm palatal displacement is possible.

Advantage

1. Finger can be incorporated with labial bow
2. With selective trimming of acrylic squeeze irregular incisor into line.
3. Rigidity of bow makes it suitable as retention appliance after active treatment.

Disadvantage

1. Slight activation of wire can produce excessive pressure.
2. Labial bow with large loops (Fig. 5.27)

Advantage

Light pressure over a long distance. Bow is useful in retaining the teeth in position after tooth movement.[6]

Disadvantage

Skill is required to control the activation of the bow at the same time prevent the wire from traumatizing the

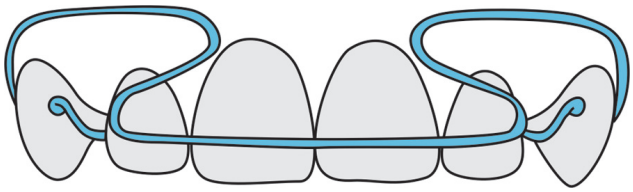

Fig. 5.27: A useful labial bow but not easy to adjust

sulcus. Wire tends to slide gingivally up proclinated teeth and must therefore be activated occlusally. Sometimes it is difficult to maintain the wire at right position on the teeth.

Mill's Labial Bow (Fig. 5.28)

Made from 0.7 mm wire. The amount of wire in the loop is as large as possible to increase flexibility.[10]

Activation

If an overjet is to be reduced, the bow should be activated by opening up the reverse loops. These labial bows are quiet rigid and the amount of activation must be small about 1 mm.

Split Labial Bow (Fig. 5.29)

Labial bow is divided into two labial arms at the incisor retraction stage.

Advantage

It gives more flexibility.

Adjustment

At 'U' loop.

Disadvantage

Rotation are difficult to correct; preservation of correct curve is necessary.

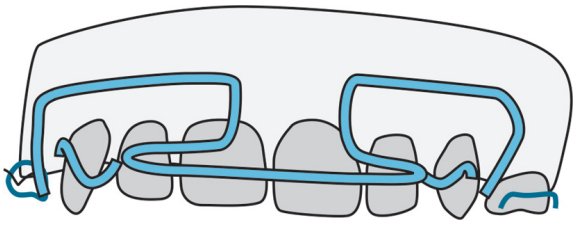

Fig. 5.28: A Mills' bow to retract the upper incisors

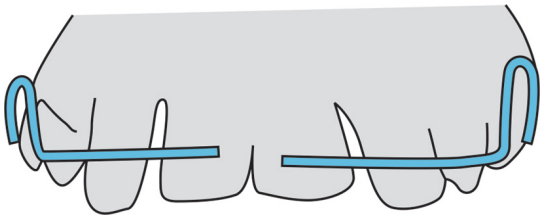

Fig. 5.29: The flexibility of a labial bow is greatly increased if it is divided

Labial Bow with Reverse Loops (Fig. 5.30)

The vertical loops which are made in this appliance, crosses the horizontal wire and then turned off in embrasure of lateral incisor and canine. It is made of 0.6 mm hard stainless steel wire. The tag arm is adapted mesial to canine.

1. It is used to close the space distal to canine in 1st premolar extraction cases after retraction of canine (as range of activation by canine retractor is reduced)
2. It can also be used in non-extraction cases to close the space between canine and 1st premolar.
3. Minor tooth movement.

Disadvantage

Too stiff for effective incisor retraction and to retain teeth in position.

Labial Bow with Finger Bent (Fig. 5.31)

Indication

To move the teeth mesially or distally to relieve crowding.

Construction

Five fingers are bent into labial bow base plate with retention clasp prepared. Distal movement of premolar is carried out by finger spring.

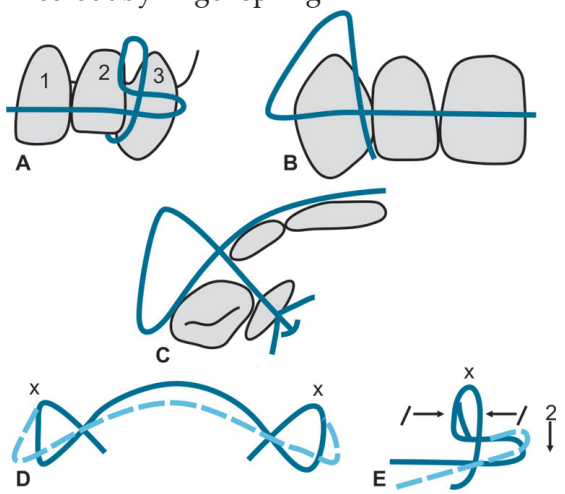

Fig. 5.30: The loop of the labial bow for the cuspid. A and B commonly used shapes in front view. C. To correct rotation of canine. D and E. Activation of labial bow at the loop D. opening the bend X; E. compressing at first the bend X (arrow 1) and Bending down the horizontal loop (arrow 2). To be activated lingually, the loop is bent against cuspid.

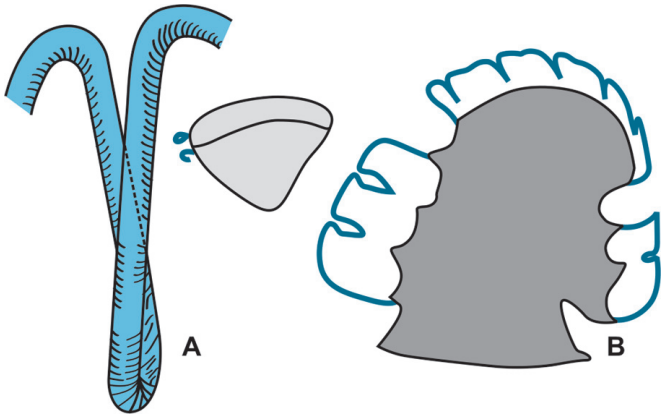

Fig. 5.31: Labial bow with finger bent

Activation

Its end is turned 90° to be easily placed at proximal surface of tooth. Activated by 1mm only in the intended movement.

Double Labial Bow (Fig. 5.32)

Indication

If different movements of the anterior teeth are intended at the same time.

A and B, one bow closes a diastema with fingers the other retrudes, intrudes, rotates the incisors. C, two labial bows to move lingually premolar, canine incisor and to move premolar mesially and canine with the arms of the bows, in a case of congenitally missing incisors. This construction is possible only in a case of open bite, in which the lower anterior teeth do not touch the plate in occlusion. Otherwise the plate would be dislodged. The plate must be relieved around the alveolar process of all lingually moved teeth. D, two labial bows combined with lingual springs to rotate all six anterior teeth.

Double Labial Bow Combined with Screw (Fig. 5.33)

Indication

When there is no space for eruption of lateral incisors and central diastema present.

The distance of the incisors which are embraced by the bows is automatically reduced by the expansion. Thus the space for lateral incisor will be obtained.

Labial Bow with Intrusion Claws (Fig. 5.34)

Indication

For intrusion and retrusion of incisors simultaneously.

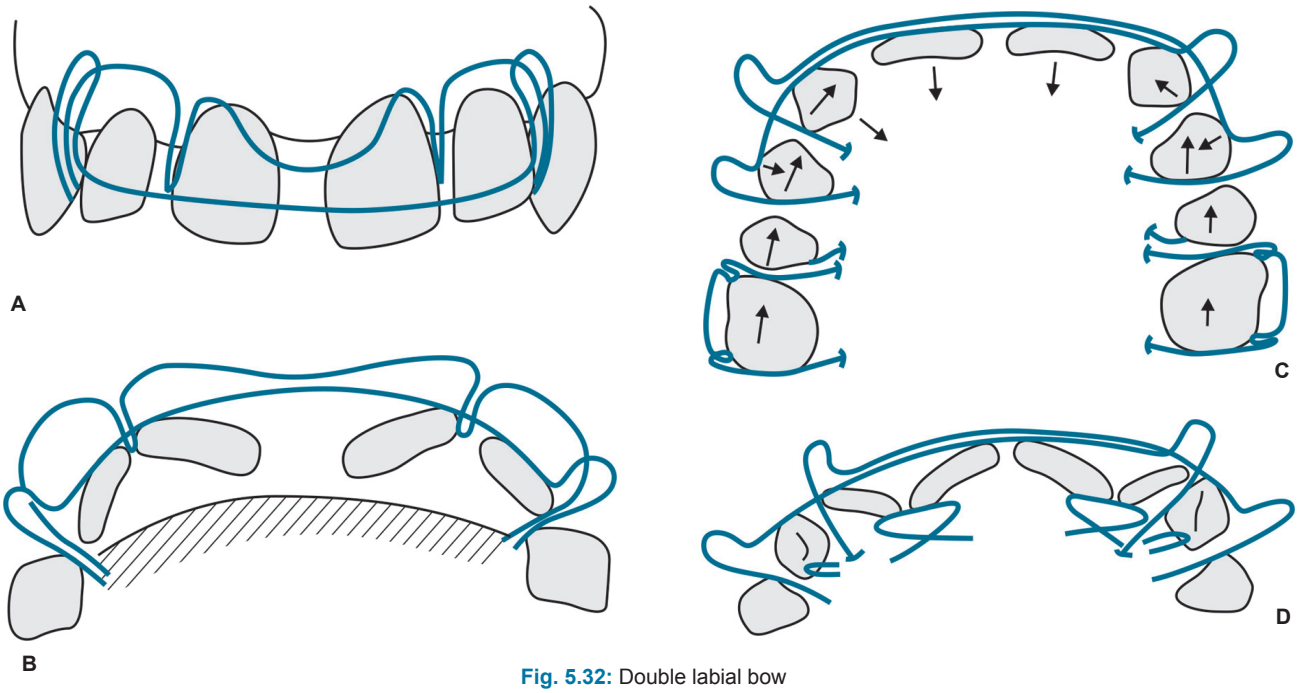

Fig. 5.32: Double labial bow

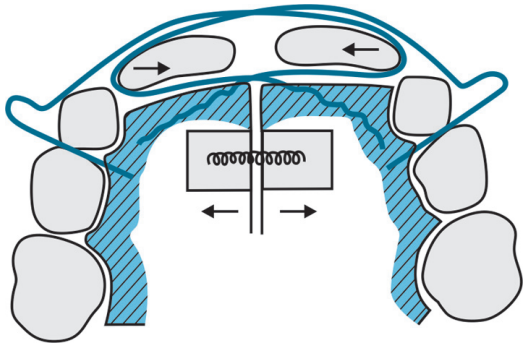

Fig. 5.33: The double labial bow combined with the screw to expand the jaw and close a diastema. The distance of the incisors, which are embraced by the bows, is automatically reduced by the expansion. In this way also the space for $I_2 + I_2$ will be obtained.

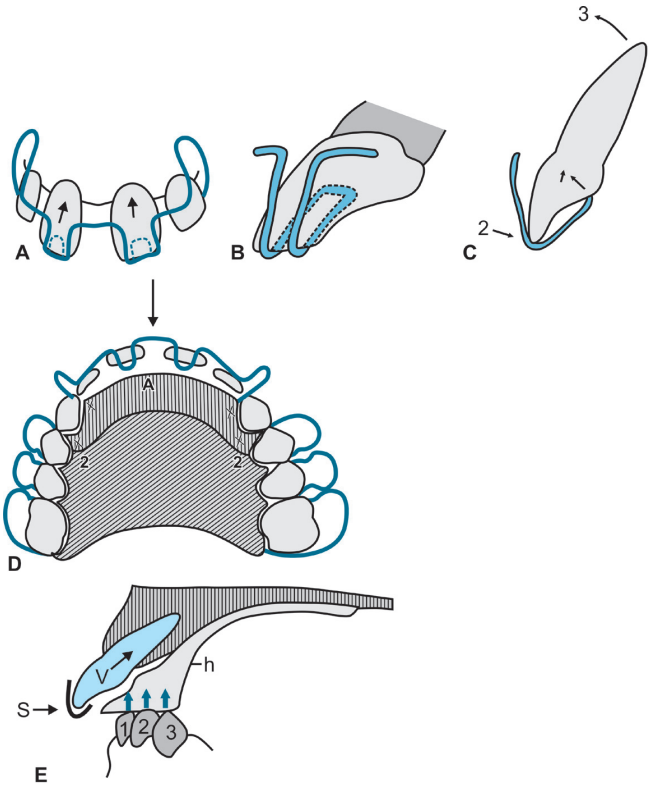

Fig. 5.34: Labial bow with intrusion claws

Design

C. Claws are prepared in labial bow. Touching the lingual surface near gingiva (arrow 1) and the incisal edge labially (arrow 1) and the incisal edge labially (arrow 2). The claw is designed to move the root of tooth labially (arrow 3).

D. Occusal view of a plate equipped with claws on the labial bow h, free space for simultaneous retrusion

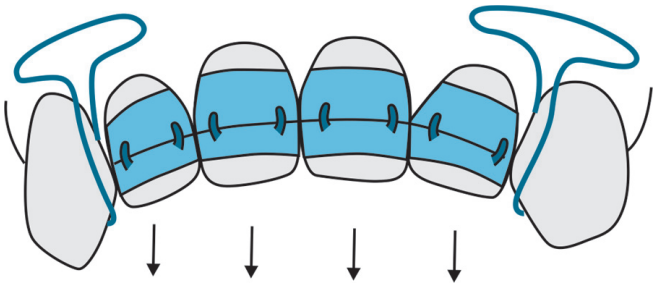

Fig. 5.35: The labial bow used to correct an open bite caused by intruded upper incisors. Every tooth is banded. Little hooks, open on the gingival surface, receive the bow. An expansion screw in the plate creates the necessary spaces at the same time

of the incisors (arrow) this plate has a bite plane, A. X1 the points where the lower cuspids touch the plane in cases of class 1 malocclusion. In cases of retrocclusion the lower cuspids touch at X2.

E. Sagitally section of D, showing the free lingual the free lingual space 'h' for retrusion of the incisors with their alveolar process. This free space must not to be moved lingually, for as the white arrows show, in this event the lower anterior teeth dislodge the plate from its contact with the palate. Therefore on one side at least the cuspid area of the upper must keep contact with the tooth and the palate.

Labial Bow for Open Bite Correction (Fig. 5.35)

Indication

To reduce the open bite by extrusion of incisors.

Design

Teeth which are elongated should be bonded with spurs attached to labial surfaces. Spurs open on gingval surfaces. So that labial bow may insert beneath the spur to provide the motivating force.

Activation

By squeezing labial bow.

Two Labial Bows for Retracting Teeth in Two Phases (Fig. 5.36)

Indication

To move lingually all front teeth and first premolars. Two labial bows are used to perform these movements in two phases. One on right side and other on left side.

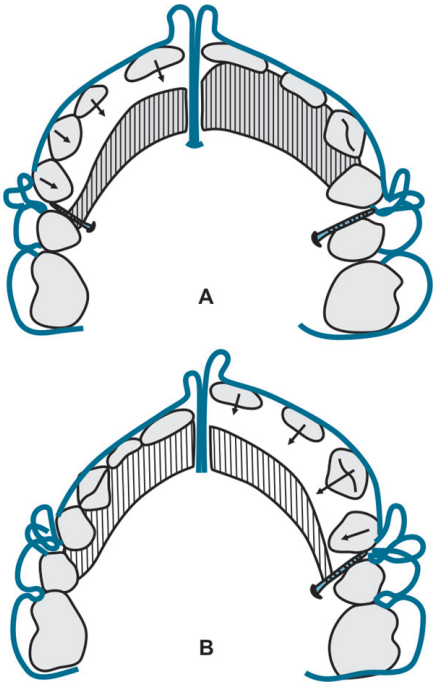

Fig. 5.36: Two labial bows for retrading teeth in two phases

First phase: The teeth of one side are retruded, while the other half of the bite plane (hatched) remains in contact with the teeth and the palate.

Second phase: After retension of the teeth on one side is assured, the margin of the plate is reclined to fit the lingual surface of the teeth with self curing acrylic, so that this half of the plate has contact with the teeth and the palate. Now the other side is retruded in the same manner.

Robert's Retractor (Fig. 5.37)

Indication

Retraction of proclinated upper incisors.

Design

Labial bow made from 0.6 mm hard wire and shape the coils. A piece of one half inch stainless steel annealed tubing having internal diameter 0.6 mm is used to slide them on straight ends of wire forming the apron until they touch coils. Adapt the ends of tubes to form tags by passing them over the embrasures distal to canines.

Activation

Adjustment is done by bending it in the vertical limb below the coil.

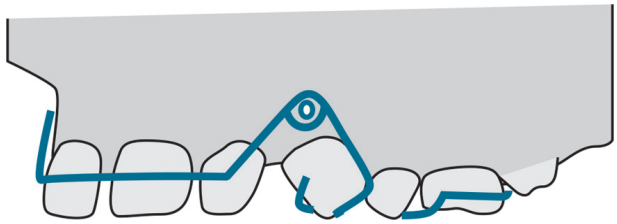

Fig. 5.37: A Robert's retractor

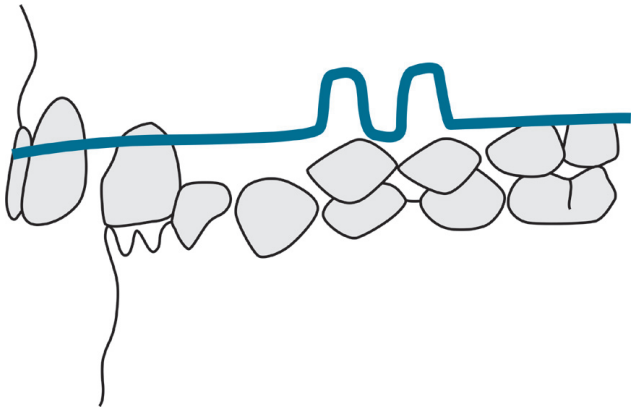

Fig. 5.38: Modified long labial bow

Advantage

Bow is light and flexible and adjustment of 3mm is suitable.

Modified Long Labial Bow (Fig. 5.38)

Design

Labial bow is made up of 0.7 mm, wire 3 loops are incorporated in one labial bow.

Activation

First and third gingival loops activation retract the incisors palatally. Middle loop or occlusal loop squeezed to bring the bow to its normal position after activation when it is raised.

Labial Bow with Coil and Loops (Fig. 5.39)

Indication

To push the canine palatally which is slightly bucally placed with the help of coil spring.

Design

Labial bow is made up of 0.6mm or 0.7mm stainless steel wire which has a coil on each side just in front of

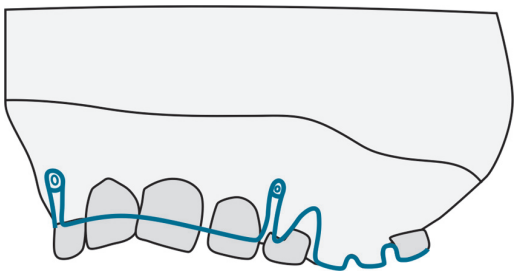

Fig. 5.39: Another type of labial bow used to retract 21/12

apex of upper canine, loops at canine region and then is brought straight down and fitted to press on the labial surface of upper incisor teeth.

Loop are used to retract the incisors.

Robert's Canine (Retractor: Labial Bow) (Fig. 5.40)

Active Component

Retractor in 0.5 mm wire supported by tubing 0.5 mm internal diameter.

Position of coil is at the center of the original position and final position of canine. Diameter of coil is 4 times as that of wire.

Retention and Anchorage: Clasps 6/6 (0.7mm)

Base Plate

Should incorporate stops mesial to 3/3. There should be an anterior bite plane to reduce the overbite. In order to maintain control of the lower incisor while it is trimmed back clear of the upper incisors, the bite plane should be at least two thirds of the height of upper incisors. It may be thickened by adding cold curing acrylic.

Recaution

Roberts retractor should not be activated where it emerges from the tubes, otherwise it will fracture in use. The bite plane should be progressively trimmed back clear of upper incisors.

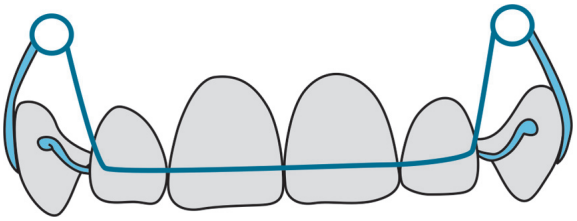

Fig. 5.40: An easily activated spring giving a light controlled force. Robert's retractor

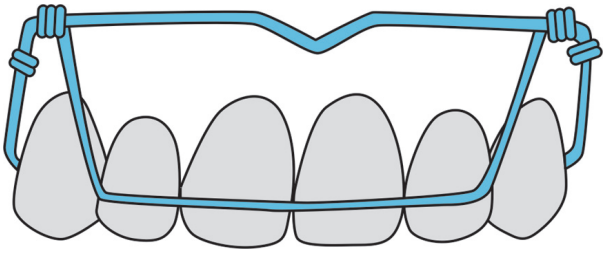

Fig. 5.41: Light wire labial bow

LIGHT WIRE LABIAL BOW

Apron Spring (Fig. 5.41)

Indications

Incisors which are proclinated excessively and periodontally weak.

Design

A strong supporting bow made of heavy wire, e.g. 1 mm. Bends should be kept sharp. It should be kept 2 mm away from mucosal tissue and does not exceed too far in labial sulcus.

Light wire of 0.5 mm diameter is wrapped on it forming an apron and bearing on most protrusive incisors. Ends forming the apron must appear from underneath the bow. Tags of apron springs are soldered to heavy labial bow.

Activation

By adjusting the apron spring so that is pushes proclinated teeth continuously.

Self Straightening Wire (Fig. 5.42)

Indication

Proclinated anteriors.

Design

The basis of this spring is a labial bow in 0.7mm wire incorporating medium adjustment loops. A light wire is wound on to the corner of one of these loops and its end hooked to the other side of labial wire. The retraction force is provided by the tendency of light wire to straighten itself across the arc formed by the

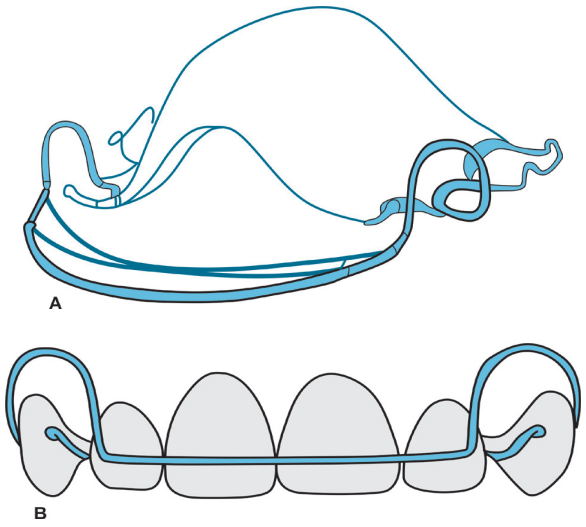

Fig. 5.42: A. Two fine wires are used to maintain arch symmetry. B. Another method using a light wire auxiliary

heavy labial bow. It is best to use a pair of these springs crossing in the midline to avoid any tendency to flatten one side of the arch anteriorly.

Advantage

Overjet can be reduced using a light wire which gives a light force. Heavy labial bow can be adjusted to provide retention.

Disadvantages

If the spring is not well constructed, it easy to find that it does not slide freely and that binding occurs. Unless bilateral wires are used and carefully controlled, it is easy to produce flattening of the arch anteriorly.

Light Wire Spring for Individual Tooth (Fig. 5.43)

Indication

For a single proclinated tooth.

Design

Heavy wire multiloop arch is prepared, a light wire of 0.5 mm is wrapped around the heavy wire so that it gives pressure on individual proclinated tooth.

SCREW APPLIANCE: FOR EXPANSION

On the basis of the region to be expanded or direction of expansion:

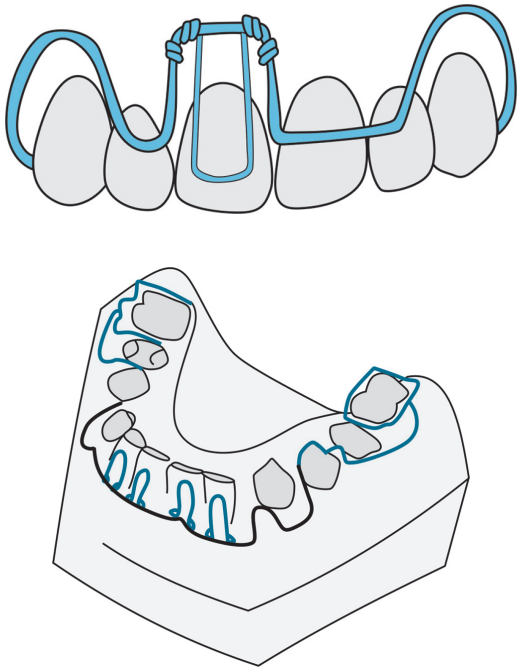

Fig. 5.43: A high labial bow with individual apron springs to retract 21/12

a. Expansion in lateral direction: Transverse appliance.
b. Expansion in Anterioposterior direction: Sagittal appliance.
c. Expansion in Anterioposterior and lateral direction – y shaped screw.
d. Expansion for distalization of segment of teeth. E.g. In case of canine retraction or molars.

Expansion Screw

Expansion screw is a metallic appliance which is used to move a tooth or group of teeth. The screw is a source of force with acrylic segment of plate affecting the teeth and alveolar process.

Indications

1. Expansion appliance with screw incorporating reciprocal anchorage and used to widen a dental arch by tilting or tipping the molars and premolars in buccal direction (cross bite).
2. Appliance with screw to move individual teeth or small groups of teeth in buccal/labial direction.
3. In mild class III cases with slight amount of upper arch crowding.
4. Repositioning of segments in cleft lip and palate patients.

Parts and Construction of the Screw (Fig. 5.44)

Screw consists of a threaded cyclinder (S1) which has a head in the center with 4 holes (H) to insert the key. For precise parallel movement of plate segments, the screw is provided with two guide pins (M1 and M2). The guide pins are placed parallel to the threaded cylinder. Smaller screws have one guide pin and are therefore easily distorted. The threaded cylinder and guide pins can be entirely encashed by the housing or only partially encased. The outside of the housing has grooves and under-cuts for retention in the acrylic. In some screws the guide pins are formed by one curved rod with parallel legs. The design offers additional retention in acrylic.

Screws are provided with a soft plastic tag covering central portion, therefore it becomes easy to hold the screw in place and it is torn off easily after processing.

A complete 360° turn of screw will produce a separation of 0.8 mm to 1mm. Holes in the center of screw allow for 1/4th turn incremental adjustment. Length of screw determines its maximum opening 5 to 8 mm.

Screw Position

The screw is accurately positioned in 3 dimensions only during construction. The screw should be in midline when bilateral expansion is required. Screw lies on an imaginary line passing between first and

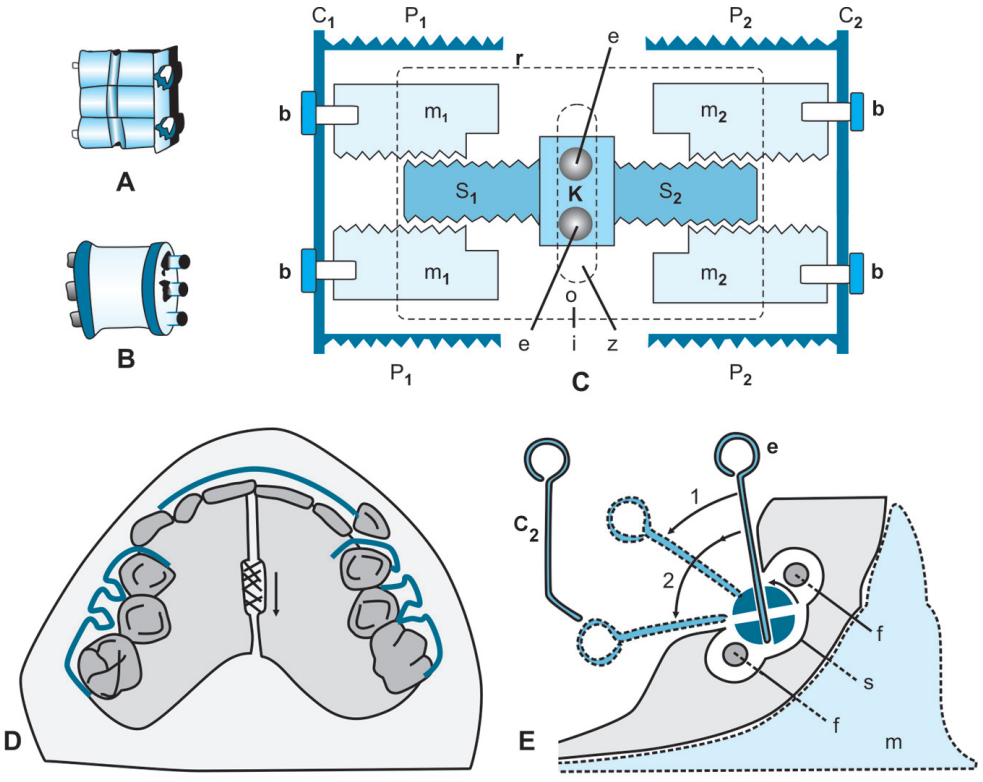

Fig. 5.44: Orthodontic screws. A, normal type (in actual size). B, Smaller type. C, Cross section through type A. The screw is opened to half its maximal expansions. (S_1S_2, the screw; k, head of the screw with holes for the key, e; m_1m_2, the nuts (guiding female parts of the screw); b, (dotted line), case with slot, z, and mark, r, which indicates the direction in which the screw is to be turned; p_1p_2, casing attached with the tiney screws, b). D, An upper expansion plate showing an arrow in the small groove near the opening of the screw, indicating the direction in which to turn; another mark above the screw indicates the point at which the dentist makes periodic measurements to ascertain that the widening is progressing according to schedule. E, Schematic sagittal section through the anterior part of an upper expansion plate on the model (s, the screw with the two holes for the key; f, the guiding rods; e, the key put in one hole, which is situated near the anterior border of the slot, z, shown in C); arrow shows a turn of 45 degrees, which is called a "half turn," arrow 2 indicates a turn of 90 degrees, until the key is stopped by the posterior borders of the slot, called a "whole turn". With this movement the next of the four holes appears at the anterior part of the slot. The patient or the parents must be explicitly instructed in the use of the screw. If the screw is placed at the side of the plate, the bent key e_2, is used. (From Schwarz, A., M., and Gratzinger, M.: Removable Orthodontic Appliances. Philadelphia, W. B. Saunders Co., 1966)

second premolar. In a narrow arch it should be placed posteriorly. Horizontal plane of screw should be parallel to occlusal plane. Orientation of screw determine the line of force and not the direction of cut of acrylic.

With the plastic tag the screw is positioned with arrow pointing in required direction.

Clinical Management

Adjustment needed every week ¼ th turn per week. Screw is turned by 90° will drive the parts of the plate apart by 0.2 mm, that means narrowing of periodontal membrane by 0.1mm on each side. It does not cause any harm in blood circulation, therefore effective way of gaining space.

The adult periodontal membrane is thin as compared to children therefore 45° turn/week is needed.

Advantages of Screw

1. Controlled movement.
2. Patient can activate it at home.
3. Various types of tooth movements are possible.
4. It can be added with functional appliances.

Disadvantages

1. Rely on patient.
2. Difficulty in cleaning.
3. Does not apply constant force.
4. Proper retention is must.
5. Over-activation may cause problem.

Uses of Expansion Screw

Transverse Appliance

It is an arch widening appliance. It is expanded laterally by opening of expansion screw, tipping of teeth bucally.

Sagittal Appliances

Sagittal is a latin word. Sagitta means arrow etymological basis. It is ninth sign of zodiac, Sagittarius the archer. Front to back i.e. anterioposterior.

It is an active plate and it is called as an arch lengthening appliance.

Screws are placed parallel to anterioposterior plane or parallel to the crest to alveolar ridge.

Component of Sagittal Appliance

1. Expansion screw
2. Labial bow
3. Retentive clasps

Labial bow: It is not an active component of appliance. It holds the proclinated or anterior teeth in position. So that the arch is maintained while expansion takes place.

Retentive clasp: To hold the screw in position. In expansion appliance 4 clasps are preferred to keep the plate in proper position.

Schwarz Appliances (Fig. 5.45)

It is developed in Europe. It is a horse shoe shaped removable appliance; fits along the lingual border of mandibular dentition.[5]

Indication

1. Mild crowding
2. Lingual tipping of incisors and posterior. Age: 6 to 9 years.

Activation

Once/week 0.25 mm, expansion in the midline.

Duration

3 to 4 months. 3-4 mm expansion anteriorly.

Disadvantage

1. Retention
2. Prone to breakage
3. More tipping movement.

Modified Schwarz Appliance (Fig. 5.46)

To overcome the disadvantage of typical Schwarz appliance, modification is done.

In this appliance a framework of 0.28 mm round wire is prepared around the molar crowns on each side. The buccal wires, running parallel to gingival margin act as the border of the appliance and provide added strength when the acrylic is ground down.

A wire mesh reinforcement is used specially in the cuspid region at the junction of acrylic and screw

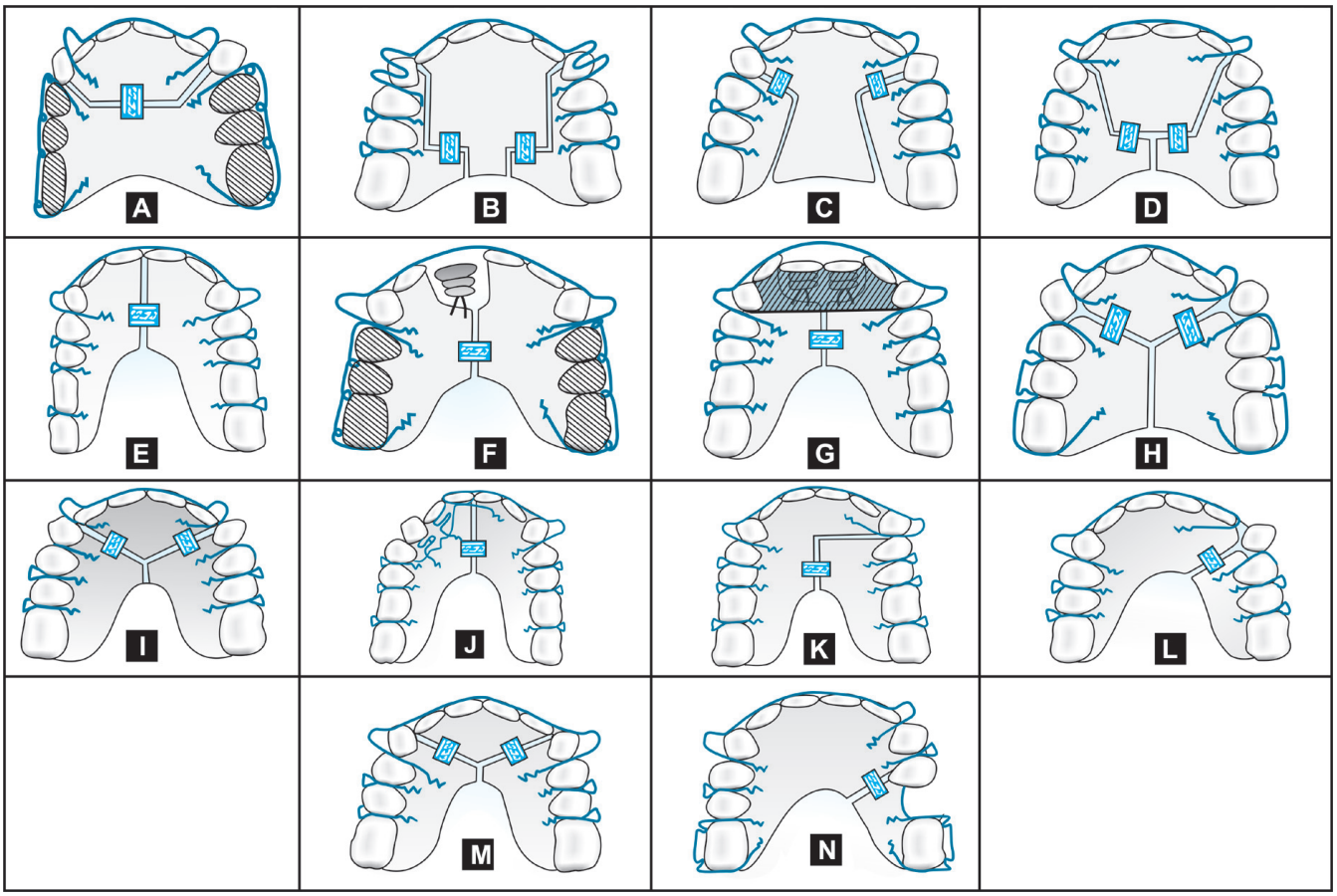

Fig. 5.45: (A) Plate for labial movement of all incisors. Lateral bite blocks are added for increased anchorage or for incisors in lingual occlusion (B) A very effective variation of the Y plate. Insertion of the labial wire into the lateral parts is combined with coverage of the largest possible part of the palate by the anterior part of the plate. U loops of the labial wire exert a slight pressure on the canines and are simultaneously activated by the turning of the screws. Anchorage with all Y plates may be reinforced by turning the screws on one side only alternately each week. A case treated with this appliance is shown (C and D). These two designs stabilize the anterior part of the plate by extending it over a large part of the palate. The screws act nearly entirely in a posterior direction. This will produce only a minimum of lateral expansion to compensate for the movement of teeth into a wider diameter of the dental arch. (E). The plate, showing a split along the midline, is used for the treatment of bilateral cross bite and minor crowding of the incisors. In this, as in most other figures, triangular clasps are shown. They are the simplest to form and are indicated in all these cases, though in some cases other clasps may serve equally well or even better. (F) Slightly crowded upper central incisor locked in lingual occlusion is tipped forward by a double loop spring after space is provided by moderate expansion. Lateral bite blocks are used. The plate is held in place by continuous eyelet clasps (G). Expansion of the maxillary arch and subsequent labial, tipping of slightly crowded upper central incisors in Class II, Division 2 malocclusion. The double loop springs can be adapted sagittally and mesially to remain in proper contact with the teeth moved. The closed bite is to be opened by a bite plate. The springs may be boxed in. Such plates are recommended for preliminary treatment before the insertion of functional appliances such as the bionator. (H) Y plates. The original Y plate of A. M. Schwarz used for the alignment of crowded canines by sagittal and lateral expansion. Lateral expansion is less if the screws ae directed more sagittally. (I) Y plates. The modernized Y plate A large part of the palate is left uncovered. Triangular clasps are used in place of the Schwarz arrow clasp. Small clasps anterior to the first premolars are necessary to make these teeth participate in the movement. (J) Expansion plate for the alignment of crowded upper right canine and lateral incisor. The right central incisor has moved over the midline and is brought back by the labial arch fastened with both ends inserted in the left side of the plate. Small helical springs exert pressure on canine and lateral incisors. The wire used for the springs is either 0.5 mm. or double 0.4 mm. The double wire enhances resistance to dislocation without loss of elasticaly. (K) Plate for unilateral cross bite. The larger part of the plate forms a block to serve as anchorage for the movement of the smaller part. The anchorage may be reinforced by the baseplate covering the palatal aspects of the buccal teeth on the side of the correct occlusion. Adams clasps may be used to advantage here. The plate is thin on the side to be moved. Bite blocks may also support the correction. (L) Y plate for the movement of teeth on one side only. (M) Y plate. The insertion of the tags of the labial wire into the lateral parts of the plate exerts a slight pressure in a posterior direction on the anterior part of the plate when the screws are turned. This serves to stabilize the anterior portion of the plate. The loops of the labial wire are small, permitting contact of the labial wire with the canines to guide them into the space provided by the expansion. Full palatal coverage may enhance stability. (N) Plate for opening the space for upper second premolar. The same plate may be used with screws on both sides for bilateral action. Similar constructions are made to serve the same purpose in the mandibular arch.

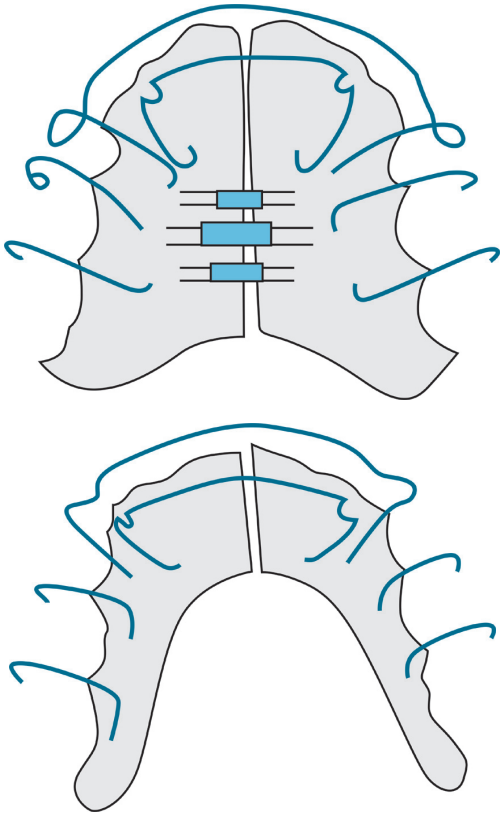

Fig. 5.46: Modified Schwarz appliance

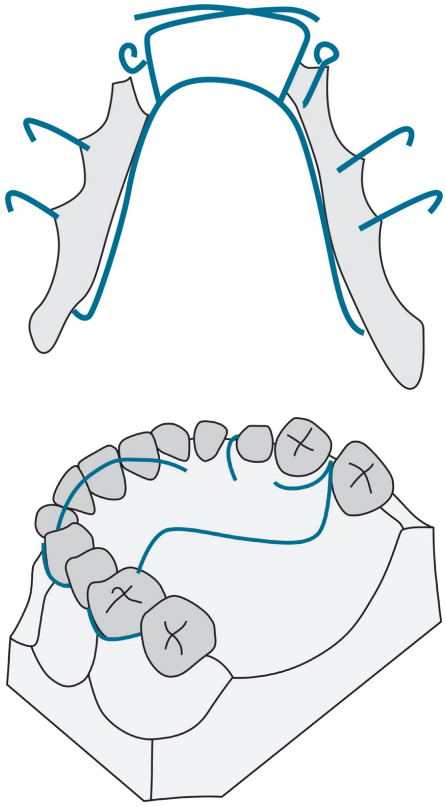

Fig. 5.47: Jackson appliance

assembly to discourage the formation of the fracture line. Using the larger 40 turn jackscrew assembly may save having to construct a second appliance because of insufficient expansion potential. The acrylic is extended distally and below the alveolar ridge with denture extension.

Advantage

1. Retention
2. Stability
3. Less prone to breakage.

Jackson Appliance (Fig. 5.47)

A specialized appliance for lower arches only. Body wire energized active plate repertoire found in 1887. Victor Hugo Jackson published lateral expansion appliance for lower arches.

Indication

Mixed to the lingual surfaces of lower teeth and lower alveolar crest by acrylic plate which snugly fit against them but do not cover the occlusal surface. No labial bow. The capability of having lap bilaterally lingually. Appliance was paddle springs resting against cuspids and is held in place with finger or ball clasp only. Slight vertical or pumping action of appliance is desirable.

Activation

Similar to Schwarz. Active force does not come from expansion screw but from lingual body wire. The appliance is open across the lingual of anterior region and two acrylic halves are held together by a large lingual wire running the entire length of lingual arch. This lingual arch body wire exists the acrylic on each side of appliance just distal to last molar. The last wire comes out (not down) here and travels the entire distance of lingual surface of lower arch to the same place on the opposite side. It is this wire that gives the appliance its springiness and provides source of power for lateral development.

Adjustment

To expand a lower Jackson appliance two Boley gauges and 3 prong pliers are needed.

With Boley gauges, measure the anterior and posterior end of appliance from the point of emergence of wire from appliance.

With 3 prong plier lingual body wire slightly at midpoint of wire just behind lower central incisors. Lap springs (crossover wires) adjusted to apply labial pressure to lower incisors either singly or in a group.

Nord Crossbite Appliance (Fig. 5.48)

By Dr. Nord in 1929 in Germany.

Indication

True unilateral posterior crossbite requiring one posterior segment to be moved laterally.

Plate

It is a transverse appliance with occlusal pads covering the upper posterior segments and an acrylic blade extending from the occlusal lingual edge of the correct side down to about against lingual surfaces of lowers. When the expansion screw is activated, plate tries to expand surfaces of lower molars against the blade of acrylic on the correct side; acts as a form of anchorage to prevent that side from moving laterally. Expansion takes place on deficient side. Thus cross bite correction without moving upper / lower arches apart on correct side.

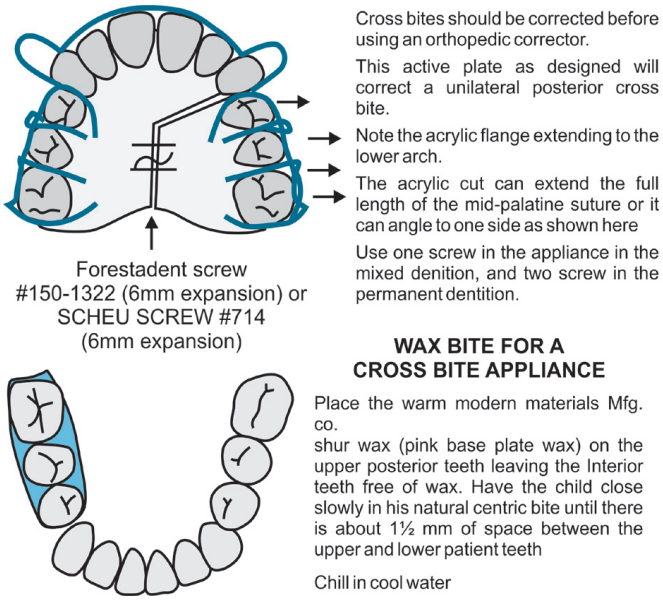

Fig. 5.48: Nord crossbite appliance

Crozat Appliance (Fig. 5.49)

George B. Crozat of New Orleans. By all means removable wire appliance relies on the tension produced by body wires to produce light and intermittent active forces that combine with natural forces of occlusion to produce bodily tooth movement.

Philosophy of Crozat

Dr Crozat did not believe in moving teeth by sheer force alone but rather by more natural methods using light and intermittent forces allowing to function its way, taking advantage of period of rest.

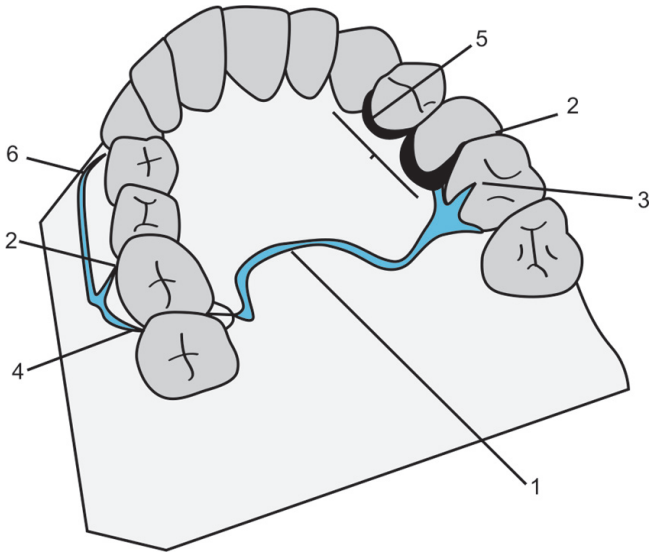

Fig. 5.49A: Maxillary Crozat appliance. The basic appliance is composed of the following standard components: (1) The body wire, which is omega-shaped in maxillary appliance and is adjusted in a manner identical to body wire of Jackson appliance in mandible. (2) Both upper and lower appliances are held in place by circular clasping components called cribs. These cribs always possess (3) occlusal stops to prevent overseating of appliance and (4) crescents (shown here adjusted out and away from embrasure area for better visualization), which are small buccal clasps soldered to buccal surface of crib wire. They are made a little too long by drilling small holes into buccal interproximal spaces of construction model. Therefore they must be ground and adjusted by hand to exactly proper length to allow proper seating and retention in mouth. They are ground back to proper length with common green stones or heatless stones and set with small occulist pliers by crimping them in toward interproximal undercuts. (5) Lingual arms (which may be sent according to contours of bicuspids or left straight) extend from lingual portion of crib and are used to flare bicuspids buccally. (6) Extensions from buccal portion of crib (sometimes used for Class II elastics) on maxillary appliance are referred to as ½-high labials. Auxillary springs are often placed on lower (similar to lap springs or criss-cross wires) to control lower anteriors.

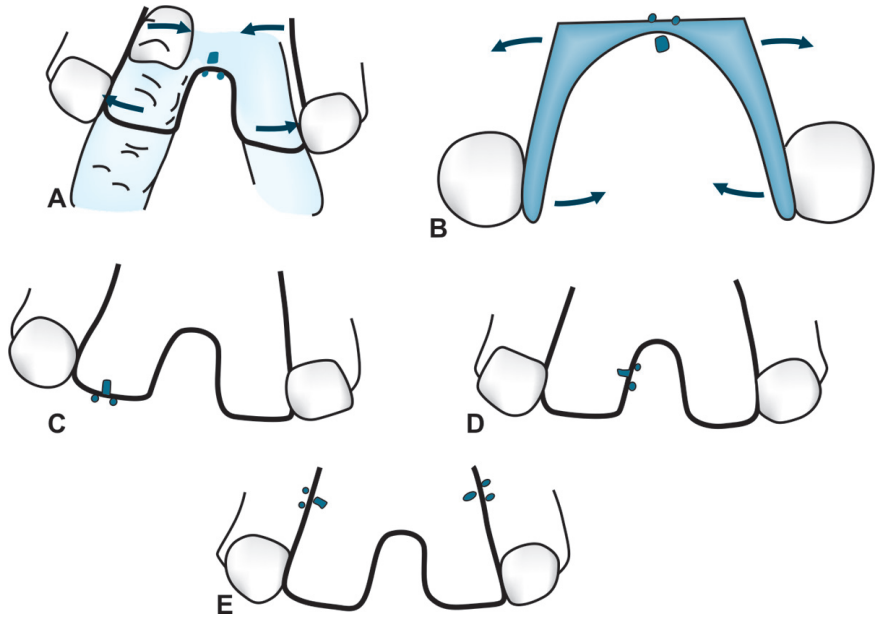

Fig. 5.49B: Crozat appliance adjustments. (A) Holding the three-prong pliers in this fashion on omega loop of body wire of this maxillary Crozat will expand molar cribs outward but bring tips of lingual arms inward. (B) Holding the three-prong pliers in opposite fashion on body wire of this mandibular Crozat will contract molar cribs inward but bring tips of lingual arms outward. (C) To rotate molar cribs (usually counterrotation buccally after expansion of body wire), place three prongs of pliers around junction of body wire and crib and using pliers as a vice (D) gently but firmly rotate the body wire away from the crib in a level manner in appropriate direction. (E) Lingual arms may be adjusted as needed for management of bicuspid teeth.

Indication

By virtue of tight clasping mechanism the appliance allowed Dr. Crozat to rotate molars. This relieves anterior crowding and also increase vertical dimensions slightly and distalization of molars is also possible.

Appliance Design

Maxillary Crozat appliance is composed of:

1. *Omega shaped palatal body:* It is made of 16 gauge wire tempered nichrome, gold with the bow of omega across the roof of valut of palate facing premaxilla (opposite direction of coffin spring). Base of omega loop descends from roof of palate and not impinging.
2. *Cribs:* They are attached to first molars and must fit precisely to provide retention necessary to carry out desired ortho movements without dislodging the appliance. Crib wires were made up of 21 gauge gold 0.7 mm tempered. Nichrome is exclusively used crib design essentially circular encompasses the entire tooth and by virtue of its horizontal and vertical components which are usually parallel to each other and buccal cusps. Horizontal component of crib should lie on the height of contour.
3. *Crescents:* To increase retention, Roach like clasps called crescents are added on buccal or labial of the crib just below the height of contour and are extended into mesial and distal undercut areas gingival to interproximal contact.
4. *Occlusal wire rest or stop:* (21 gauge, 0.028 inch, 0.7 mm) running up into the lingual groove to prevent displacement of wire gingivally.
5. *Lingual arms:* It is usually made of 18 gauge, 0.036 inch. Nichrome are extended from lingual surface of crib forward to first bicuspids area. They may be adjusted to apply pressure or lingual surface of bicuspids.
6. *Half high labials:* It is extension from buccal portion of crib on maxillary appliance. It is referred as half high labial.
7. *Auxillary springs:* Similar to lap springs or cross over wires in active plates. They are often added to lower anterior area to manage incisor teeth.

Adjustments

Expansion of lateral direction in upper arch by opening out the omega loop of body in upper or lingual arch of body wire on lower arch.

Three prong plier, a flat to flat plier, two boley gauges. With Boley gauge measure from the tip of right lingual arm to tip of left lingual arm with flat pliers gently compress the centermost point of main body wire so that cribs expanded by 3 mm over there; initial distance from each other represented by first Boley gauges. 3 mm load of appliance starts tipping teeth buccally.

Activation

After every 4 week intervals first measuring the appliance inside then outside the mouth to determine how much expansion must be added per 3 mm load.

Removable Quadhelix Appliance (Fig. 5.50)

The quadhelix appliance was developed from the 'W' type of expansion spring which was soldered to molar bands. Originally used by Ricketts (1973) to treat cleft palate patients with narrow palatal arches. Lateral arms gave adequate expansion both in anterior and posterior regions. In order to increase flexibility and improve the control of molars, four helical loops were introduced and quadhelix assumed its present design.

DESCRIPTION AND DESIGN

The MIA (Mobile Intra-Oral Arch) quadhelix is constructed from 0.035 inch (0.9 mm) stainless steel wire and is available in three sizes.

Extra long lateral arms allow contact with the anterior teeth. The long arm have also been found useful to facilitate handling of the appliance during fitting at the chairside.

Curved retention loops fit precisely into similarly curved lingual sheaths which are welded to the lingual surface of the upper first molar bands. The curve of the sheath has its concave side to the occusal, allowing easy insertion and removal of the appliance, avoiding the anterior teeth. Distal end of the retention loop must slide through the sheath and extend beyond the distal position by slipping a large elastic module over the lateral arm and pulling it over the distal end of the retention loop.

Clinical Management

Fitting

The quadhelix may be adapted either directly at the chairside or indirectly in the laboratory. The direct method requires fewer appointments by clinician. Chairside time is increased.

Direct Method

Upper first molar bands with suitable buccal attachments are selected. The bands are placed, and the mark is made on their lingual surface corresponding to the mesial end of the lingual sheath. The lingual sheaths are welded on the bands which are then cemented into position.

A quadhelix to correct size is chosen using study model as guide. The anterior helices should be positioned at the level of the first premolars and posterior helices at the level of sheaths, the lateral arms are longer but useful to cut only the side being adapted. The arms, when adapted should contact the teeth as needed and adjusted as treatment progresses.

The quadhelix is fitted passively at first by inserting one retention loop of the arch and observing the relationship of the loop to the sheath on the opposite side. Adjustment are made until the loop opposite lies directly and passively above its sheath.

At this stage following points should be checked.

1. Quadhelix lies passively.
2. The quadhelix lies close to but not in contact with the palate.
3. The posterior helices should lie parallel to the vault of the palate so as to reduce interference with the tongue.
4. The lateral arms extend forward and are shaped to follow the curve of anterior teeth.

Indirect Method

Upper first molar bands with suitable buccal attachments are selected and fitted. Lingual sheaths are welded into position. An alginate impression is taken over the first molar bands, the bands are then removed, and seated into the impression. The working model is then cast, with the bands in place and the quadhelix can be adapted to fit the model in the laboratory.

It is important that the adapted quadhelix lies passively on the model, ready for fitting in the mouth. It is advisable to adopt the appliance and to fit it

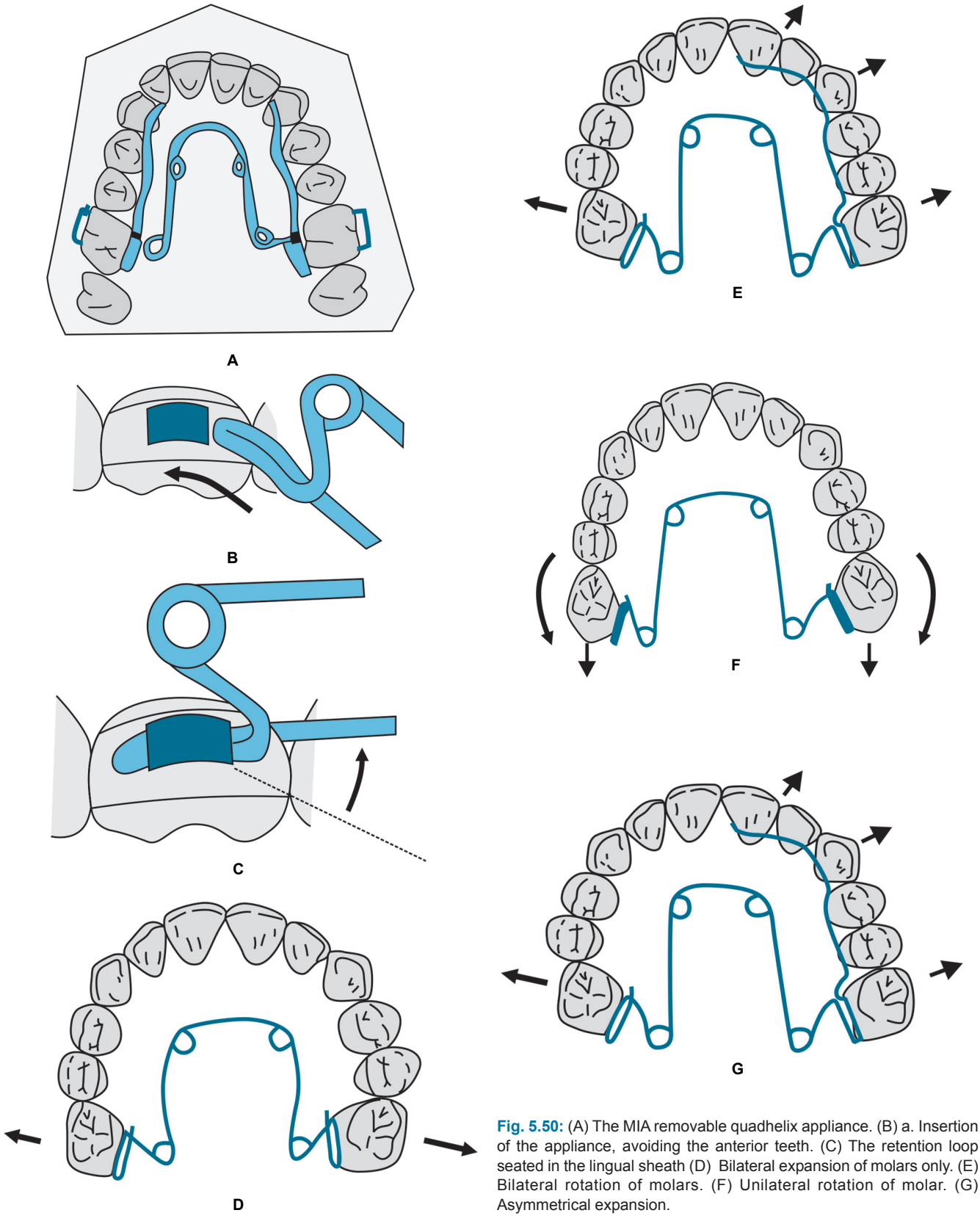

Fig. 5.50: (A) The MIA removable quadhelix appliance. (B) a. Insertion of the appliance, avoiding the anterior teeth. (C) The retention loop seated in the lingual sheath (D) Bilateral expansion of molars only. (E) Bilateral rotation of molars. (F) Unilateral rotation of molar. (G) Asymmetrical expansion.

initially so that it is passive in the transverse plane. Molar torque and rotation may be included from the start of treatment.

Activation

Activation to expand the arch is carried out at the next visit. This is carried out extraorally using flat pliers and finger pressure. The amount of activation is checked by inserting one side and observing the relationship of the retention loop to the sheath on the opposite side. It is recommended that for an eight week period, activation should not exceed the following amounts.

Expansion: 3 mm; Rotation: 20°; Torque: 10°. Checkup of patient is seen every 6 week. Removal, activation and reinsertion of the appliance is quick and simple. The relapse may be successfully compensated for by over expansion of 2.3 mm during the active phase of treatment.

Advantages of Removable Quadhelix

1. The appliance can be removed and reinserted easily at the chairside, avoiding dehanding and recementation.
2. Activation ix extraoral. This allows increased control and precise adjustment at every visit.
3. Buccal root torque can be applied to the first molar. This is reactivated and checked at each appointment.
4. Quadhelix should follow the shape of the palate when fitted. There is thus less tongue involvement with the conventionally shaped quadhelix.
5. It is simpler to correct localized pressure areas on the palatal mucosa.
6. The appliance can be left in place whilst conventional treatment is continued or it may be removed without the need for new molar bands.

There are difficulties which may be encountered when the appliance is first used.

1. During fitting of the quadhelix, it is important to avoid distortion of the retention loops. They are made to fit the sheaths precisely.
2. The retention loops sometimes require considerable adaption before they lie passively in the sheaths.

Clinical Applications

In addition to symmetrical expansion of buccal segments, the removal quadhelix allow the following tooth movements.

1. Bilateral expansion of molars only (Fig. 5.50D)
2. Bilateral rotation of molars (Fig. 5.50E)
3. Unilateral rotation of molar using the teeth on the opposite side as anchorage (Fig. 5.50F)
4. Asymmetrical expansion of posterior teeth using different lateral arm lengths (Fig. 5.50G)
5. The addition of helices for differential expansion Figure 5.50D shows a case with bilateral cross bite in molar region and a crowded upper labial segment with L2 in lingual occlusion. A removable MIA quadhelix was adapted and fitted directly with an addition helix added to the lateral arm on the left side (Fig. 5.50G) when the cross bites in the molar region had been corrected, the lateral arm was activated to procline L2 over the bite. Edgewise brackets were then placed for correction of rotation and further alignment, leaving the quadhelix in position to retain the expanded buccal segment.
6. For expansion of upper second molars, it is a fairly simple procedure to initiate their correction during treatment with the removable quadhelix appliance bands with appropriate buccal attachments and cemented to 7/7 and a stiff rectangular wire is then tied in so that the second molars move as a unit with the first molar.
7. Retention following rapid maxillary expansion. Use of the removable quadhelix considerably simplifies the retention phase following treatment of a narrow upper arch with rapid maxillary expansion.

BITE CORRECTION APPLIANCES

Acrylic component is used in removable appliance for bite correction. When base plate is thickened or extended locally to form bite plane it gives an active tooth movement i.e., extrusion or intrusion of teeth.

Anterior Bite Plane (Fig. 5.51)

It is a thickened platform of acrylic palatal to upper incisors on which the lower incisors occlude leaving the posterior teeth out of occlusion.

Indication

- In C1 II div 2
- In C1 I deep bite with low facial height.

Contraindication

- High facial height
- Skeletal deep bite

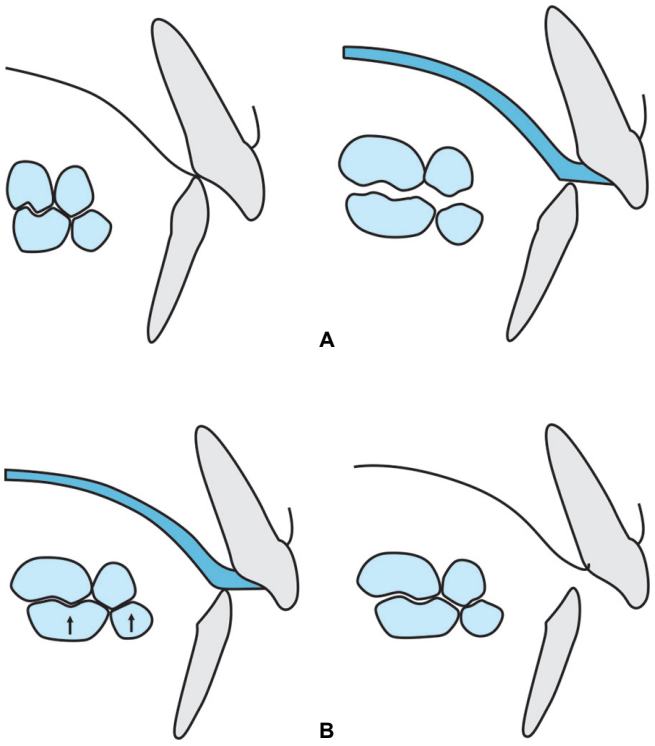

Fig. 5.51: (A) Anterior bite plane. Incisor overbite is increased and complete. The bite plane produces molar separation when the appliance is fitted. (B) Continued wear allows the posterior teeth to erupt into occlusion. With the appliance removed, the incisor overbite is now incomplete.

Advantage

Overbite reduction take place due to over eruption of posterior teeth and intrusion of lower teeth. Curve of spee correction is also possible if it is very slight.

Due to molar extrusion, mandible rotates downward and backward tending to increase the vertical height.

Construction and Adjustment of Anterior Bite Plane

Bite Plane

Laboratory supplies an appliance with a bite plane which is too thick and extends too far. After fitting into mouth adjustment are done.

Correction of Height

Articulating paper is used to aid the reduction of bite plane so that posteriors are separated by 1-2 mm. This allows patient to masticate the food and thus faster eruption of posterior.

Horizontal Adjustment

Surface of bite plane is parallel to occlusal plane and horizontal. Occlusal load should be spread over all six anterior teeth.

Acrylic distal to the markings of lower incisors obtained by articulating paper should be removed. Appliance is then finished and polished.

Adjustment of Bite Plane During Treatment

Appliance is worn full time, overbite reduction should be visible by one month. Molars should have over-erupted.

If bite opening requires, again the bite is increased and adjusted in subsequent visits.

Acrylic is trimmed from lingual surface of upper teeth to allow the incisor alignment and overjet reduction but care should be taken that this will not remove support from any of the lower anterior teeth.

Posterior Bite Plane (Fig. 5.52)

It is thickened acrylic which is used to cover occulsal surface of posterior teeth bilaterally to "Prop the bite" and so relieve cuspal lock.

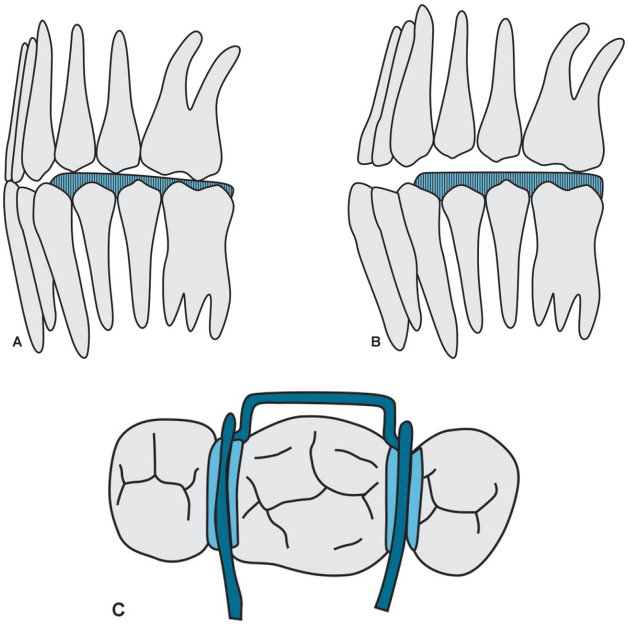

Fig. 5.52: (A) Posterior bite plane. A common error; the bite planes are too thick and of uniform thickness, this props the bite posteriorly. (B) Correctly adjusted posterior bite plane giving even occlusal contact and minimal separation. (C) Clasp arms should be free from the acrylic of the bite plane where they cross the embrasure. This is achieved by adding wax before the acrylic is laid down

Indications

Anterior crossbite, buccolingual crossbite, slight open bite.

Clinical Applications

1. *Incisor crossbite:* A single upper incisor has been caught deeply behind the bite of lower incisor. Posterior bite plane is used to free occlusion before attempting to move the misplaced tooth. If the locked incisor is pushed labially without freeing the occlusion, the intermittent impact of occlusion against steady forward pressure on the tooth soon produces a marked loosening of the tooth and periodontal pain.
2. *Buccolingual correction:* Posterior unilateral crossbite which occurred due to lateral mandibular displacement.

   Posterior bite planes should be minimum height and used for shortest possible time.

Correction and Adjustment of Posterior Bite Plane

The parts of clasps must not be incorporated into acrylic covering occlusal surface of teeth to maintain the flexibility of the clasps.

Adjustments: Reduction in the height of bite plane is such that it only eliminates occlusal interferences. Its height should be accepted by patient.

Catlan's Appliances (Fig. 5.53)

Lower anterior inclined plane was first introduced by Catlan more than 160 years ago.

Indications: Anterior cross bite

Construction: Inclined plane can be prepared with self curing acrylic, directly on the patient and cemented on incisors or indirectly on the plaster model and then cemented. It should have inclination of about 45° to occlusal plane.

SVED Bite Plane (Fig. 5.54)

This appliance was suggested by Alexander in 1947. This is an upper inclined bite plane. It consist of horizontal biting platform sited behind the upper anterior teeth and also a cap of acrylic resin covering the incisal tips of these teeths.

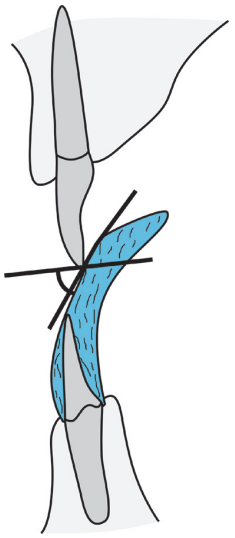

Fig. 5.53: Catlan appliance

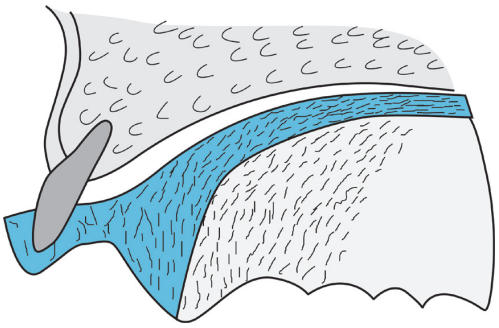

Fig. 5.54: SVED bite plane. SVED bite plate with anterior inclined bite plane

Indications:
1. Deep overbite cases;
2. To bring the mandible forward.

Function:
1. To open the bite by extrusion of posteriors.
2. Intrusion of lower incisors.
3. Inclined biting platform produced proclination of lower anteriors.

Advantages:
1. Capping of upper anteriors prevents the spreading of incisors.
2. Anchorage is provided therefore distal movement of plate is prevented.

Disadvantages: Capping causes staining and decalcification of incisal edges if care is not taken.

Procedure

1. Mount the models on a straight line articulator.
2. Construct Adam clasps on 6/6 from 0.7 mm hard stainless steel wire on model upon which appliance is to be made.
3. Adapt a single sheet of modelling over the palate covering the clasp and incisal half of upper anteriors labially.
4. Build up the plane with wax, lingually it should extend about 2mm behind opposing anteriors.
5. Flask, pack in clear resin and finish as usual.

APPLIANCE FOR ROTATION CORRECTION

If an adequate space is available, a single rotated tooth in a patient with an otherwise acceptable occlusion may be rotated with a "whip".

An Attachment to the Tooth (Fig. 5.55)

Either a begg or edgewise bracket may be used, cemented via a single hand or bounded directly to the tooth.

A Sectional Wire

A sectional wire or whip is attached at one end to the bracket on the tooth while the other is hooked to a suitable site on the removable appliance. Care should be taken that wire should not rotate on its long axis. Wires which are relatively inflexible should incorporate suitable coils to reduce the stiffness.

Removable Appliance

Appliance will require clasps for retention and will need extra clasps or a labial bow to engage the hook of the whip. For mesio- labial rotations a plane hawley type bow will serve well. For disto-labial rotations site of engagement is bridge of clasp on molar or premolar.

Rotation Correction with Removable Appliance (Fig. 5.56)

Mild rotation can be corrected using this appliance. An appliance to derotate an upper central incisor.

Active components: A couple must be applied to the teeth. This can be generated by a labial bow and a palatal spring. If the palatal aspect of tooth is already in the line of arch, contact with the baseplate, without palatal spring may be adequate.

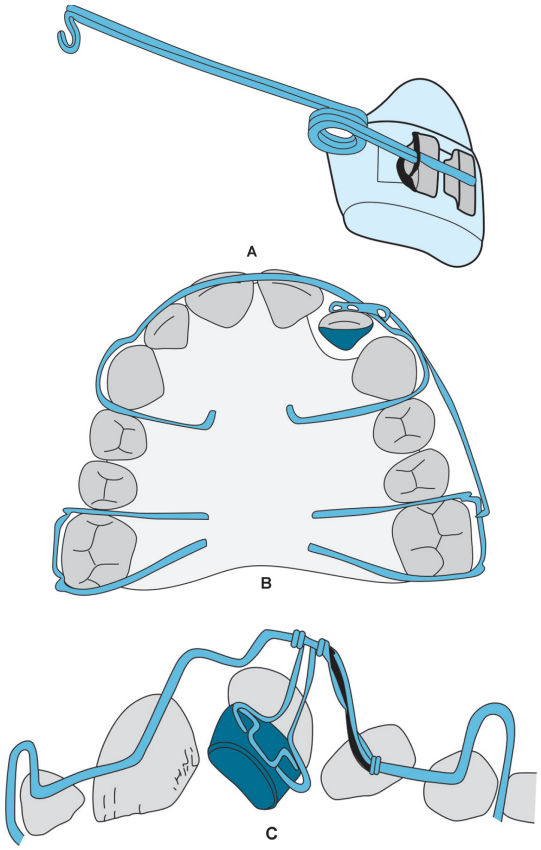

Fig. 5.55: (A) A whip constructed in rectangular wire will not rotate within the bracket slot. The incorporation of coils will allow a light force to be delivered for the correction of a rotation. (B) Where an incisor has a disto-labial rotation the whip can engage onto the bridge of a molar or premolar clasp. In the case of a mesio-labial rotation the whip would engage the labial wire. (C) Showing a fine wire T spring used to rotate an upper incisor. Note the band on the central with a labial hook facing downwards

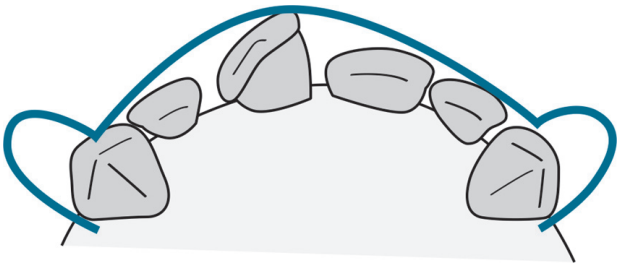

Fig. 5.56: A rotated 1 to be aligned with a U loop labial bow (0.7 mm). The labial bow is activated progressively

Retention: Clasp on 6/6

Anchorage: Provided by baseplate, anchorage is not a problem.

Baseplate: This is trimmed well clear of a labially displaced aspect of the tooth but should be left in contact with palatally positioned surface.

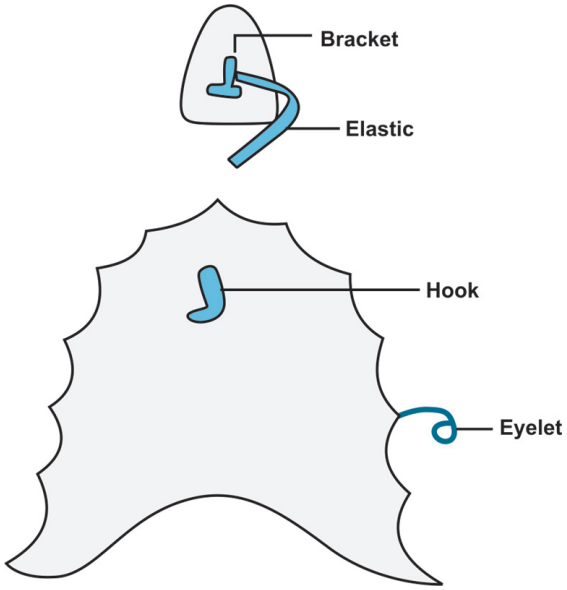

Fig. 5.57: Hooked appliance

Hooked Appliance (Fig. 5.57)

A band is placed on the rotated tooth. Bracket is placed on the lingual or labial surface of bands according to the change of rotation of tooth.

An elastic is worn from bracket to the hook which is on palatal or labial side. Elastic is changed after alternate days. Posterior bite plane is required to cause the clearance in occulsion so that movement of tooth is free.

CHAPTER

Passive Appliances

6

TYPES OF PASSIVE APPLIANCES

1. Retention appliances
2. Space maintainer
3. Habit breaking appliances

RETENTION AND RETENTION APPLIANCES

After completion of active mechanical tooth movement, there follows a period when the teeth are held in their new positions.

Five different classes of retention may be considered.

a. When the tooth which has been moved is locked in its new position. E.g. Upper incisor moved over the bite of lowers.
b. Where the tooth which has been moved instable in its new position. E.g. Retention of canine in premolar space.
c. Tooth which has been moved is unstable in new position owing to abnormal muscle behaviour pattern. E.g. Upper incisors in C1 II div 1 malocular.
d. When the tooth which has been moved has undergone rotation.
e. Where the tooth which has been moved is unstable and requires permanent retention.

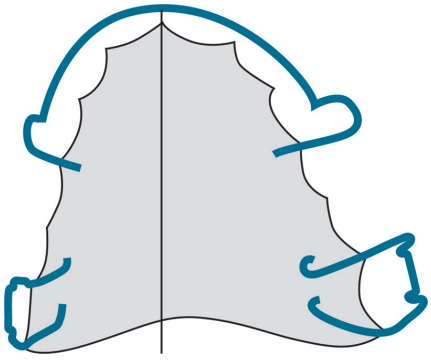

Fig. 6.1: Hawley retainer

Removable Retainer

Hawley Retainer (Fig. 6.1)

It consist of an upper plastic base with molar clasp. A short labial bow and a short inclined plane to retain the almost all movements of upper teeth and particularly used after treatment of the C1 II div 1 cases. Inclined plane should prevent relapse of lower incisors if they have been proclinated.

Simple Hawley Retainer without Inclined Plane (Fig. 6.2)

It is a simple labial bow and Adam appliance which is used to restart the incisor; can be used as a retention appliance. It is made up of 0.7mm wire.

Wraparound Appliance (Fig. 6.3)

Simple Hawley appliance in which the wire is wrapped around mesial and distal surface of each tooth, it is maintained in its position.

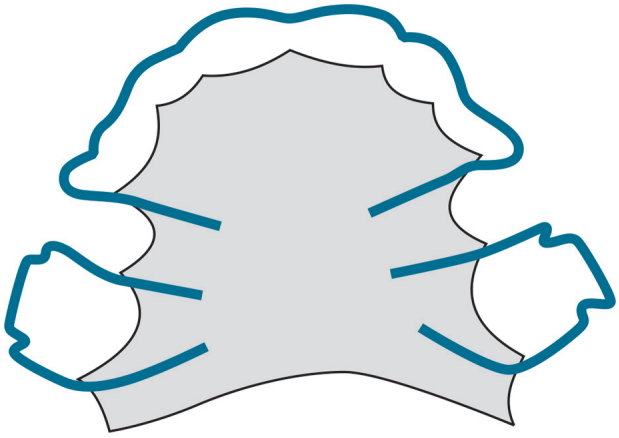

Fig. 6.2: A retainer

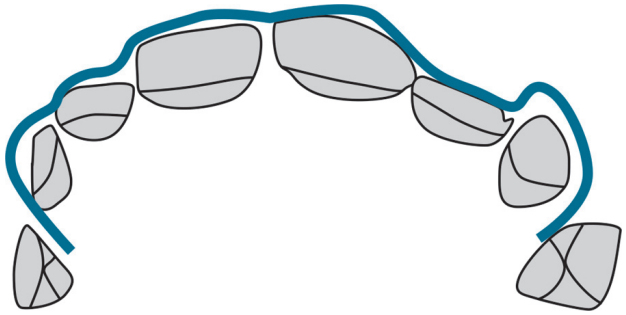

Fig. 6.3: Wraparound appliance

Andersen Appliance (Fig. 6.4)

Following fixed intermaxillary traction of short duration, Anderson appliance is very useful to retain the arch relationship whilst adjustment of occusal plane and reduction of muscular behaviour pattern are taking place.

Indication: C1 II div 1 malocculsion.

Oral Screen (Fig. 6.5)

When upper incisors have been retroclinated as for e.g. C1 II Div 1 which has been treated by extraction of first premolars and retraction of upper labial segment.

Duration of retainer: After rapid tooth movement retention of upper incisor at right only. Appliance is then discarded for one month and occlusion checked. If there is any relapse the appliance is reinserted for a further 3 to 6 months.

Continuous Clear Retainer (Fig. 6.6)

In a standard Hawley retainer, due to crossing of wires there tend to remain spaces and interference with the occlusion.

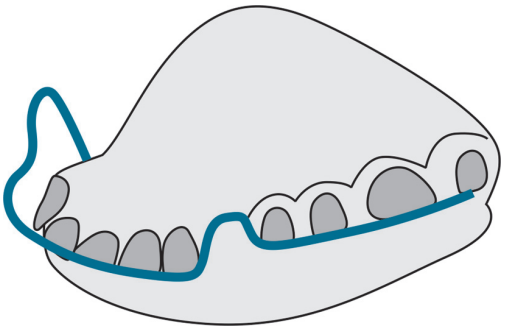

Fig. 6.4: The Monobloc. Note this is also called the Andersen appliance or Norwegian appliance when it is made as an active appliance

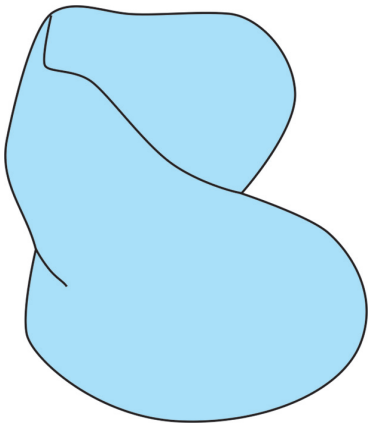

Fig. 6.5: Oral screen

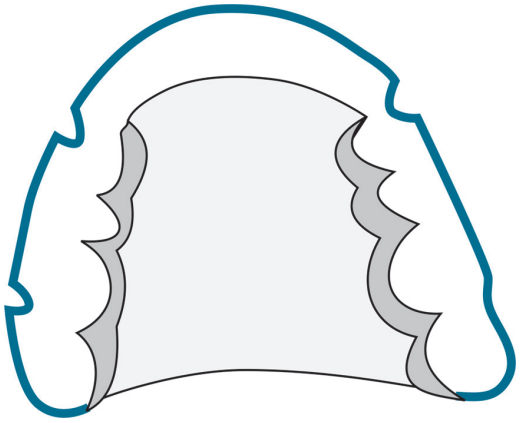

Fig. 6.6: Continuous clear retainer

With continuous clear retainer, there is no interference with occlusion. It offers much greater control of corrected positions due to circumferential retention from second molar through central incisor and broad (5-6mm) coverage on labial side. Because the continuous labial position is made of cold cure acrylic and finished to a high shine, it does not stain and tends to be extremely accurate.

Construction

The wires are outlined on a stone working model and bent out of 0.030" stainless steel wires. Two loops should be in the same horizontal plane, with no vertical component that could unseat the appliance when it is activated. In patients with developing second molars, it is important to curve the gingiva to permit the most posterior circumferential wire to settle into developing

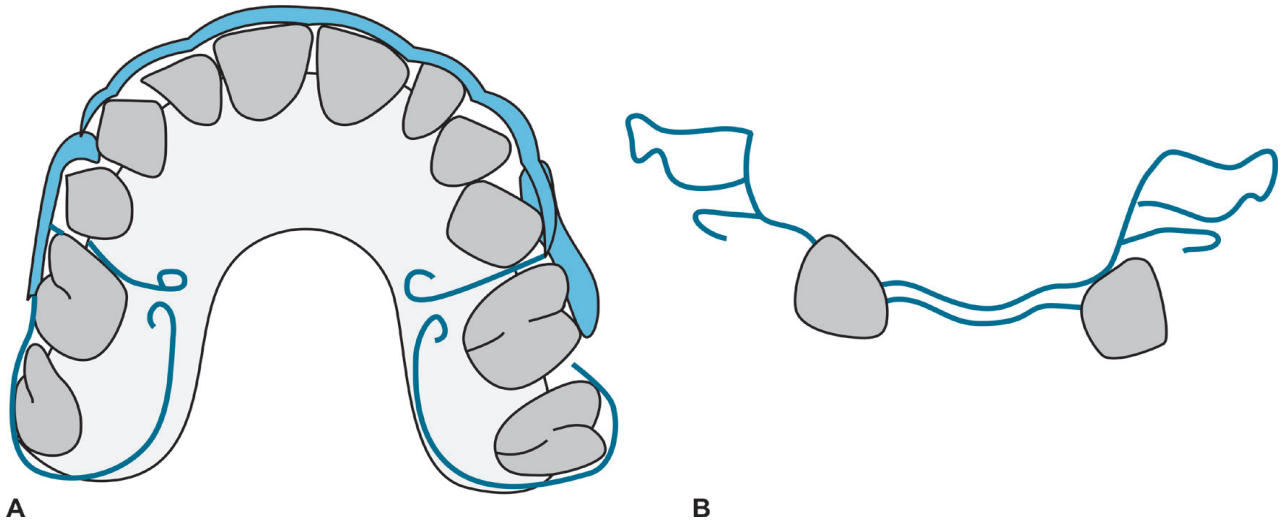

Fig. 6.7: Non-acrylic removable retainer

gingival embrasure and this must be adjusted in the mouth. The spur between the first molar and second bicuspids should fit snugly.

Model is coated with Al-cote and the wires are sticky waxed into place. A strip of soft white wax is pressed on the occluar surface as a barrier between the inner and outer portions of appliance. The acrylic portions are then fabricated using a cold curve acrylic with a pepper and salt technique.

Appliance is then finished and polished. Palate is relieved in a 'V' shape to avoid interference with taste and temperature perception and to avoid gagging and speech impediments. An 0.020" rubber ligature is used to connect the two wire loops, and the appliance is ready for insertion.

Non-Acryic Removable Retainer (Fig. 6.7)

A special appliance, constructed of heavy wire (0.9mm, 0.351") adapted to the gingivopalatal surface of the upper teeth. Retention was gained with Adams clasps on the first molars and three quarter clasps on the first bicuspids.

Advantages: No soft tissue inflammation, allergy.

HABIT BREAKING APPLIANCE

Thumb Sucking (Fig. 6.8)

It is a removable appliance. It consist of acrylic plate in which a pearl is introduced in a crib, so that whenever the patient sucks the thumb he is reminded not to suck it. Because of this appliance, the palate which gets pressurized due to thumb is prevented.

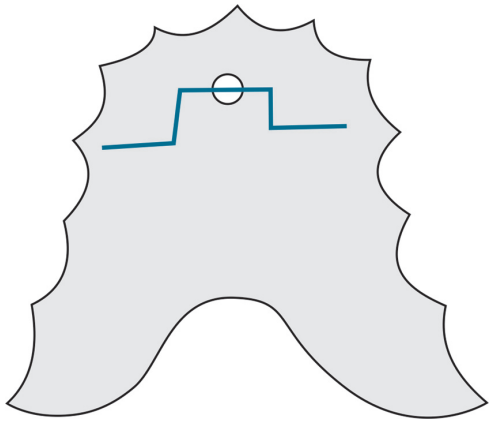

Fig. 6.8: Reminder appliance

Tongue Thrust (Fig. 6.9)

Anterior tongue thrust: Open bite in the anterior region and there is perfect fit of posterior teeth in occulsion. It is with teeth together or teeth apart.

Lateral tongue thurst: Open bite in posterior region and there is perfect fit of anterior teeth.

Management

By removable appliance which is used to restrict the thrusting of tongue consist of molar clasps, labial bow

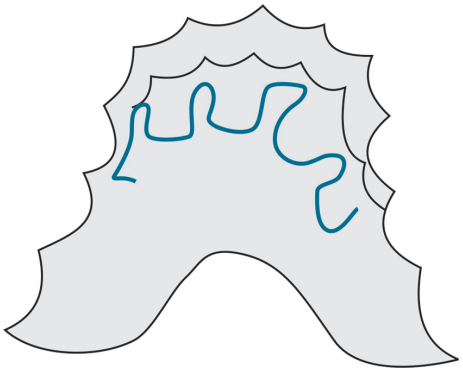

Fig. 6.9: Tongue guard

and tongue cribs or rakes. The height of cribs is such that it lies just behind the lingulii of mandibular anterior teeth when the casts are articulated.

In lateral tongue thrust habit, the cribs are placed laterally.

Bruxism

Occlusal interference may precipitate bruxism due to displacement in centric relation and centric occlusion (Fig. 6.10).

Occlusal bite plate which is prepared from vinyl plastic that covers the occlusal surface of all teeth plus 2mm of buccal and lingual surface and can be worn at night to prevent abrasion of teeth (Figure 6.11)

Removable Lip Bumper

For lip sucking habit. It is retained by adams clasp. The acrylic placed between the base and auxillary wire

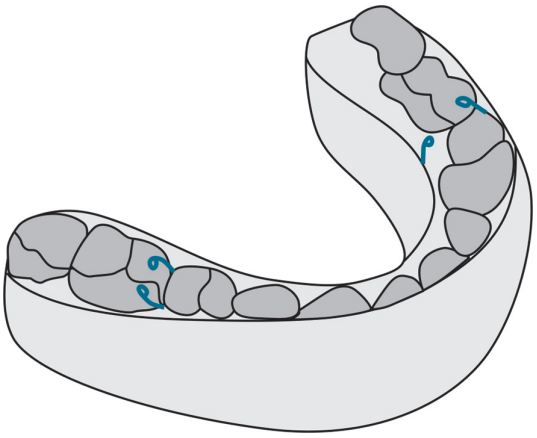

Fig. 6.10: Elastoplastic positioner

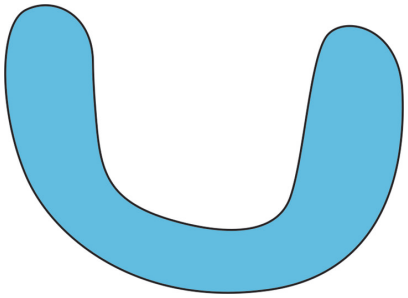

Fig. 6.11: Occlusal bite plate

should be approximately 3 mm away from gingival tissue. This will reduce the irritation and there will be self cleansing action. Appliance worn for a period of 8-9 months (Fig. 6.12).

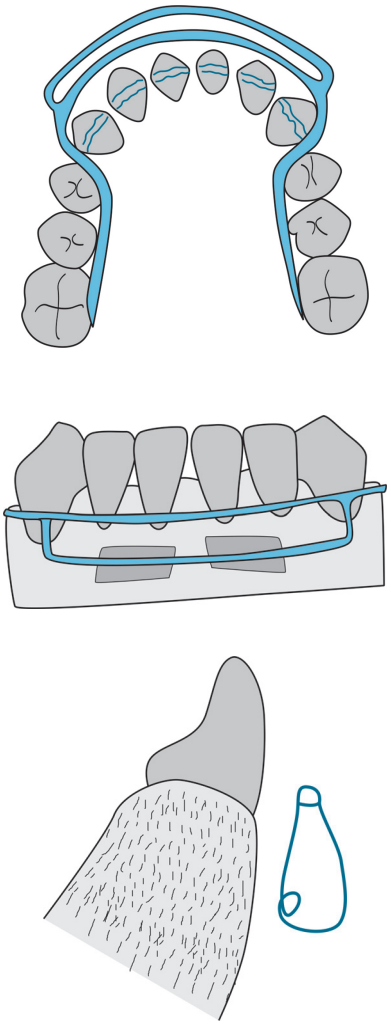

Fig. 6.12: Lip bumper

Removable Cheek Bumper

For cheek biting habit. This appliance keeps the cheek away to prevent it from coming in between teeth during mastication (Fig. 6.13).

Appliance consist of an acrylic plate and few cribs. After articulating the upper and lower models of the patient, an acrylic plate is made on buccal surfaces of upper teeth extending into the vestibule. Retention is provided by lingually adding cribs.

Oral Screen

For mouth breathing habit. It was introduced by Newell in 1912. Used for mouth breathing when airways are open, thumb sucking, lip biting and tongue thrust. Flaccid, hypotonic, facial musculature (Fig. 6.14)

SPACE MAINTAINER

Space maintainer is device or an appliance designed to retain a given space or area in primary or mixed dentition. Especially after the premature loss of deciduous teeth.

Function of Space Maintainer

1. To prevent malocclusion
2. Pressure arch length
3. To replace the physiologic functions
4. To prevent tongue thrust
5. To prevent speech impairment
6. To prevent psychological trauma.

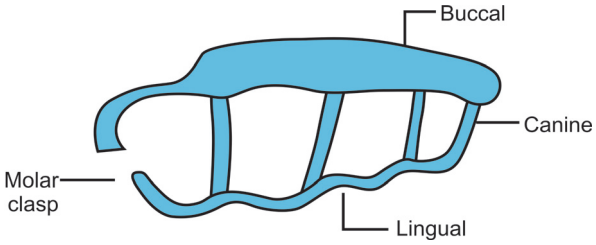

Fig. 6.13: Cheek bumper

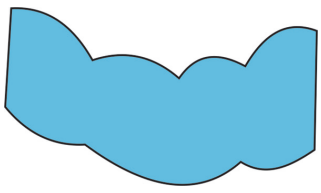

Fig. 6.14: Oral screen

Classification of Space Maintainer

1. Depending on construction and design
   a. Removable
   b. Fixed
   c. Semifixed
2. According to functions, (Mastication and Esthetics)
   a. Functional
   b. Non-functional
3. a. Active space maintainer: It is also referred as space regainer
   b. Passive space maintainer: Just to maintain the available space.

REMOVABLE PARTIAL DENTURE

1. To maintain the space for permanent incisors when there is loss of primary anterior teeth, removable partial denture with artifical teeth is used to maintain the esthetic results, function to prevent tongue and speech habits (Fig. 6.15).
2. To maintain the space for premolars when there is bilateral loss of primary molars, so to maintain the function of mastication and space for premolars, a removable partial denture with molars is given.

BASKET CLASP

Due to early shedding of deciduous molars there is mesial migration of molars. So to maintain space for premolars basket clasp is given on deciduous canine and deciduous molar. (Fig. 6.16)

Basket clasp consist of a loop and 'C' shaped clasp. It holds the canine from labial and lingual surface. Similarly with molar, it is embedded in acrylic.

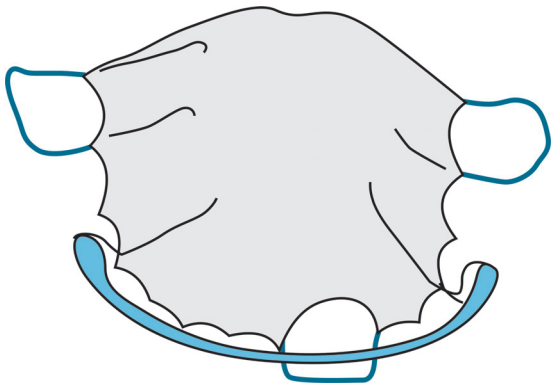

Fig. 6.15: Removable space-maintaining partial denture with Adams clasps on the first permanent molars.

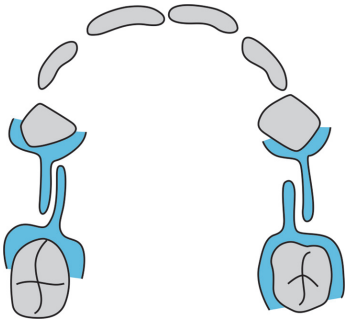

Fig. 6.16: Basket clasp

SPACE REGAINER

Split Acrylic Dumbbell Spring

In the lower arch at Hawley appliance constructed with a split- acrylic dumbbell spring used to regain upto 2 mm of lost space by tipping one of the 6 year molar distally (Fig. 6.17).

The limit of possible spring opening is atleast 3mm which is obtained by adjusting twice a month by opening the spring 0.5 mm increment of opening at a time.

Sling-shot Elastic

Instead of a specially contoured wire spring that transmits a force against the molar to be distalized a wire elastic holder with hook may be used. This is called as a sling-shot appliance (Fig. 6.18).

Adjustment

Distalization force is produced by the elastic stretched between two hooks.

Construction

One hook is located on the middle of lingual surface

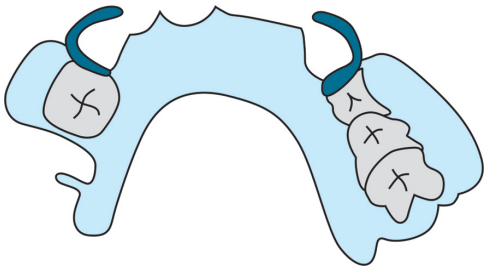

Fig. 6.17: Basket clasp

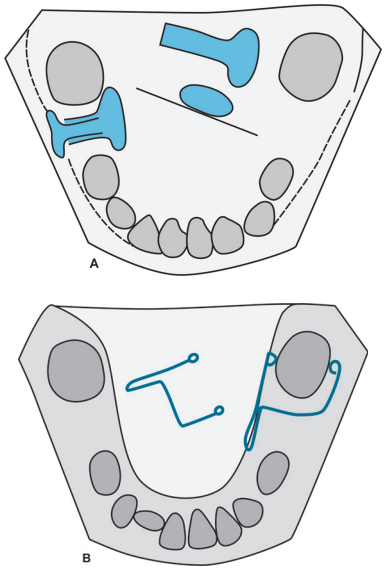

Fig. 6.18: (A) The two loops of wire that are bent to make the dumbbell spring are shown. Channel between the wire loops must be at least 3 mm wide, to allow for cutting acrylic with a separating disk. (B) Sling-shot spring. This spring requires that a ¼-inch or 3/16-inch latex elastic be engaged between the hooks to exert distalizing force against a 6-year molar. It works best in lower arch

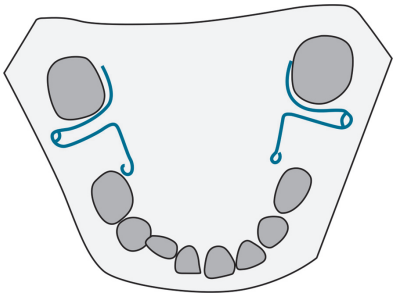

Fig. 6.19: Posterior helical springs for distalizing right and left 6-year molars. Note that the helices of wire are bent as mirror images of each other, so that the part of the spring contacting the molar comes off the tissue side of the helix

of molar to be moved. The other is located in the same position on buccal surface of molars. Elastic can be changed once each day.

Posterior Helical Spring

This is a much larger spring formed of 0.028 yellow elgilloy. It is used to provide the force of distalizing mesially drifted maxillary or mandibular molars. If proper retention and anchorge requirement have been met in the design of Hawley appliance posterior helical spring is an extremely effective generator of force[7]. (Fig. 6.19).

CHAPTER

Retentive Component of Appliance

7

RETENTIVE COMPONENT OF APPLIANCE

Retention is the means whereby displacement of appliance is resisted in vertical direction. Retention is provided by:

1. Clasp/retainer
2. Base plate

CLASP OR RETAINER

Clasp engages the undercut area of tooth to hold the appliance. Undercut is an area between the gingival and the most bulbous part of the tooth. It is a passive wire part.

Retention areas found in gingival half of crown. It is greater on mesial and distal faces than on buccal and lingual faces.

Importance of Retention

1. It maintains mechanical efficiency of an appliance by ensuring that spring are continuously held accurately in position.
2. The appliance is a firm fit; the patient adapts to it more readily.
3. Habit movements are discouraged and common initial difficulties with speech and eating are minimized.
4. Extraoral retention may be added without risk of displacement.
5. Anchorage contribution from fit of appliance against the teeth and mucosa is maximized by preventing forward sliding of acrylic down curvature of palate.

BASE PLATE USED AS RETAINER

1. It acts as support for springs.
2. It encloses and secures the tags of clasps.
3. Base plate are extended interproximally to gain anchorage and stability against the rocking anterioposteriorly.
4. In upper arch, the baseplate is carried distal to last tooth to prevent displacement in anterioposterior direction and to increase the anchorage to reactions acting in forward directions.
5. Lower plate present some problem because of shallowness of lingual sucker; thus the lingual plate should be made shallow and thick for extra strength.

In molar region, the undercuts are blocked and then tags are fitted to get a plate which is comfortable to patient.

Types of Clasps

C Clasps of ¾ Clasp

Constructed in 0.7 mm hard round stainless steel wire (21 gauge) (Fig. 7.1).

Indication: To engage the mesial or distal undercut for retention purpose.

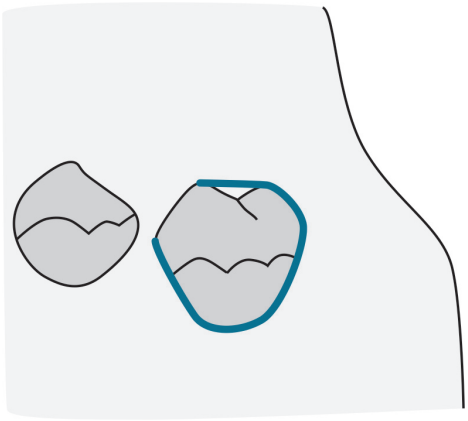

Fig. 7.1: A three quarter crib

Advantage:
1. Easy to construct
2. Since, it prevents the mesial migration of tooth due to engaging the mesial undercut; it is used to maintain the space.

Disadvantage: Skill is required for preparation.

Full Clasp or Jackson Clasp (VH Jackson 1906)

Indication: Fully erupted teeth (Fig. 7.2)
Partially erupted teeth.

Advantage: Mesial and distal undercuts are used. The wire of clasp running around the cervical margin of tooth buccally and then interproximally, mesially and distally at gum margin.

Arrowhead Clasp: AM Schwarz 1956 (Fig. 7.3)

This clasp uses mesial and distal undercuts on teeth using a half round or round stainless steel wire

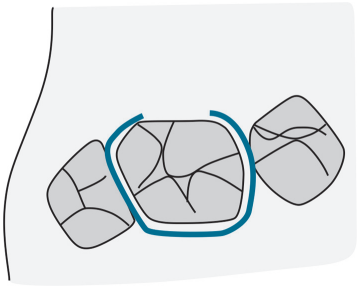

Fig. 7.2: A Jackson crib or full clasp

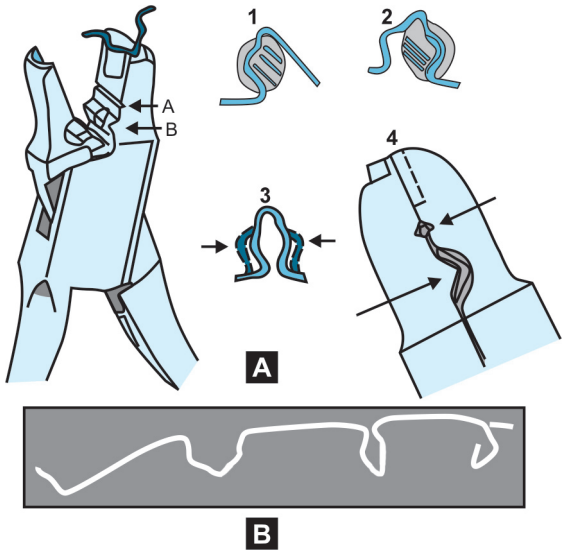

Fig. 7.3: Bending the arrows using the arrow-forming pliers of AM Schwarz. The material used is stainless, highly elastic steel, usually 0.7 mm

0.7 mm is inserted between two teeth in approximal contact; just below their contact points secure retention is obtained.

Arrowheads are bent at right angles to interdental space. It is made up of 0.7 to 0.8 mm hard stainless steel wire. Clasp is made of a special plier called "Tischler's" plier.

Advantage: Good retention, on partially erupted tooth, eruption of tooth is not hampered.

Disadvantage
1. Requires special plier construction and requires adequate skill.
2. It occupies a large amount of buccal surface.

Continuous Arrowhead Clasp (Fig. 7.4)

An appliance will carry four or six arrow clasps, it is continuous arrowhead clasps.

Anterior arm inserted in marginal plate crossover mesial contact point of premolar or deciduous molar. Three arrowhead are found. Posterior arm runs distally around last erupted tooth and inserted into the plate. Thus it is one continuous wire with ends in acrylic mass.

Adam's Clasp or Universal Clasp or Modified Arrowhead Clasp or Lever Pool Clasp

Adam's clasp is now known, was devised by CP Adam as a modified arrowhead clasp in 1948.

Parts of Adam's clasp (Fig. 7.5)
1. *Horizontal bridge:* It connects the mesial and distal arrowheads of clasp. It serves to facilitate the removal of appliance.
2. *Arrowheads:* Two arrowheads, one mesial and other distal to engage the mesial and distal undercut and provide resistance to displacement.
3. *Retentive tags:* Two tags connect the arrowhead to clasp; to acrylic base plate of the appliance.

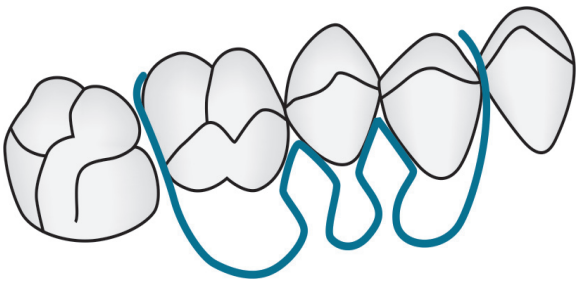

Fig. 7.4: The arrowhead crib or continuous clasp

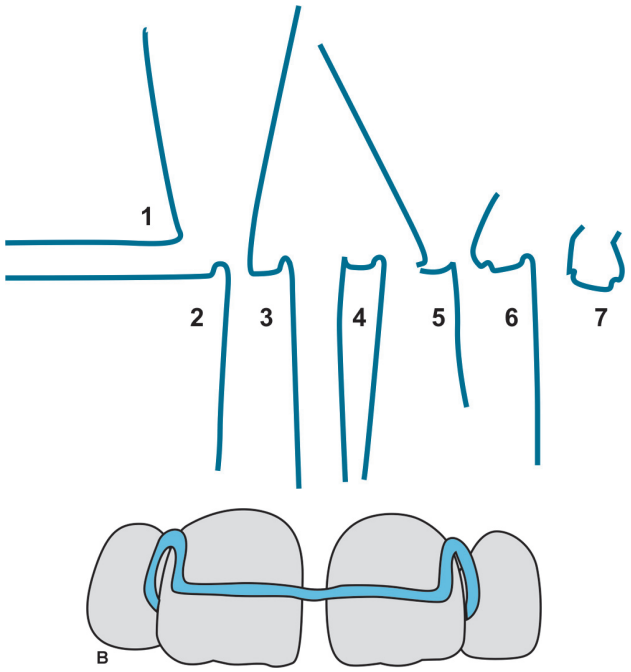

Fig. 7.5: (A) Showing the stages of formation of an Adams clasp. (B) A less prominent version of the double incisor clasp

Construction of Clasp

- 0.7 mm wire is used for premolar and molar clasp
- 0.6 mm wire is used for anterior teeth
- 7 to 8 mm wire length is sufficient

Steps

1. *Forming of bridge:* Length of bridge should be two third of the mesiodistal width of crown. Bridge is made by bending the wire to slightly more than right angles.
2. *Forming the arrowheads:* At each of the above bends 'U' turn in the wire is made outside the tips of the pliers so that a tight acute bend is formed, sides forming the arrowheads being parallel. Arrowheads are then aligned to follow the gingival margin by bending them at 45° the horizontal bridge and tried on the tooth.
3. *Forming the retentive tags:* A bend is made grasping the arrowheads from the inside of the clasp with half the length of the arrowhead between the break of the pliers. This makes the bend at a level a little below that of bridge. The end is at an angle a little less than 90° to the arrowhead.
4. *Trial of clasp:* Clasp tried on tooth to check the angulation of the arrowheads to the teeth. Direction of tags towards the groove between marginal ridges of the tooth to be clasped and adjacent teeth.
5. Clasp is completed by bending tags over contact point between two teeth into the lingual embrasure slightly away from palatal mucosa. Clasp is stabilized while the base plate is being constructed and tags are embedded securely in the acrylic material.

Adjustment of Adam's Clasp

It is done by making a slight bend at each tag buccal to where the tag makes contact with teeth in crossing the contact point to obtain desired degree of grip.

Advantages

1. Clasp is small, neat and unobstructive. Takes minimum space in buccal sulcus.
2. Useful on deciduous, permanent teeth.
3. Strong enough for retention purpose.
4. No specialized pliers required.
5. Bridge is used for removal and insertion of appliance.
6. It resist the force of mastication.
7. Hooks, helixes can be soldered to the bridge and bent into the clasp.

Limitations

1. Construction requires time as compared to 'C' of full clasp.
2. Unsatisfactory on proclinated incisor because of much undercut labially.
3. Clasp fracture can occur due to overworking of the wire.

Modifications of Adam's Clasp

Modification of Adam's clasp is done by placing arrowheads vertically or horizontally instead of aligned to gingival margin.

Traction Hooks

For intermaxillary traction, traction hooks can be incorporated by bringing hooks or helix into the clasp or by welding or soldering them into the bridge of clasp (Fig. 7.6).

Examples of these type of clasp are:

1. *Adam's clasp with distal extension (Fig. 7.7):* Distal extention is bent into the clasp by bending the tag

arm at an angle less than 90°. Distal extension is directed gingivally; modification is preferred in maxillary molar because it does not irritate buccal sulcus and cheek. Used to engage the elastics.

2. *Adam's clasp with 'J' hook* (Fig. 7.8): A 'J' shaped hook made of 0.7 mm wire is soldered to the bridge of Adam's clasp gingivally with the hook pointed distally to engage elastics.
   Modification is used in mandibular molars.
3. *Adam's clasp with helix* (Fig. 7.9): A helix of 4 mm diameter is incorporated into the bridge of the clasp. Preferred on mandibular molar.

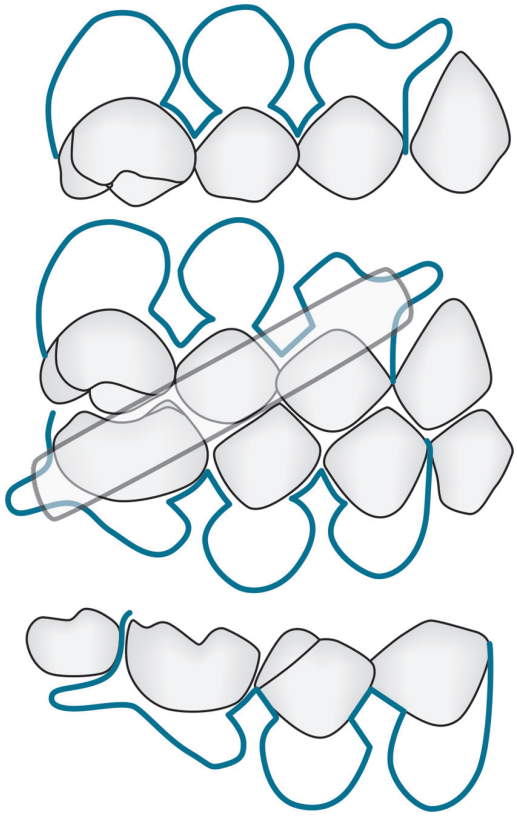

Fig. 7.6: Arrowhead clasps modified for intermaxillary traction

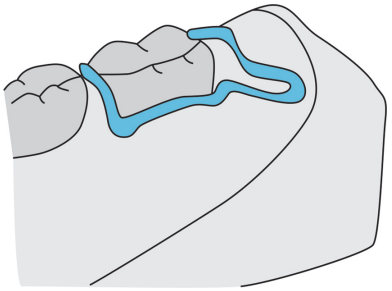

Fig. 7.7: Extension type of traction hook incorporated distally on a lower molar Adam's clasp. Note this can be also used anteriorly on an upper premolar Adam's clasp

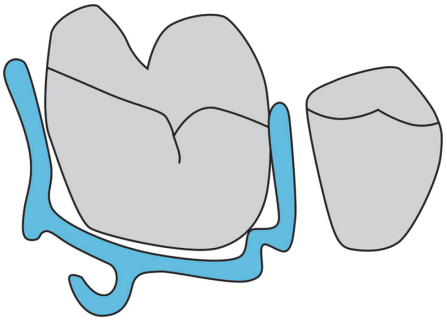

Fig. 7.8: Adam's clasp with 'J' hook

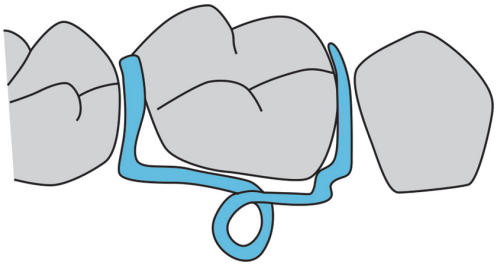

Fig. 7.9: Adam's clasp with helix

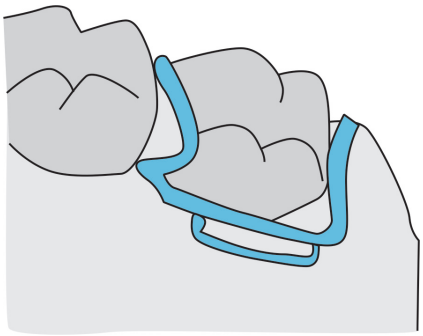

Fig. 7.10: A buccal tube strapped and soldered to the bridge of an Adam's clasp

Buccal Tubes for Extraoral Traction

JC Stephenson described attachment of buccal tube i.e. soldered to bridge. The appliance can be worn at night without extraoral headgear and buccal archwire which is sliding. Thus it becomes a removable appliance for extraoral anchorage (Fig. 7.10).

Accessory Arrowhead Clasp (Fig. 7.11)

When extra retention is required for an appliance and it is possible to clasp a second tooth, then it is possible to use an accessory arrowhead which fits to the undercut of adjacent tooth that is away from the clasped tooth and free tag is soldered or welded to the bridge of the main clasp.

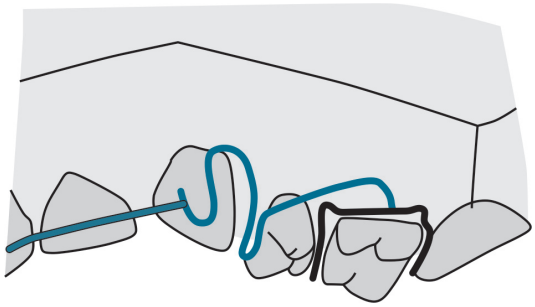

Fig. 7.11: The accessory arrowhead

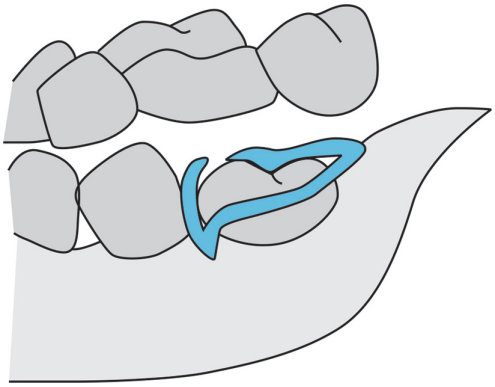

Fig. 7.12: A single arrowhead clasp

Adam's Clasp with Single Arrowhead

This clasp combines the characteristics of Adam's clasp and C clasp. It is useful in clasping molars which are in semierupted state and in which only one proximal undercut is exposed. The arrowhead engage this undercut while remaining tag is adapted to the gingival margin on the other side (Fig. 7.12).

Smart Clasp: A Modified Adam's Clasp

Smart clasp was developed for use with magnetic activator device. Magnets attached to the upper and lower removable plates of this appliance exert about 600 gm of attracting or repelling force, requiring maximum stabilization to keep plates in positions (Fig. 7.13).

Construction

- Smart clasp is made up of 0.028" wire
- Instead of bending the interdental arrowheads at 45° angles to the bridge in the vertical and horizontal planes. Bend them perpendicularly to bridge.

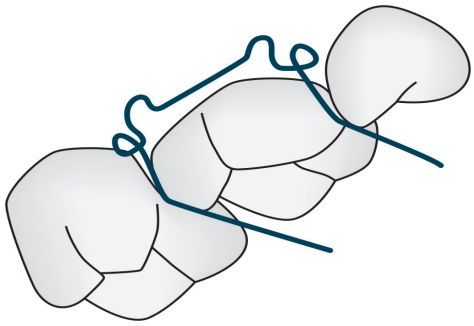

Fig. 7.13: Smart clasp with 45° bridge-arrowhead angle of traditional Adam's clasp

- Bend a 2 mm loop on each side and then cross the tags over the contact point.

Advantage

- Coils of smart clasp increases its spring back properly reducing the likelihood of wire fracture and need for refrigerating activation.
- Clasp is tightened it is activated like a spring by holding the coils with a brdige break plier and pushing the bridge arrowhead component involved.

Pot Hooks

These are single spurs of 0.7 mm hard stainless steel wire which pass over the embrasure and engage undercuts present in the interdental space immediately below it. The end of wire must be rounded and polished to prevent abrasion of teeth (Fig. 7.14).

Visick Spur (Fig. 7.15)

It is a modification of Jackson clasp. The lingual aspect of the tooth is clasped; made in 0.7 mm wire.

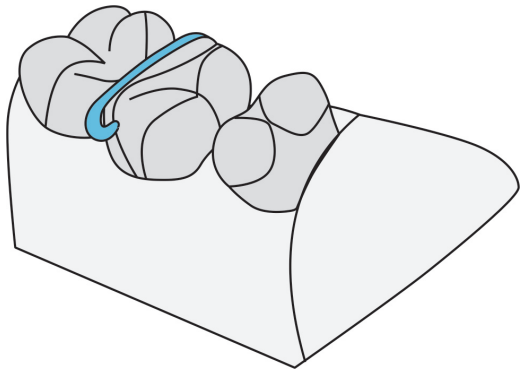

Fig. 7.14: Pot hook

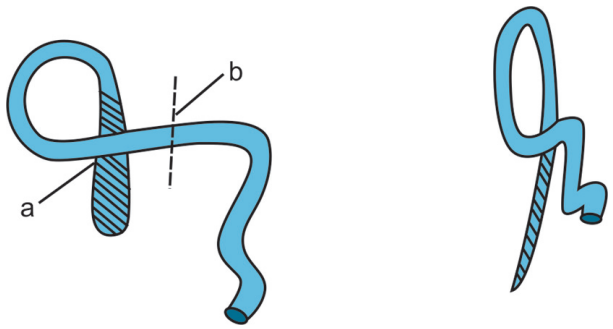

Fig. 7.15: The Visick clasp—lingual spur

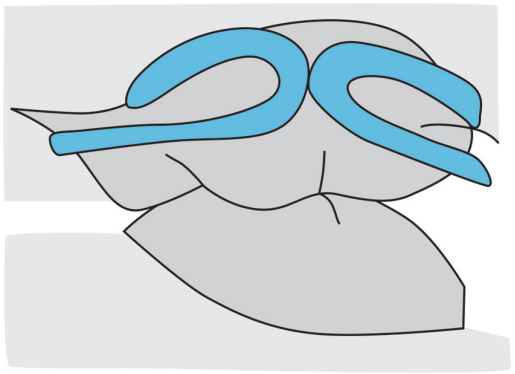

Fig. 7.16: The Dyzl ings clasp

This retainer is used in circumstance where retentive undercuts are not present.

Dyzling Clasp (Fig. 7.16)

It is made by two wires emerging from the plate to cross the occlusion over the anterior and posterior contact point of the tooth clasped. Each wire then goes above greatest circumference of the tooth to the middle of the tooth and back again below using undercuts. It is also possible to use only half of that clasp or a half extended to the anterior posterior part of the tooth.

Crozat Clasp (Fig. 7.17)

Crozat (1920) suggested a clasp design which is based on Jackson clasp but makes use of mesial and distal undercuts by addition of a short piece of wire which runs into the mesial and distal undercuts on the neck of tooth.

Clasp is made in precious metal and additional wire is soldered on.

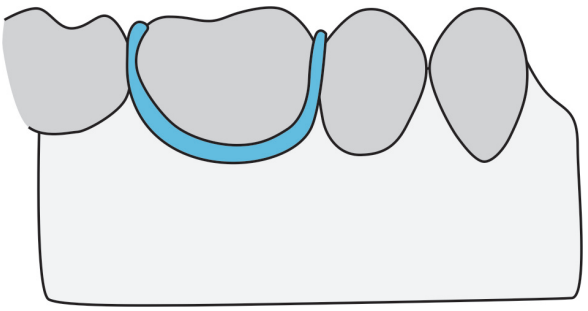

Fig. 7.17: Crozat clasp

Triangular Clasp (Fig. 7.18)

It is a single arrow on a wire crossing the contact point. Excellent retention is provided without using irritation of gingival tissue.

Arrow Pin Clasp

It is solid arrow bent to penetrate into the interdental space. It provides firm grip (Fig. 7.19).

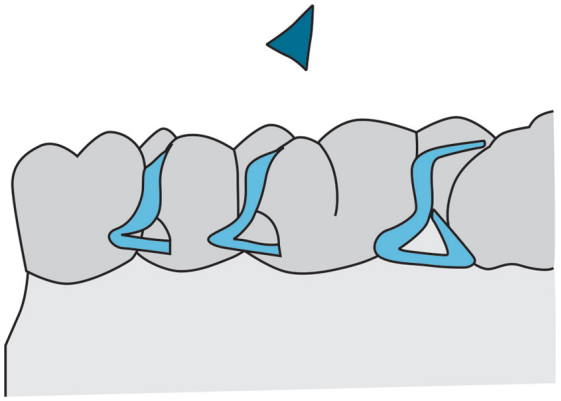

Fig. 7.18: Triangular clasp

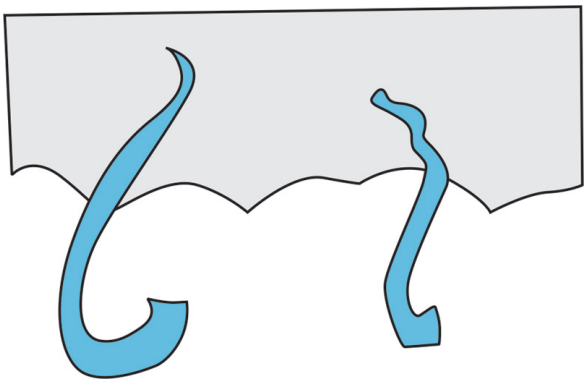

Fig. 7.19: Arrow pin clasp

Eyelet Clasp (Fig. 7.20)

Heideborn and Burgert have invented this clasp. It is a continuous clasp. Eyelet clasp is kept below greatest circumference of tooth.

Convenient under bit blocks and does not provides eruption of teeth.

Molar Clasp (Fig. 7.21)

In partially erupted molar where there is only a small undercut molar area, this clasp is used.

Length of clasp should engage the gingival margin.

The arm of clasp which passes over the occusial surface should have a sharp downward bend at occlusal side before turning along gingival border so an inverted 'U' which can be bent inwards to give a positive inward pressure and well down in embrasure. It is made of 0.7 mm wire.

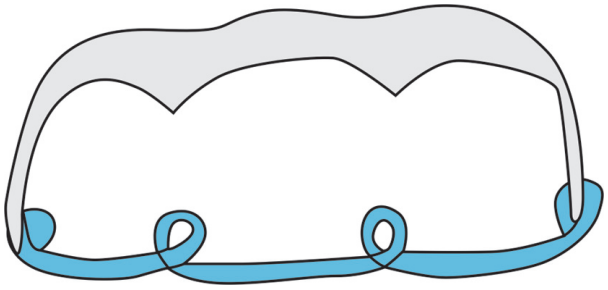

Fig. 7.20: Continuous eyelet clasp

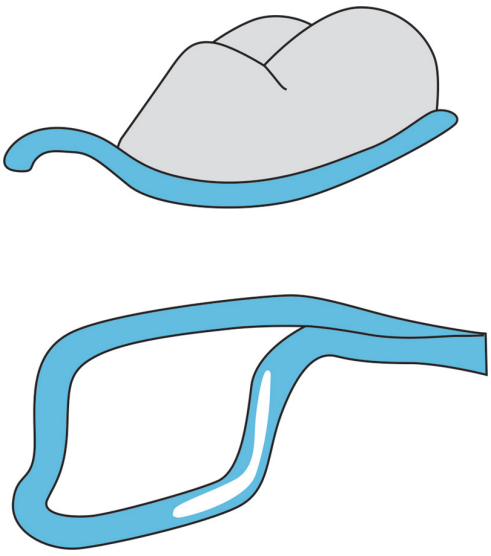

Fig. 7.21: The molar clasp. (A) An upper molar (incorrectly made). (B) Anteroposterior view of clasp (correctly made)

Visick Clasp (Fig. 7.22)

HC Visick found a clasp which is used on palatal side for active retention accompying the base plate and molar clasp on buccal side.

Construction

- 0.7 mm stainless steel wire, of length 7-8 mm
- One end of wire is beaten flat, smoothened and curved to fit palatal surface of tooth
- Loop is formed and end of wire kinked for retention
- A hole is made to receive the flattened portion in palatal part of gingival margin

Advantage

Retention is increased on due to this clasp. Buccal and palatal surface are engaged.

Southend Clasp

It is developed by Mr. DiBise and Mr. Leavis of the orthodontic department southend hospital and used at Bristol Hospital (Fig. 7.23)

Anterior retainer.

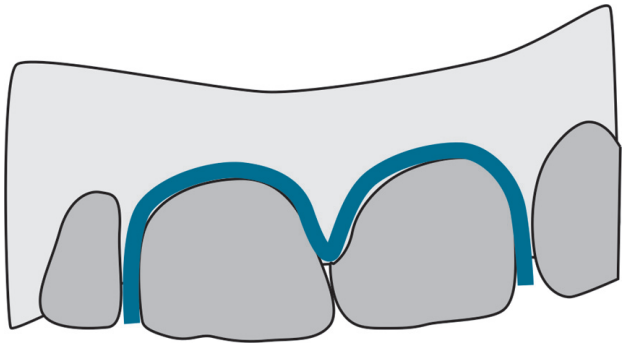

Fig. 7.22: Southend clasp

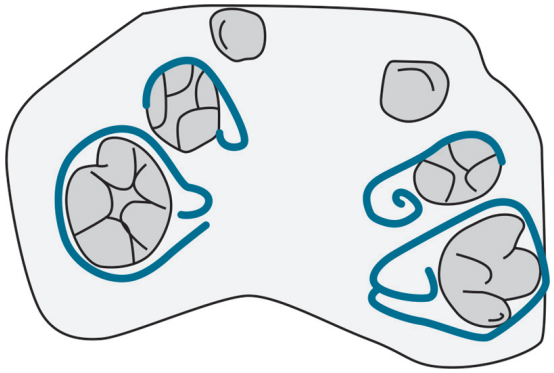

Fig. 7.23: Visic clasp and spur

Design and Construction

Clasp is made in 0.7 mm semihard stainless steel wire or 0.71 mm 'blue' elgiloy.

It consist of curved sections which passes around the cervical section which pass around the cervical margins of two adjacent incisors interconnected by an interdental U loop. The clasp run widely around the embrasure to achieve maximum flexibility and therefore less fracture channels.

Advantages

Readily acceptable to patient.
Suitable for rotated and spaced incisors

Adjustment

By pushing the U loop gently in midline than on tags.

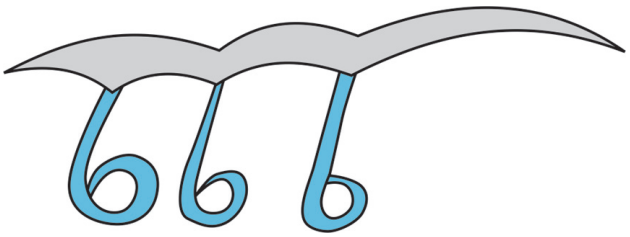

Fig. 7.24: Ball end clasp

Ball End Clasp

It is single eyelet clasp (Fig. 7.24). Engages the interdental area.

Advantage

1. It requires less space.
2. It can be given with fixed appliance as habit breaking appliance.

CHAPTER

Plate Construction and Finishing 8

INTRODUCTION

Heat cure method for active plate preparation:

1. Carefully check the model for all defects, holes, bubbles, etc. Particular attention must be given to the lingual margins, especially the lingual. Remove all bubbles with a universal scaler, leaving margins clear and sharp.
2. Using a scaler or carver, carefully shave away plaster in the interproximal embrasure, where the arrow of arrow clasp will be positioned, shortening the papillae by mm.
3. Bend all wires (spring, clasp, bows) according to the treatment sketch made at the time of diagnosis. Wires should be adapted carefully to model.
4. Now remove all parts of wire from model.
5. Paint the model with separating medium or adapt thin foil.
6. Apply softened wax base plate to the lingual and palatal surfaces. Trimming the wax to the outlines of plate. Be sure that wax is carried into the interproximal space and around the margins of the gingiva. One layer of wax is sufficient. Thickness of 2-3 mm is reliable.
7. Remove the wax from all areas where the springs, clasps or bows must be free of acrylic, cover these parts of wire with modelling clay or plaster.
8. Apply a thin second layer of wax over the ends of wire attachments, form the bite if indicated and mold the finishing touches to the wax base. The wax may be carried into the space of spring.
9. If modelling clay was used for the spring and wires, it is now removed and the wires exposed. The cast is now placed in flask and the exposed parts of wires painted over the plaster.
10. After the plaster has set, it is painted with a separating medium along with the surface of wax.
11. The upper part of flask is placed and plaster poured to fill the upper section and top placed on the flask.
12. When the plaster is set, the flask is placed in the boiling water for about five minutes.
13. Flask is then opened and wax is washed out. All traces of wax are then removed with wax remover on a cotton pellet.
14. Both halves of flask are again painted with separating medium.
15. The acrylic is packed into place according to manufactures instructions and acrylic should be pressed under pressure.
16. After acrylic has been curved, flask is cooled plated is carefully removed from the flask and is finished in the same way as denture. Stoning, sand paper finishing, coneing and lastly buffing with finishing powder. Great care must be taken during the polishing process not to distort the carefully adapted wires with a brush wheel or felt polishing cone. If expansion screw is to be used in palatal portion, the portion of screw that shows the turning holes should be covered with moldine. The screw is then placed with its layer half pointing towards the oral cavity.

Marking on the screw indicates the direction of turn. Moldine water soluble. It can be removed easily from expansion screw after curing procedure.

Screw is placed in the appliance after the first 9 steps of this procedure have been completed. After the placement of screw, steps 10 to 14 are carried out.

When the flask is opend, screw is in upper half being held by broad portion of fixing device.

COLD CURE OF SELF CURING METHODS

1. The model is prepared by removing bubbles in lingual gingival area. After sharpening all margins and making space for the arrow clasps. Paint the model with a separating medium.
2. This method is called increment method or drop and powder method.
3. All wire parts are added to cast and sticked cold wax.
4. Now add the polymer or powder resin in increments to palatal surface of cast and then monomer, start spreading it slowly. A thickness of 2 mm is acquired.
5. Smoothen it with monomer and Vaseline finally.
6. Cast is placed in the pressure pot at 20 pound of air pressure without water.
7. After 20 minutes, dry cured cast is removed from the pressure pot and immersed 10 min in warm water for final curing.
8. Appliance is removed from the palatal surface and cleaned.
9. Polishing first with wet pumice and then with denture polish kept in a cold sterilized solution until patient is available for final fitting.

CHAPTER

Practical Management

9

INTRODUCTION

Successful management of orthodontic treatment depends upon the careful assessment at each visit so that lack of progress of unwanted tooth movement can be recognized early.

IMPRESSIONS AND DESIGN OF APPLIANCE

An impression for an appliance must also reproduce the full depth of buccal sulcus. The appliance should be designed while the patient is still in the chair. To indicate the correct position of spring, mark the design with pencil on working model.

FITTING A REMOVABLE APPLIANCE

Comfort

The blebs or sharp edges on the fitting surfaces should be examined, it is removed and then the appliance is tried in. Wire components must not cause blanching. Buccal springs and bows should lie close to the alveolar mucosa but not in contact with it and must be clear of the base of the buccal sulcus and buccal frenii when cheek is displaced laterally.

Retention

If necessary, the clasps are adjusted at this stage to ensure adequate retention.

Base Plate

Bite planes are adjusted for height. Posterior bite planes are trimmed so that the patient occludes evenly on both sides and are thinned, so that the occlusion is propped open by sufficient amount to clear occlusion.

Anterior bite planes are checked for depth. Patient occludes with at least two or three lower teeth. Bite plane will be levelled by additions of cold cure acrylic.

When incisors are to be retracted, anterior bite plane will be trimmed away from them. Too small a gap between base plate and tooth will encourage food packing and gingival hyperplasia and tooth may be prevented from moving.

Active Components

First it is necessary to ensure that springs are contacting the teeth correctly so that they will move in the direction intended. Initial activation of spring should be slight. This will allow the initial tissue changes to progress without extensive hyalinization of periodontal ligament. An adjustment of about 1 mm for a palatal spring.

Anchorage

Anchorage is determined at design stage. If extraoral reinforcement is to be used, the headgear should be fitted at this visit. Retention by base plate is checked.

Measurement Taken During Subsequent Visits

It is important to recognize the progress of treatment. A movement of at least 1 mm each month is to be expected. When retracting a canine a measurement should be made from its cusp tip to the buccal groove of first permanent molar. Overjet changes are measured with a steel rule.

Lack of progress in teeth movement is due to:

1. Was the tooth free to move?
2. Was the active component adjusted correctly?

Springs are checked for deflection during insertion and removal of appliance. Excessive forces will also delay process of tooth movement. Spring should be adjusted to give a force in the range of 25-40 gm per single rooted tooth.

When a screw plate is being used, the patient may be adjusting it incorrectly. This can be checked by calculating the number of turns and turning the screw back to see that it corresponds.

3. *Has the appliance been worn as instructed?*

The appliance has been correctly adjusted, lack of tooth movement is usually due to inadequate wear. Due to dense bone structure also the tooth movement gets delayed.

INSTRUCTIONS

How to remove and insert the appliance; it is to be removed by clasps not by springs. Demonstrate to the parent. Full time wear is normally recommended for an active appliance.

Remove it after meals. Clean the plate and your teeth. Replace it at once.

If the appliance is broken or if it cannot be worn for any reason, contact the dentist.

SUBSEQUENT VISITS

Patient should be seen 2-3 weeks after the appliance is fitted and then at monthly intervals.

Preliminary

Equire whether the patient has experienced any problem with the appliance. Avoid leading questions and if the appliance has not been worn as instructed, then ask the patient to wear it.

General Condition of the Mouth

Teeth, gingivae and oral mucosa, particularly the area covered by appliance are inspected, generalized palatal inflammation may reflect the need for more thorough oral hygiene and heaping up of the gingivae around the teeth being moved indicates that appliance has not been trimmed away adequately.

GERMICIDE DEODORIZER FOR REMOVAL APPLIANCE

Ethyl alcohol is an excellent germicide, at high concentrations. Germicide consists of sodium enzoate, citric acid, disodium phosphate, glycerine, water.

Retainer were removed from mouth and immersed in germicide.

Bibliography

1. Anne Hoyle: The development of removable appliances in the United Kingdom BJO Vol. 10 No. 2 April 1983.
2. C Phillip Adams: The design and construction of removable orthodontic appliances, 6th edition, Varghese Publishing Company Wright, Bristol 1993.
3. Catherine Asher: The removable Quadhelix Appliances BJO, Vol 7 No. 3, JCO/July/1983.
4. CD Stechnes: South end clasp. BJO vol 6 1979 185-183.
5. DP Walther: Current Orthodontics by eight techers. Removable appliances design and construction and uses 257-310.
6. Gordon C. Dickson, Graber and Newman : Orthodontics in General Dental Practice, Lead and Febiger, 1964, Philadelphia 216-259.
7. I Brin, Y Zilberman, H Tennenhaus : Non Acrylic, metal removable retainer, 641, JCO, July 1984, Volume XVIII, Number 9.
8. JD Muir and RT Reed: Tooth movement with removable appliances pitman medical, London, 1979.
9. Jerry R Clark: Wraparound retainer, JCO/January/1983.
10. John W. Witzig: The clinical management of basic maxilofacial orthopaedic appliances, volume I mechanics, PSG Publishing Company INC, Littleton Massachusetts 1987 223-409.
11. Joseph M Sim: Minor tooth movement in children, 2nd edition CV Mosby Company Saint Louis, 1977.
12. Martin Schwarz, Max Gratzinger : Removable orthodontic appliance, WB Saunders Company, Philadelphia and London, 1966.
13. Michael C Alpern, Larry Hyden : Continuous clear retainer, JCO July 1984 494-496, Volume XVIII, Number 7.
14. NE Waters: The mechanics of buccal canine retraction springs for removable orthodontic appliances. BJO April 1982.
15. Robert Kottad, Henri Petit : A safe effective germicide deodorizer for removable appliances, JCO/January/1983.
16. S. Edmondson FG Shaw: Practical exercises in Orthodontics Removable appliances, Henry Kimpton, London 1962.
17. TM Graber Thomas, Rakosi Alexandre, G Petrovic: Dentofacial Orthodontics with functional Appliances, CV Mosby Company, 1985.
18. TM Graber: Orthodontics Principles and Practice, Third edition, WB Saunders Company, Philadelphia, 1988.
19. White TC, Gardiner JH, Leighton BC: Orthodontics for dental students, Third edition 1976, The Macmillan Press Ltd.
20. WJB Houston, KG Isaacson: Orthodontic treatment with removable appliances, Second edition, Bristol John Wright and Scons Ltd (7-16).
21. WJB Houston, WJ Tulley : A textbook of orthodontics, Bristol, 1986, Indian editions, KM Varghese Company.
22. WJB Houston: Walther's orthodontic notes, Third edition, John wright and Sons Ltd Bristol 1976.

Index

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Summary

The patient is the center of the medical universe around which all our world resolved and towards which all our efforts trend.

JB Murphy

Removable appliances are well suited to the treatment of simple malocclusions where teeth have to be tipped about a fulcrum close to the middle of the root; good results can be obtained in suitable cases but experience and careful case selection are required if they are to be used to maximum advantage.

Different modifications which are available for teeth movements. Easy to construct and patients response to removable appliance is better than fixed appliances hence treatment is easy.

Results obtained are good. Rotations, Overjet deep bite, open bite can be corrected easily. Patient satisfaction is easy.

Concentration is the key to economic results no other principle of effectiveness is violated as frequently today as the basic principles of concentration. Our motto seems to be: Let's do a little bit of everything.

Shakespere