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NAVIGATING ORTHODONTIC CHALLENGES: A REVIEW AMONG YOUNG ADOLESCENTS

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ABSTRACT

Introduction: Though vertical dimension is the easiest to deal with, it has the longest duration and magnitude in terms of growth. It is a morphologic abnormality resulting from a disturbance in skeletal development or an expression of muscle growth and muscle function

Etiology: Vertical discrepancies occur as an interplay between various factors during the period of growth which includes the mandibular and maxillary growth, tongue& lip function., and dentoalveolar development leading up to tooth eruption. Other one important factor is the growth of mandible, variations in growth of maxillary sutures, mandibular condyles. It is of two types skeletal and dental.

Diagnosis: Accurate diagnosis is a key element in the design of any successful treatment plan. To plan an appropriate treatment strategy declination should localise and quantify any skeletal and dental contributions vertical and sagittal variations and the role of abnormal function to the development of vertical problems. Proper facial evaluation, ie patients with vertical discrepancies are broadly classified as long and short face patients. Functional assessment has to be done to determine disorders involving Airway, speech, tongue function should be carefully evaluated.

Treatment plan: Treatment goals- facial, skeletal, and Dental - is the best way to approach treatment planning for vertical discrepancies. All cases cannot be treated in a similar manner due to extreme

variation in facial pattern and morphology characteristics. In this review we have mentioned on various aspects of treatment on open bite and deep bite in young individuals which includes, removable appliances, behaviour modification techniques, orthopaedic appliances, intrusion arches etc.

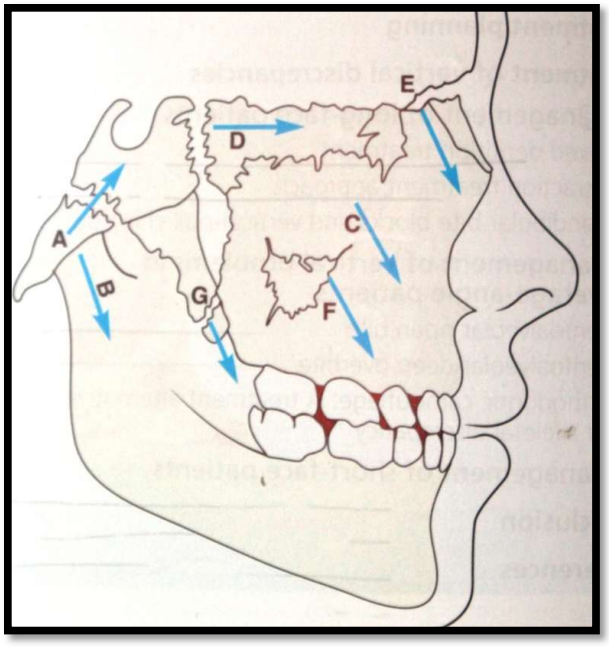
Keywords: Vertical discrepancies, high angle v/s low angle, behavioural modification techniques, growth modification, removable appliances

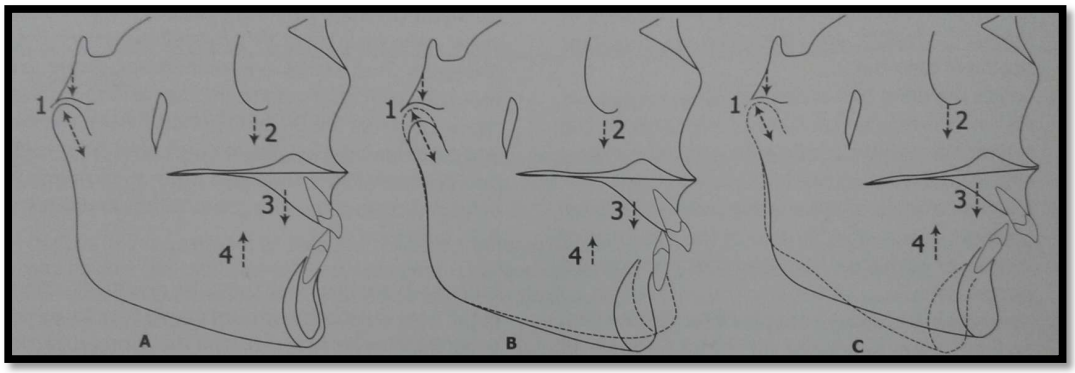
INTRODUCTION

The vertical dimension is the easiest for an orthodontist to deal with. It has the longest duration and the largest growth in magnitude. It has a longer chance to make a change and longer that change exist. It is a morphologic abnormality resulting from a disturbance in skeletal development or an expression of muscle growth and muscle function **[1]**. Therefore, before the initiation of orthodontic therapy, it is vital for the clinician to clearly define the treatment goals related to the vertical dimension of face and design a detailed individualized treatment strategy and mechanics plan based on sound biomechanical principles.

GROWTH:

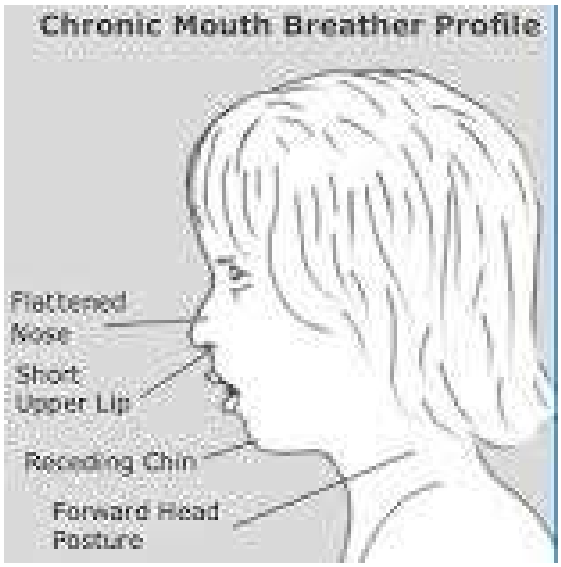
For the facial proportions and the occlusion relationships to be normal the components of the crane official complex consisting essentially of cranial base naso maxillary complex and mandible should exhibit harmonious growth and should maintain a reasonable proportion in size and form. It is well recognised that special position of maxillary dentition is influenced by the eruption pattern of the teeth and the growth of the maxilla and its contiguous bones.





ENVIRONMENTAL FACTORS:

The role of environmental factors like swallowing breathing and tongue posture in altered vertical dimension continues to be the subject of debate. However breathing problems due to large adenoids tonsils deviated nasal septum Etc .. are frequently associated with high angle patients which alter mandibular posture creating more room for posterior teeth eruption it has been shown that removal of adenoids and tonsillectomy have resulted in closing the mandibular plane angle and reduction of anterior phase height.



GROWTH PATTERNS IN SUBJECTS WITH LONG AND SHORT FACES:

Diagnosing a case with varied growth pattern requires a thorough understanding of growth, growth rotations, & morphology of skeletal structures. For normal occlusion & facial harmony, all bones should grow in harmony to each other. If a bone does not grow in harmony with surrounding parts, some compensation of contagious parts will usually occur for harmony, otherwise disharmony is evident.

The term “growth rotation” was coined by Bjork in which direction and inclination of

jaw bases differs. Bjork in 1951 conducted an implant study (tantalum inert pins of which 1.5 mm long and 0.5 mm diameter is used). Based on this study bjork concluded that growth rotation are mainly two types forward & backward.

LONG FACE PATIENTS	SHORT FACE PATIENTS
Maxillary-mandibular dento alveolar protrusion	Maxillary and mandibular bidentoalveolar retrusion
Upright and supraerupted maxillary and mandibular incisors	Upright incisors
Excessive eruption of posterior teeth	Deep curve of spee
Anterior open bite and posterior crossbite	Excessive deep bite

DIAGNOSIS OF THE VERTICAL DISCREPANCY

Accurate diagnosis is a key element in the design of any successful treatment plan. To plan an appropriate treatment strategy declination should localise and quantify any skeletal and dental contributions vertical and sagittal variations and the role of abnormal function to the development of vertical problems. Desmit and Dermot discovered that long-face features which were regarded as more unattractive **[2]**. Sassouni V and Nanda S cephalometric analyses of vertical proportions and they concluded that the treatment should be centred on the cause and not on the effects **[3]**.

Proper facial evaluation, ie patients with vertical discrepancies are broadly classified as long and short face patients. Functional assessment has to be done to determine disorders involving Airway, speech, tongue function should be carefully evaluated. Vertical discrepancies can be divided into those that are dental in nature and into those that are predominantly skeletal. As a result of growth patterns of the jaws cephalometric assessment must be done properly. Cranial flexure angle(N-S-Ar) Articular angle (S-ar-Go) and gonial angle (Ar-Go-Me) are often used to determine the growth pattern of an individual. Mean value of the sum of these angles is 396+_ 6.4degree (> high angle, < low angle).

BJORK'S SIGN: has to be evaluated to know about low angle or high angle patient.

1. Inclination of the condylar head 2. Curvature of the mandibular canal 3. Shape of the mandibular lower border 4. Inclination of the symphysis 5. Interincisal angle 6. Inter premolar or intermolar angles 7. Anterior lower facial height.

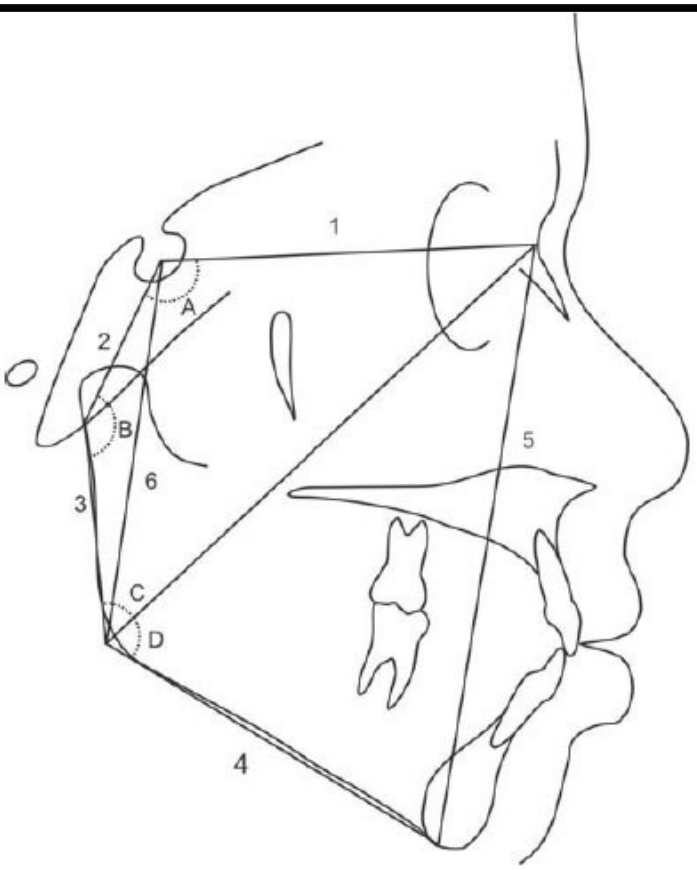


Figure 1. Measurements used for cephalometric analysis. Angular measurements: A. N-S-Ar (saddle angle); B. S-Ar-Goc (articular angle); C+D. Ar-Goc-Me (gonial angle); C. Ar-Goc-N (upper gonial angle); D. N-Goc-Me (lower gonial angle) and A+B+C+D. Ar-Goc-Me (sum of angles). Linear measurements: 1. S-N (anterior cranial base); 2. S-Ar (posterior cranial base); 3. Ar-Goc (ramus heigth); 4. Goc-Me (mandibular corpus); 5. N-Me (anterior facial heigth) and 6. S-Goc (posterior facial height).

JARABAK RATIO:

$$\textbf{Jarabak Ratio:} \quad \frac{\textbf{Posterior facial height} \times 100}{\textbf{Anterior facial height}}$$

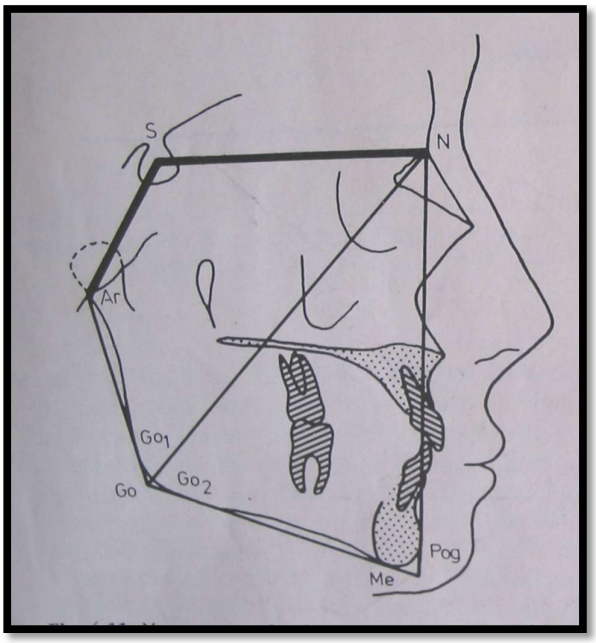
Posterior facial height: Sella (S) – Gonion (Go)

Anterior facial height: Nasion (N) –Menton (Me)

54-58% - HYPER DIVERGENT

59-63 %- NEUTRAL

64-80 %- HYPODIVERGENT



TREATMENT PALNNING:

Treatment goals- facial, skeletal, and Dental - is the best way to approach treatment planning for vertical discrepancies. All cases cannot be treated in a similar manner due to extreme variation in facial pattern and morphology characteristics. The facial pattern is not constant since it is changed by growth and by orthodontic treatment. Also the effects of vertical growth increments on different facial types are different in patients with compromised anterior facial height. Vertical discrepancy can be grouped as- vertical discrepancies with increased lower anterior facial height/normal vertical dimension of face/decrease the lower anterior facial height.

HIGH ANGLE PATIENTS	LOW ANGLE PATIENTS
1. Steep MP angle.	1. Decreased MP angle
2. Rotation of palatal plane down posteriorly.	2. Decreased lower facial height
3. Large gonial angle.	3. Normal or long posterior facialheig ht
4. Short ramus height or decreased posterior face height.	4. Reduced maxillary molar height - the strongest measure of vertical maxillary deficiency
5. Increased maxillary and mandibular dentoalveolar height.	5. Reduced incisor height maybe associated with deficient incisor display.

OPEN BITE:

Definition: failure of a tooth or teeth to meet its or their antagonist in the opposite arch.

A condition or malocclusion wherein there is a lack of overlap between the maxillary and mandibular teeth.

Anterior open bite: There is no vertical overlap of the incisors when the buccal segment teeth are in occlusion

Posterior open Bite: When the teeth are in occlusion there is a space between the posterior teeth.

Pseudo-open bite: Cases with an overjet combined with an open bite of less than 1mm.

Complex open bite: Cases in which the open bite extends from premolars or deciduous molars on one side to the corresponding teeth on the other side.

Compound or infantile open bite: Cases in which the bite is completely open including the molars.

Open bite is a condition that is commonly observed in children who have good skeletal proportions but also have sucking habits. If the child's skeletal proportions are good, it is likely that the anterior open bite will correct itself spontaneously when the sucking habit is eliminated. In most cases, it is not necessary to make extensive efforts to prevent preschool children from sucking their thumbs or fingers. Sucking habits are unlikely to cause long-term problems in children with proper jaw relationships until they are around 5 years old. In primary dentition, orthodontic appliances are not recommended to actively close an open bite. However, in cases where there is a skeletal discrepancy of the long face, which is characterized by increased lower face height, the spontaneous correction of an open bite is unlikely to occur.

MANAGEMENT:

Behaviour modification techniques

a) Counselling-Discuss and Monitor habit

As the permanent incisors erupt the mostly seen therapy will be habit therapy. A clear discussion b/w dentist and child will help in reducing the thumb sucking

b) Reminder therapy

Positive reinforcement: encourage the child, reward them with small gifts if they are not doing thumb sucking.

Reminders: Use a reminder appliance such as a maxillary lingual arch with a crib to impede sucking or an adhesive bandage on the finger that is sucked. The anterior portion of the quad helix appliance can also be used as a reminder.

Negative reinforcement: Use an aversive taste or texture on the thumb, such as bitter nail polish, to discourage thumb-sucking.

Distraction: Encourage the child to engage in other activities that keep their hands busy, such as playing with toys or coloring.

Behavioral therapy: Seek professional help from a pediatric dentist or psychologist who can provide specific behavioral therapy techniques to help the child quit their habit.

Physical barriers: An elastic bandage loosely wrapped around the elbow can prevent the arm from flexing and the fingers from being sucked.

c) Adjunctive therapy

A cemented reminder appliance can be fitted to actively impede sucking.

d) Lip Sealing Training In The Treatment Of Skeletal Open Bite Habit

Rolf Frankel in 1980 emphasized the importance of lip seal training as an integral part of functional orthopaedics treatment as a part of fixed orthodontic therapy. Tongue thrusting was a major causative factor of open bite and myotherapy was recommended to overcome this abnormal pattern.

Growth modification

The typical growth pattern shows vertical growth of the maxilla, more posteriorly than anteriorly, coupled with downward and backward rotation of the mandible and excessive eruption of the maxillary and mandibular teeth.

The key to successful growth modification would be restraining vertical development and encouraging anterior-posterior mandibular growth, while controlling the eruption of teeth in both the jaws **[4]**.

Treatment goals for hyper divergent Class II patients are as follows:

1. reduction in maxillary and mandibular dento alveolar height
2. reduction in gonial angle
3. increase in palatal plane angulation
4. maxillary expansion
5. mandibular auto rotation to decrease lower facial height and reposition the chin forward.

The vertical facial growth extends into the adolescent and post-adolescent years, because of which even if the growth can be modified successfully in the mixed dentition, active retention will be necessary for a number of years.

Hierarchy of effectiveness in long face class II treatment

HP headgear to functional with bite blocks

⇩

Bite block on functional appliance

⇩

High pull headgear to maxillary splint

⇩

High pull headgear to molar

DEEP BITE:

Deep bite is often associated with certain skeletal proportions, such as a short face with a square gonial angle and flat mandibular plane. In cases where a child with a short face and decreased lower face height has a deep bite, spontaneous correction is unlikely to occur, and active treatment may be necessary. It has been suggested that excessive overbite can

contribute to periodontal disease and other ailments, including discomfort, headache, fatigue, tinnitus, pain around the temporal region, tenderness of the joint, mandibular subluxation, migraine, ineffective mastication, and changes in facial expressions.

DEFINITIONS:

GRABER has defined deep bite as a condition of excessive overbite, where the vertical measurement between the maxillary and mandibular incisal margins is excess when the mandible is brought into habitual or centric occlusion.

BRITISH STANDARD INSTITUTE (1983): The extension of the maxillary teeth over the mandibular teeth in a vertical direction when the opposing teeth are in intercuspal position.

TYPES OF DEEP BITE:

1. Dento-alveolar deep bite: This type of deep bite is characterized by the absence of any complicated skeletal features. Dental deep bite occur due to:

1) Over erruption of anteriors.
2) Infra-occlusion of molars.

a) Deep bite due to over eruption of anterior:

Dental deep bite associated with over eruption of lower incisors are usually seen in Class II malocclusions. The presence of an increased overjet allows the lower incisors to over erupt until they meet the palatal mucosa. These patients hence exhibit an excessive curve of spee. The inter-occlusal clearance is usually normal as the molars are fully erupted.

b) Deep bite due to infra occlusion of molars:

The presence of a lateral tongue posture or lateral tongue thrust may prevent the molars from erupting to their normal occlusion level. It can also occur due to premature loss of posterior teeth. Deep bite caused by infra occlusion of molars are characterized by the presence of partially erupted molars (i.e. reduced crown height) and large inter-occlusal clearance.

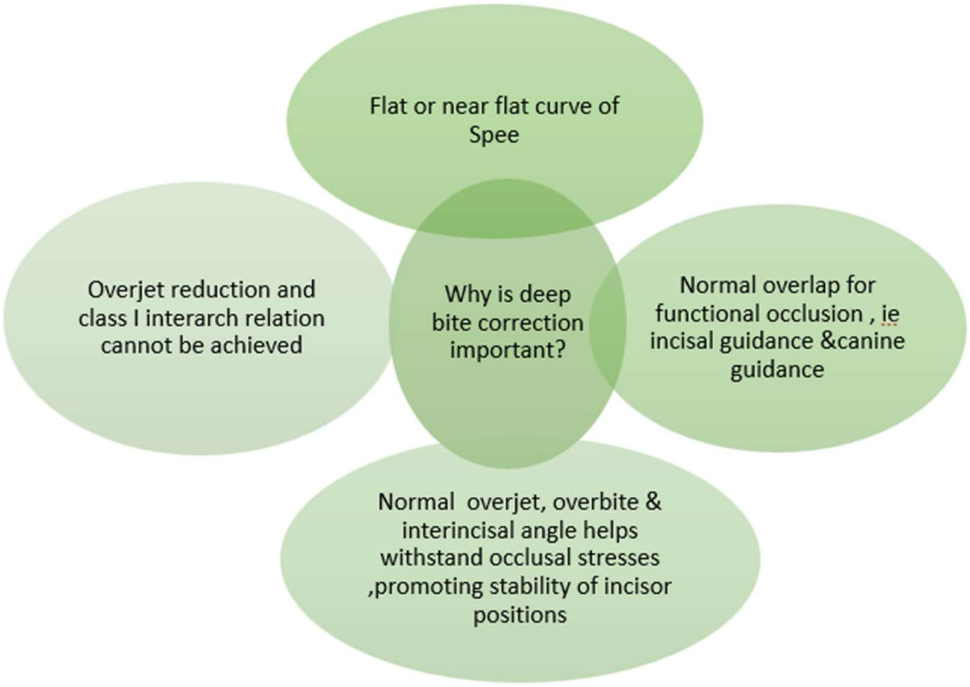
Acquired deep bite:

This type of acquired secondary deep bite is seen either when a deciduous 1st molar is lost prematurely, or teeth tips into extraction site, after early loss of permanent posterior teeth or along with tooth abrasion.

Skeletal deep bite:

It is a reduction in the mandibular plane angle and a decrease in the vertical height of the maxilla, which has been described as the short face syndrome.

Management:



ANTERIOR BITE PLANE

-In growing patients an efficient method of overbite reduction is the use of an anterior bite plane. The anterior plane inhibits the vertical development of the lower incisors and allows differential eruption of the posterior teeth to take place. The anterior bite plane should be just thick enough to disengage the posterior teeth by 2-3 mm.

FUNCTIONAL APPLIANCES:

ACTIVATOR:

Deep bite due to infra occlusion of the molars can be managed with an activator which has been selectively trimmed in such a manner so as to allow the supra eruption of the posterior teeth. This results in vertical rotation of the mandible.

With an Activator only minimal intrusion is possible. The intrusion which occurs is relative, since the posterior teeth are allowed to erupt. If patient shows equal amount of vertical growth then treatment is usually successful.

BIONATOR

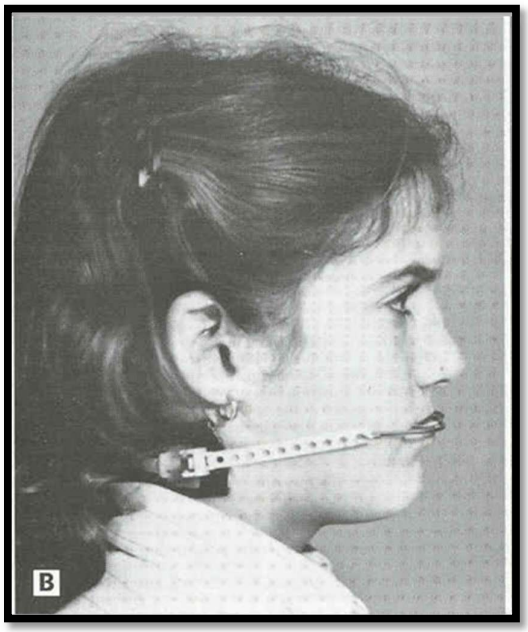
Overbite due to infra-occlusion of the molars and premolars can be treated effectively with bionator. Best result can be obtained if the premolars are still erupting.

In order to allow for the supraeruption of the posterior teeth the upper and lower molars are unloaded (trimmed) first, then the lower premolar region are unloaded, while the upper molars and premolars are loaded. Next the upper premolars are unloaded, while the lower molars and premolars are loaded.

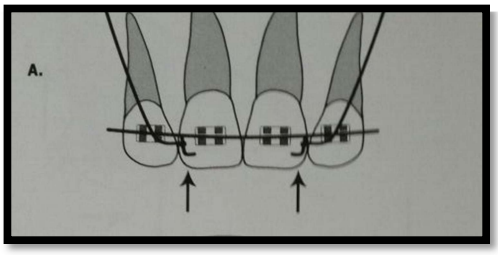
ORTHOPEDIC APPLIANCE:

Cervical headgears

Very effective in extruding and distalizing the upper molars. It exerts a vertically downward component of force with the potential for extrusion of the molars. With cervical pull headgear the molars get distalized and extruded and the mandible rotates downward and backward and deep overbite gets corrected. For extrusion and distalization of molars 200-300 gm of force per side is applied. The force duration should be 14 to 16 hours per day or more.

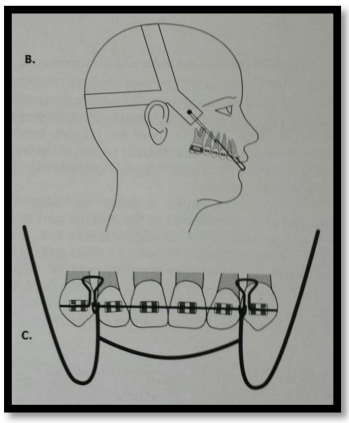


Another application of headgear is to apply the intrusive force on the upper incisors directly by using the ***J hook*** to the archwire as was described by ***Terrel Root.***



Asher headgear

Choice for intrusion and retraction. With a high pull cap, it retracts and intrudes, the bow is hooked to the arch wire mesial to the cuspid against a keyhole loop or a hook attached to the wire.

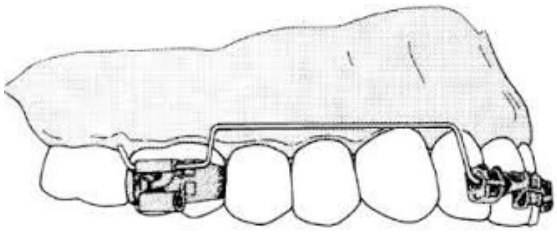


Herbst Appliance: The Herbst appliance is more effective in correcting the sagittal discrepancy of the mandible, but since the anatomy of the glenoid fossa and the articular eminence is such that it will not allow pure displacement, the mandible is displaced vertically which in turn helps correct the deep overbite to a certain extent.

Utility Arch

The 'utility arch' was designed by Ricketts to reduce the overbite. It engages the molars and the lower incisors only. The arch wire is stepped down in the buccal segment area to give long lever arm and is stepped up immediately distal to the lower incisors.

The anterior section of the arch wire is constructed with slight lingual crown torque to limit labial movement of lower incisor crowns. The use of square or rectangular sectional arch wire ensures that the force can be directed down the long axis of tooth and proclination or retroclination of the incisors can be minimized.



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