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# Methods of Treating Maxillary (Transverse ) Deficiency in Crossbite Cases

A Project Submitted to
The College of Dentistry, University of Baghdad, Department of Orthodontic in Partial Fulfillment for the Bachelor of Dental Surgery

By
**Zumrud Mohammed Kadhim**

Supervised by:
**Dr. Yassir A. Yassir**
B.D.S., M.Sc., PhD. (Orthodontics) (UK)

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## CERTIFICATION OF THE SUPERVISOR

I certify that this project entitled "**Methods of Treating Maxillary Deficiency**" was prepared by the fifth-year student **Zumrud Mohammed Kadhim** under my supervision at the College of Dentistry/University of Baghdad in partial fulfillment of the graduation requirements for the Bachelor Degree in Dentistry.

Supervised by

**Dr. Yassir A. Yassir**

Date:

## DEDICATION

This project is dedicated to my father and mother. Although he was my inspiration to study dentistry. For my **father** who helped me in all things great and small. For my **mother** who has always been there for me.

Thank you to my academic advisor who guided me in this process and the committee who kept me on track.

## ACKNOWLEDGEMENT

All praise and thanks to Allah the ever magnificent and ever thankful for his endless blessings and mercy upon us.

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And offer our profound appreciation to Assist Prof. **Dr. Dheaa H.Algroosh**, Head of orthodontics Department And may God reward them with his blessings.

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Finally, special thanks to our families and friends who kept pushing us forward to give our best.

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| | |
|---|---|
| **UCLP** | Unilateral cleft lip and palate |
| **BCLP** | Bilateral cleft lip and palate |
| **RME** | Rapid maxillary expansion |
| **SME** | Slow maxillary expansion |
| **MPS** | Mid-palatal suture |
| **Mm** | Millimeter |
| **CBCT** | Cone-beam computed tomography |

# Introduction

Maxillary deficiency is the most skeletal change that involves the maxilla, under development of the bones of the upper jaw, is the primary morphologic problem, it may be in association with clefting unilateral cleft lip and palate (UCLP) bilateral cleft lip and palate (BCLP) or a more complex craniofacial syndrome (e.g., Apert, Crouzon, Pfeiffer, Kleeblatt- schadel, or Binders). Until the late 1960s, when **Dr. Tessier** developed the field of craniofacial surgery and Obwegeser introduced and Bell refined the Le Fort I osteotomy, the concept of surgical management of maxillary deficiency was of only theoretical interest **(Bell, 1975).** Patients with maxillary transverse deficiency can exhibit unilateral or bilateral posterior crossbites, often accompanied by anterior dental crowding **(Ramires *et al*., 2008).** Crossbite and dental crowding, therefore, are two easily recognizable clinical signs that could be the result of maxillary deficiency. Other effects of maxillary deficiency, however, are not as easily identifiable and often not detected. For example, laterally flared maxillary posterior teeth may camouflage a maxillary transverse deficiency **(McNamara , 1999).**

The incidence of a maxillary transverse discrepancy ranges between 8 to 18% in the deciduous and mixed dentition, presenting as a unilateral or bilateral crossbite. It is believed that expansion therapy should be started in patients either before or during their peak growth spurt. To obtain maximal skeletal changes, the therapy is typically initiated at a very early age. Expansion therapy performed after the peak growth spurt will lead to more dental changes than skeletal which leads to tipping of buccal teeth **(Baccetti, 2001).**

# Aims of the study

To review the methods of treatment maxillary deficiency by three modalities (Rapid maxillary expansion, Slow maxillary expansion and surgically assisted maxillary expansion), and a brief on commonly used appliances regarding their indications, contraindication, advantages and disadvantages.

# Chapter One: Review of Literature

## 1.1 Methods of Treatment of Maxillary Deficiency

### 1.1.1 Growth and development of maxillary

The maxilla is the most important bone of the midface. It has a central location and provides structural support to the viscerocranium. It has functional and aesthetic significance as it has a fundamental role in facial architecture, separates the nasal and oral cavities, forms the upper jaw, and contains the maxillary sinus (**Dal grof and Higgin, 2008)**.

The maxilla develops postnatally entirely by intra- membranous ossification. Since there is no cartilage replacement, growth occurs into two ways

1. **Sutural growth:**

a) **Transverse growth:**

By apposition of bone at the sagittal sutural such as inter nasal suture , their activity decrease at the end of the first year but they continue forming osteal tissue for a long period also apposition of bone at the external aspect of the maxilla on both sides at the premolar regions by surface remodeling , Additive growth on the free ends increase the distance between them , The buccal segment move downward and outward , as the maxilla itself is moving downward and forward, owing the principle of expanding as seen in figure (1) .

b) **Vertical and Antero - posterior growth:**

Apposition of bone: at the sutures that connect the maxilla to the cranium and cranial base such as:

- **Tempro – Zygomatic**
- **Maxilla – Zygomatic suture**
- **Pterygoid – Palatine suture**
- **Fronto – Maxillary suturer**

These are parallel to each other, and they orient the direction of the facial growth downward and forward **(Singh, 2007).**

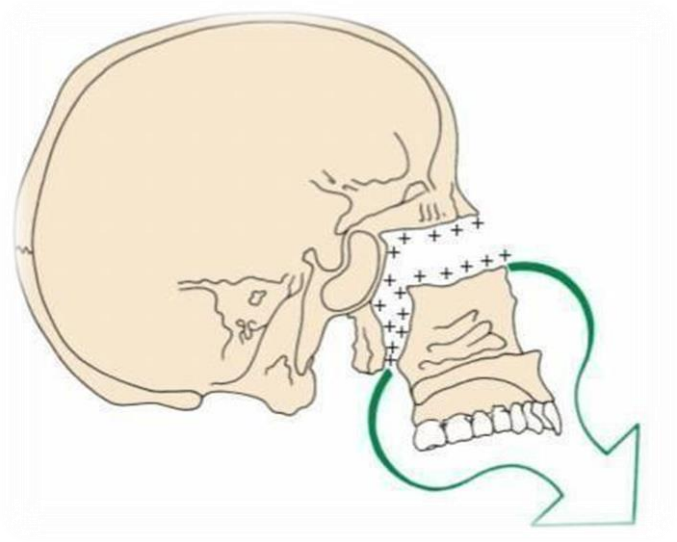

**Figure 1: As growth of surrounding tissues translates the maxilla downward and forward (Saunders, 1996).**

## 2. Surface remodeling:

A. **Vertical growth include**:

- Alveolar process: the formation of alveolar process by apposition of bone on three aspects (inferior, internal, external) in posterior region and on two aspects (internal, inferior) in the anterior region.
- Palate: There will be resorption on the superior aspect (nasal) and apposition on the inferior aspect (oral) which will bring the palate downward **(singh, 2007)**.

### B. Antero – posterior growth Occurs by:

- anterior alveolar growth, resorption in the vestibular part and apposition on the inferior and palatal part as seen in figure (2).
- an apposition on the posterior aspect of the horizontal part of the palate.
- development of tuberosity **(singh, 2007).**

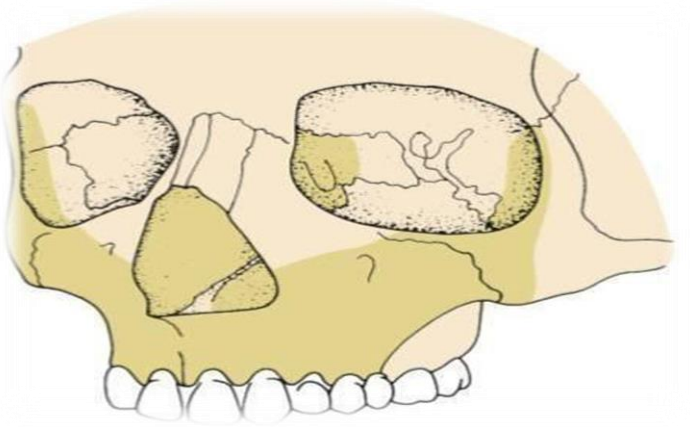

**Figure 2: As the maxilla is carried downward and forward, it's anterior surface tends to resorb. Resorption surfaces are shown here in dark yellow (Saunders1996).**

## 1.1.2 Diagnosis of Maxillary Deficiency

With a transverse deficiency due to a narrow maxilla, the temporomandibular joints, musculature, periodontal tissue, and airway can be adversely affected in the susceptible patient. There are three different methods for diagnosis the transverse dimension: one using traditional cephalometry, one using dental casts, and one using cone-beam computed tomography (CBCT). Regardless of which of these methods one chooses, one still must keep optimal treatment goals in mind as a rationale to normalizing the transverse dimension **(Gbologah *et al.*, 2010).**

## 1.1.3 Etiology of Maxillary Deficiency

**1.** Class III

**2.** Crossbite

**3.** Cleft lip and palate

### 1.1.3.1 Class III

**A. Occlusal feature:**

A person with class III malocclusion may exhibit either maxillary deficiency, mandible excess or combination of the two. Class III malocclusions

occur when the lower incisors are positioned more labially relative to the upper incisors. Therefore, an anterior crossbite of one or more of the incisors is a common feature of Class III malocclusions **(Gravely, 1984).**

**B. The etiology factors for class III malocclusion (Battagel, 1993).**

**1- Skeletal pattern:**

The skeletal relationship is often the most important etiological factor, with many Class III incisor relationships being associated with an underlying Class III skeletal relationship cephalometric studies have shown that, compared with Class I occlusions, Class III malocclusions exhibit the following:

- Increased mandibular length.
- A more anteriorly placed glenoid fossa so that the condylar head is positioned more anteriorly leading to mandibular prognathism.
- Reduced maxillary length.
- A more retruded position of the maxilla leading to maxillary retrognathia **(Bryant, 1981**)

**2- Soft Tissues:**

Soft tissues do not play a major etiological role. In fact, the reverse is often the case, with the soft tissues tending to tilt the upper and lower incisors towards each other so that the incisor relationship is often less severe than the underlying skeletal pattern. This dentoalveolar compensation occurs in Class III malocclusions because an anterior oral seal can frequently be achieved by upper to lower lip contact.

**3- Dental Factors:**

Class III malocclusions are often associated with a narrow upper arch and a broad lower arch, with the result that crowding is seen more commonly, and to a greater degree, in the upper arch compared with the lower. Frequently, the lower arch is well aligned or even spaced.

### 1.1.3.2 Crossbite

A discrepancy in the buccolingual relationship of the upper and lower teeth.

**A. The etiology of crossbite classified according into**

- Local cause: The most common cause is crowding where one or two teeth are displaced from the arch.
- Skeletal cause: a cross bite of the buccal segments may be due to a true transvers discrepancy between the arches, or because of an anteroposterior discrepancy which results in a relative mismatch of arch width with a wider part of one arch occluding with a narrower part of the opposing jaw.
- Soft tissue: non-nutritive sucking habits are often associated with a posterior cross- bite because the habit leads to a lowered position of the tongue with a negative pressure being generated intraorally **(Lewis, 2019).**

**B. Classification of Crossbite: (Phalaris and Naik, 2017)**

1. **According to their location in the arch**
    A. Anterior Crossbite
        - Single tooth crossbite
        - Segmental crossbite

    B. Posterior crossbite
        - Single tooth crossbite
        - Segmental crossbite.

Classification of posterior crossbite based on its presence on one side or both side of the arch can be classified into following two types:

- Unilateral posterior crossbite
- Bilateral posterior crossbite.

2. **According to the extent of crossbite**

   - Simple posterior crossbite.
   - Buccal non occlusion (scissor bite).
   - Lingual non occlusion.

3. **Classification of crossbite based on structure involved**

Crossbite can be classified into following three types based on structure involved:

**A. Dental crossbite**

**B. Skeletal crossbite**

**C. Functional crossbite**

**A.** Anterior crossbite: refers to an abnormal labiolingual relationship between one or more maxillary and mandibular incisor teeth. This may be termed a reverse overjet when the patient is in centric occlusion and one or more maxillary incisors are positioned lingually to the mandibular incisor teeth **(Olsen, 1996).**

**B.** Posterior cross bite: exhibit lateral shifts of the mandible on closure associated with a transverse width discrepancy between the dentoalveolar relationships of the maxilla and mandible It may be unilateral or bilateral, buccal or lingual, seen in figures (3) (4) **(Bell *et al*., 2014).**

**Figure 3: Bilateral posterior crossbite (Phulari and Naik, 2017).**

**Figure 4: Unilateral posterior crossbite (Phulari and Naik, 2017).**

### 1.1.3.3 Cleft lip and palate

Cleft lip and palate are one of the most common types of craniomaxillofacial birth anomalies. Midface deficiency is a common feature of cleft lip and palate patients due to scar tissue of the lip and palate closure **(Mossey *et a*l., 2012).** Oral clefts commonly affect the upper lip, alveolar ridge and hard and soft palates. The clefting anterior to the incisive foramen is defined as the cleft of the primary palate. The clefting posterior to the incisive foramen is defined as a cleft of the secondary palate **(Naik and Phulari, 2017).**

**Classification of cleft lip and palate** is morphological and described as four types of clefts **(Tolar ova and Cervenka, 1998).**

- **Group I:** Clefts of the soft palate only.
- **Group II:** Clefts of the hard and soft palates extending to the incisive foramen.
- **Group III:** Complete unilateral clefts involving the soft palate, hard palate, alveolar ridge and the lip on one side as seen in figure (5).
- **Group IV:** Complete bilateral clefts of the soft and hard palates, alveolar ridge and the lip on both sides as seen in figure (7).

**Figure 5: Baby with a complete unilateral cleft lip and palate on the left side (Mitchell, 2019).**

**Figure 6: Baby with a bilateral incomplete cleft lip. (Mitchell, 2019)**

**Figure 7: Baby with complete bilateral cleft lip and palate (Mitchell, 2019).**

## 1.2 Treatment of maxillary deficiency

The treatment of maxillary deficiency can be classified in to the

### 1.2.1Nonsurgical treatment

- Rapid maxillary expander.
- Slow maxillary expander.

### 1.2.2 Surgical techniques treatment.

### 1.2.1 Non-Surgical treatment

### 1.2.1.1Rapid Maxillary Expander (RME)

#### 1.2.1.1.1 Introduction

Rapid maxillary expansion appliances are the best appliances for orthopedic expansion in that, the changes are produced mainly in the underlying skeletal structures rather than by the movement of teeth through the alveolar bone. Rapid maxillary expansion not only separates the mid-palatal suture but also affects the circum-zygomatic and circum-maxillary suture systems. Rapid maxillary expansion is also called palatal expansion or split palate. Rapid maxillary expansion is a skeletal type of expansion which produces skeletal changes by the separation of mid-palatal suture **(Phulari, 2017).**

The main object of RME is to correct maxillary arch narrowness but its effects are not limited to the maxilla as it is associated with 10 bones in the face and head **(Ceylan, 1996).**

#### 1.2.1.1.2 Effects of the RME on Maxillary Skeletal Base

Effects of rapid maxillary expansion on maxillary skeletal base are as follows: triangular or fan-shaped of the mid-palatal suture with maximum opening in the maxillary incisor's region and gradually diminishing towards the posterior part of the palate **(Phulari, 2017).**

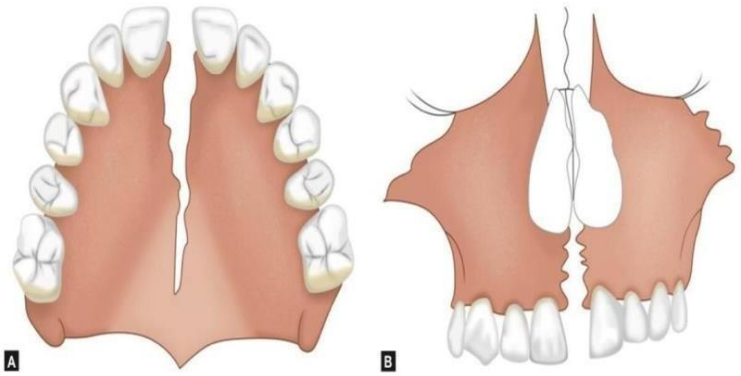


**Figure 8: RME causes triangular or fan shaped opening of the mid-palatal suture. (A)Transverse (B)Frontal view (Phulari, 2017).**

#### 1.2.1.1.3 Effects of the RME on Maxillary Anterior Teeth

Activation of rapid maxillary expansion produces the separation of incisors in the midline resulting in midline diastema, which indicates that the expansion has taken place. This midline diastema will be closed because of the transseptal fiber traction in about 3–5 months **(Phulari, 2017).**

**Figure 9 Effect of the RME on maxillary anterior teeth: (a) before activation (b) after activation. Appearance of midline (Phulari, 2017).**

#### 1.2.1.1.4 Effects of the RME on Maxillary Posterior Teeth

With the initial alveolar bending and compression of the periodontal ligament, there is a definite change in the long axis of the posterior teeth. Teeth show buccal tipping and are believed to extrude to a limited extent **(Hicks, 1978)**.

#### 1.2.1.1.5 Effects of the RME on Alveolar Bone

Because bone is resilient, lateral bending of the alveolar processes occurs early during RME, which rebounds back after a few days **(Isaacson *et al*., 1964).**

#### 1.2.1.1.5 Effects of the RME on Mandible

There is a concomitant tendency for the mandible to swing downward and backward **(Bishara and Stalye, 1987).** It is important for the clinician to remember that the main resistance to mid- palatal suture opening is probably not the suture itself, but in the surrounding structures particularly the sphenoid and zygomatic bones **(Bishara and Stalye, 1987).**

### 1.2.1.1.7 Indications for Rapid Maxillary Expansion

Patients who have lateral discrepancies that result in either unilateral or bilateral posterior crossbites involving several teeth are candidates for RME. The constriction may be skeletal (narrow maxillary base or wide mandible), dental, or a combination of both skeletal and dental constriction **(Haas, 1965; Wertz, 1970).** Anteroposterior discrepancies are cited as reasons to consider RME. For example, patients with skeletal Class II, Division I malocclusions With or without a posterior cross bite Patients with class III malocclusions and patients with borderline skeletal and pseudo-class III problems are candidates if they have maxillary constriction or posterior cross bite **(Hass and Wertz, 1970; Hass, 1980).**

Cleft lip and palate patients with collapsed maxillae are also RME candidates. Finally, some clinicians use the procedure to gain arch length in patients who have moderate maxillary crowding. According to Bell, the enhanced skeletal response that accompanies RME redirects the developing posterior teeth into normal occlusion and corrects asymmetries of condylar position. This should allow more vertical closure of the mandible and eliminates both functional shifts and possible temporomandibular joint dysfunction **(Bell, 1982)**.

### 1.2.1.1.1.8 Contraindications for Rapid Maxillary Expansion

Patients who cannot cooperate with the clinician are not candidates for RME. Patients who have a single tooth in crossbite probably do not need RME. Patients who have anterior open bites, steep mandibular planes, and convex profiles are generally not well suited to RME. Patients who have skeletal asymmetry of the maxilla or mandible, and adults with severe anteroposterior and vertical skeletal discrepancies are not good candidates for RME. Reservations about the patients who have marked skeletal problems are qualified if orthognathic surgery is planned **(Wertz, 1970; Alpiner and Beaver, 1971).**

### 1.2.1.1.9 Types of the RME appliances

- ❖ Removable Appliances
- ❖ Fixed Appliances
  - ➢ Tooth borne
  - ➢ Tooth and tissue borne

### A. Removable Rapid Maxillary Expansion Appliances

Removable appliances produce skeletal expansion by the splitting of mid-palatal suture, when they are used in the deciduous or early mixed dentition the reliability of these appliances in producing skeletal expansion is highly questionable when used in older adults **(Phulari, 2017).** Removable rapid maxillary expansion appliances consist of an expansion screw in the midline with a split acrylic plate. It may also consist of retentive clasps ("C" or Adam's clasp) on the posterior teeth and a labial bow on the anterior teeth **(Phulari, 2017).**

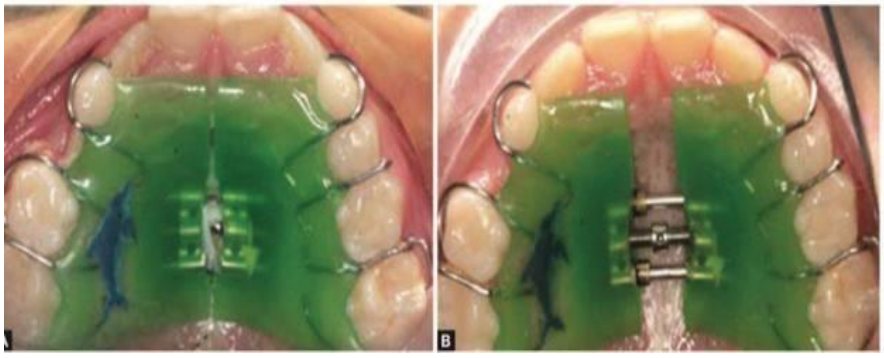

**Figure 10: Removable rapid maxillary expansion appliances, consisting of an expansion screw in the midline with split acrylic plate, Adam's clasp one the first molar and labial bow on the anterior teeth (Phulari, 2017)**

## B. Fixed Rapid Maxillary Expansion Appliances

Fixed rapid maxillary expansion appliances are fixed expanders and cannot be removed by the patient. These fixed expanders can be classified into tooth and tooth tissue borne appliances **(Phulari, 2017).Most used fixed expander of tooth and tissue borne appliances are:**

**-Derichsweiler-type expander** consists of molar bands on right and left permanent first molars and first premolars with wire tags soldered into the palatal surface of all molar and premolar bands, the outer free ends of wire tags are inserted into split palatal acrylic, incorporating a jack expansion screw in its center **(Derichsweiler *et al.*, 1953).**

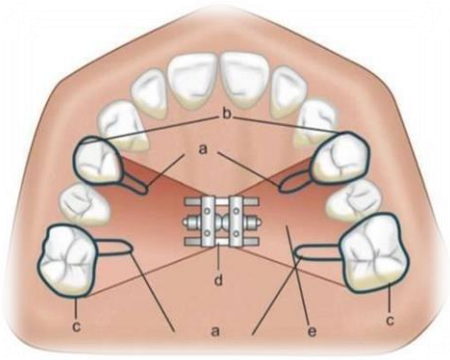


**Figure 11: Parts of Derichsweiler expansion appliance.**
**(a) Wire tags, (b) Premolar bands (c) Molar bands (d) Expansion screw, (e) Acrylic plate (Phulari, 2017).**

**-Haas-type expander:** This appliance consists of molar bands on right and left permanent molars and premolars. A jack screw is incorporated in the midline into the two acrylic pads that closely contact the palatal mucosa. Support wires also extend anteriorly from the molars along the buccal and lingual surface of the posterior teeth to add rigidity to the appliance **(Haas, 1961)**. Haas states that more bodily movement and less dental tipping is produced when acrylic palatal coverage is added to support the appliance thus permitting the forces to be generalized not only against the teeth but also against the underlying soft and hard

palatal tissues **(Haas, 1961).**

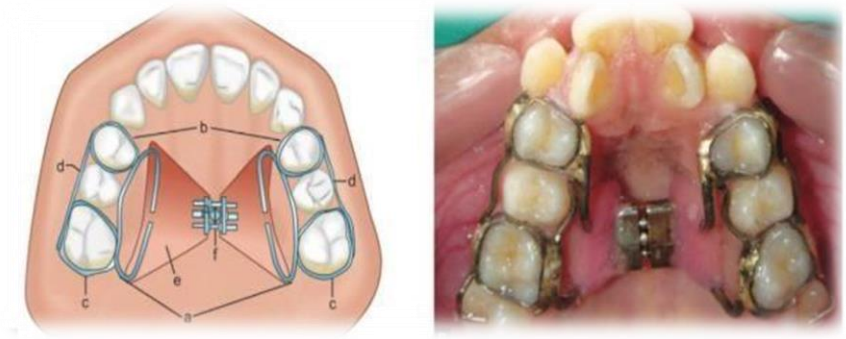


**Figure 12: A) Hass type of expansion appliance. (a) Lingual support wire, (b) Premolar bands, (c) Molar band, (d) Buccal support wire, (e) Acrylic plate, (f) Expansion screw (B) A case treated with Haas Derichsweiler type of expansion appliance (Phulari, 2017).**

**Tooth borne appliances are:**

**-Hyrax-type expander:** The more commonly used type of banded RME appliance is the Hyrax-type expander. This type of expander is made entirely from stainless steel. Bands are placed on the maxillary first molars and first premolars. The expansion screw is localized in the palate in proximity to the palatal contour, buccal and lingual wires may be added for rigidity. The main advantages of it are that it does not irritate the palatal mucosa and it is easy to keep clean. It can provide sutural separation of 11mm within a very short period of wear and a maximum of 13 mm (about 0.51 in) can also be achieved. Each activation of the screw produces approximately 0.2 mm (about 0.01 in) of lateral expansion and it is activated from front to back (**Bishara and Stalye, 1987).**

**Figure 13: Hyrax type of expansion appliance: (A) Pre- treatment. (B) Post-treatment of a patient treated with Hyrax rapid expander (Phulari, 2017).**

**-Isaacson expansion appliance:** Isaacson expansion appliance is a fixed tooth borne appliance without acrylic covering. This appliance consists of molar bands on the first right and left permanent molars and premolar bands on right and left permanent premolars. Metal flanges are soldered into the molar and premolar bands on buccal and palatal sides **(Bishara and Staley, 1987).**

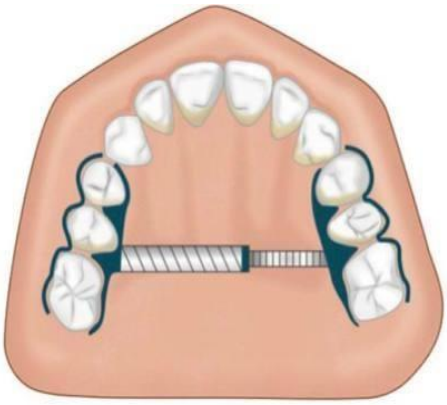

**Figure 14: Isaacson type of expansion appliance (Phulari, 2017).**

## C. Bonded Rapid Maxillary Expansion

Bonded rapid maxillary expansion appliances consist of an acrylic splint, covering a variable number of teeth on either side in the maxillary arch, to which a jack screw is attached. Splint can be either a cast cap made of silver copper alloy or acrylic splint made of polymethyl methacrylate a wire framework may be adapted around the teeth to reinforce the acrylic. The bonded rapid maxillary expander has become increasingly popular because of its advantages.

- It can be easily cemented during the mixed dentition stage, when retention from other appliances can be poor.
- Number of appointments reduced , seen in figure (15) **(Sarver, 1989)**

**Figure 15: Bonded rapid maxillary expansion appliances consist of an acrylic splint, covering several teeth on either side in the maxillary arch to which a jackscrew is attached (Phulari, 2017).**

### 1.2.1.1.10 Expansion Screw

A typical expansion screw consists of an oblong body divided into two halves. Each half has a threaded inner side that receives one end of a double-ended screw. The screw has a central bossing with four holes. These holes receive a key called expansion screw key, which is used to turn the screw, seen in figure (16) **(Phulari, 2017).**

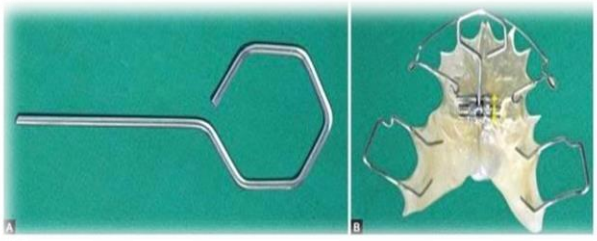

**Figure 16: (A) Expansion screw key. (B) Showing how to activate the expansion appliance with the key. Usually for RME the key should be turned 90° (Phulari, 2017).**

**Table1: Different types of expansion screws (Phulari, 2017)**

| Expansion screw type | Use |
|---|---|
| Symmetrical bilateral expansion screw | Bilateral expansion |
| Traction screw | Closing space |
| Three-dimensional | Anterior and bilateral expansion |

### 1.2.1.2 Slow Maxillary Expansion (SME)

### 1.2.1.2.1 Definition of SME

Slow palatal expansion is a procedure to expand the maxillary arch in transverse dimension to correct the constricted maxillary arch with light forces (**Singh, 2007).**

#### 1.2.1.2.2 Indications of SME

1. Unilateral or bilateral crossbites
2. To correct minimal crowding by gaining spaces
3. To correct dental crossbite in permanent dentition
4. To correct mild maxillary deficiency in cleft lip and palate patients by providing slow continuous forces **(Naidu and Suresh, 2019)**.

#### 1.2.1.2.3 Contraindications of SME

Adult patients who have completed their growth **(Naidu and Suresh, 2019).**

#### 1.2.1.2.4 Advantages of SME

1. It delivers a constant physiologic force until the required expansion is obtained.
2. There is minimum tipping of anterior teeth.
3. The appliance is light and comfortable for the patient.
4. Relapse tendencies are less.
5. Maintenance of sutural integrity and the reduced stress loads within the tissues.
6. Less pain and discomfort due to light forces **(Naidu and Suresh, 2019).**

#### 1.2.1.2.5 Disadvantages of SME

Longer treatment duration compared to rapid palatal expansion **(Naidu and Suresh, 2019).**

#### 1.2.1.2.6 Appliances Used to Produce Slow Maxillary Expansion

### A. COFFIN SPRING

The coffin spring was introduced by Sir Walter Coffin in the year 1875.

The appliance consists of Adam's clasps in the first premolars and first molars of both sides with an omega shaped wire placed in the mid-palatal region. The appliance is made up of 1.2 mm (about 0.05 in) stainless steel wire and the components of the appliance are embedded into an acrylic base plate. Two separate acrylic wings are made around the wire framework on the slopes of the palate; these also contain the retentive clasps. The appliance is mainly indicated to bring about dentoalveolar changes in cases of unilateral or bilateral crossbite, cases where lateral expansion is indicated, cases requiring antero-posterior expansion, and when space requirement is less than 3 mm (about 0.12 in), seen in figure (17) **(Naidu and Suresh, 2019).**

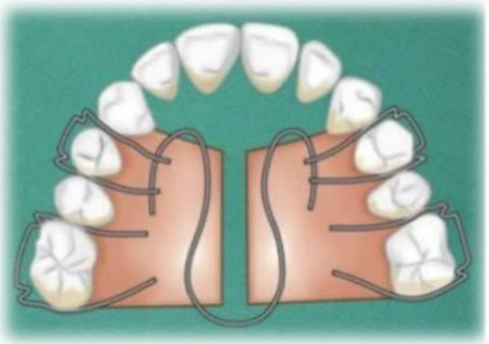

**Figure 17: Coffin spring (Naidu and Suresh, 2019).**

**B. Quad helix**

The Quad Helix appliance, as described by Ricketts in 1975, is a modification of the earlier trans palatal Coffin spring **(Brandt and Ricketts, 1975)**. It has four helical loops, each of which comprises an extra 25-mm wire which lightens the force magnitude. This helps in providing continuous action during expansion because of the greater range of activation provided by the longer wire, seen in figure (18) **(Bench, 1998).**

**Figure 18: Quad helix appliance used in a cleft palate case to: (A)Before expansion. (B)After expansion (Phulari, 2017).**

### 1.2.2 Surgical Treatment

The effect of the dental arch on the maxillary base diminishes as age advances so surgically assisted expansion techniques can be considered. Indications of surgical expansion are:

a. To widen the arch.
b. To correct posterior crossbite when large amount (>7 mm) of expansion is required to avoid the potential increased risk of segmental osteotomies
c. To widen the arch following maxillary collapse associated with a cleft palate, in cases with extremely thin and delicate gingival tissue, or presence of significant buccal gingival recession in the canine- bicuspid region of the maxilla; and in condition, where significant nasal stenosis is found **(Gill *et al.*, 2004).**

**The techniques available are:**

A. Surgically Assisted Rapid Palatal Expansion.
B. Distraction Osteogenesis.

**A. Surgical Assisted Rapid Palatal Expansion**

A transverse deficiency of the maxilla in adult patients can be treated with surgically assisted rapid maxillary expansion. This procedure involves the techniques of orthodontic palatal widening with modification of the Le Fort I osteotomy. A cut is made along the lateral surface of the maxilla, which is like the Le Fort I cut in this area. Then a vertical cut is made in the anterior nasal spine above the apices of central incisors to open/split the midpalatal suture activation of the maxillary expansion appliance is now begun When the maxilla reaches its desired width, the expansion appliance is stabilized for 3 months in a retention phase **(Winter, 1991).**

**B. Distraction osteogenesis**: It is a new approach to correct the deficiencies of maxilla and mandible (**Tsahannerr *et al*., 2017).**

**Advantages**

- Can produce larger skeletal movements without stretching tissues.
- Eliminates the need for bone grafts and the associated secondary surgical sites.
- Less chances of trauma to TMJ structures.
- Decreased risk of neurosensory loss.

**Disadvantages.**

- Procedure very technique sensitive.
- Needs two surgical procedures: placement and removal.
- Can be used for treating only skeletal discrepancies with deficiencies.
- Cannot be used for treating excesses of the jaws **(Tsahannerr *et al.*, 2017).**

# Chapter Two: Discussions or Comments of the researcher

Maxillary expansion is a widely accepted procedure performed by orthodontists to correct posterior cross bites and transverse maxillary deficiency and early treatment has been performed to correct the transversal discrepancy to avoid the need for future extraction. There are many types of maxillary expansion, rapid maxillary expansion, slow maxillary expansion and surgical expansion. Rapid maxillary expansion could generally greater changes because it is the skeletal type of expansion cause forward movement of the maxilla complex and associated with anterior displacement of maxilla.

| Rapid Maxillary Expansion | Slow Maxillary Expansion | Surgical Expansion |
|---|---|---|
| Use for skeletal construction (narrow maxilla or wide mandible), dental or combination of both. | Use for minimal crowding, crossbite and mild deficiency of cleft lip and palate. | Use the wide arch and correct posterior crossbite when a large amount >7mm is required. |

# Chapter Three: Conclusion and Suggestions

Maxillary transverse discrepancy usually requires expansion of the palate by combination of orthopedic and orthodontic tooth movement, three expansion treatment modalities are used: rapid maxillary expansion, slow maxillary expansion and surgically assisted maxillary expansion. The type of skeletal and dental pattern greatly influences the type of expansion chosen which greatly facilitate the overall treatment objectives.

1-Methods of treating anterior maxillary deficiency

2-Methods of treating maxillary excess

3-Methods of treating mandubular deficiency

4-Methods of treating mandibular excess

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