Transverse Discrepancy in Orthodontics: A Review

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In today’s orthodontic practice esthetics is a primary concern both for patient and the orthodontist. The perception of esthetics for a lay person largely depends on the symmetry of the face. Hence, diagnosis and correction of the transverse discrepancy are imperative for optimum result. Some occlusal relations can result from skeletal jaw relation or from tooth positions. Malocclusion can occur in three planes of space, i.e., sagittal, transverse, and vertical plane. Transverse discrepancy is “An abnormality of development in transverse plane.” In orthodontic diagnosis and treatment planning, the emphasis is placed on recognizing asymmetry and achieving symmetric results with dental midlines coincident with each other and with the facial midline. Humans, like most other animals, are considered to display bilateral symmetry. By strict definition, this implies that mirror-image mathematical identity exists between right and left halves. In orthodontic diagnosis and treatment planning, emphasis is placed on recognizing asymmetry and achieving symmetric results. Treatment of an asymmetry can be challenging. The 1st treatment step is to diagnose if the asymmetry is of functional, dental or skeletal cause. The treatment options for transverse problem may include arch coordination, asymmetric extraction, asymmetric mechanics, and skeletal correction by orthopedic or surgical procedure. However, it is crucial to determine that the observed asymmetry is genuine and not the product of a functional or habitual shift of the mandible as is often the case with unilateral cross-bites due to reduced width of the maxillary arch.

Keywords: Asymmetric maxillary expansion, Brodie bite, Rapid maxillary expansion, Scissor bite, Surgically assisted rapid palatal expansion, Telescopic bite

INTRODUCTION

A malocclusion is a misalignment or incorrect relation between the teeth of the two dental arches a when they approach each other as the jaws close. Some occlusal relations can result from skeletal jaw relation or from tooth positions. Malocclusion can occur in three planes of space, i.e., sagittal, transverse, and vertical plane. Hence, Transverse discrepancy is basically “an abnormality of development in the transverse plane.”

Under normal circumstances, the right and left halves of the face are nearly symmetrical and the maxillary arch overlaps the mandibular arch both labially and buccally. When this relationship is violated, a transverse discrepancy is said to exist. Due to biological imperfection, some of which are inherent in the developmental process and some of which are caused by environmental disturbance, absolute symmetry is never encountered.

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TREMS AND DEFINITION

Cross-bite
It is defined by Graber as a condition where one or more teeth may be abnormally, malposed buccally or lingually or labially, with reference to opposing tooth or teeth.

Complete Maxillary Buccal Cross-bite (Brodie Bite)
A situation in which the maxillary dental arch is wide and it lies entirely buccal to (contain) the mandibular dental arch. This rare situation sometimes is seen in extreme Class II anomalies associated with maxillary hypoplasia (Figure 1).

Telescopic Bite
Denotes either, a complete mandibular lingual or a complete maxillary buccal cross-bite. The opposite (i.e., a complete maxillary palatal or a complete mandibular buccal cross-bite) sometimes is called a reverse telescoping bite.
**Scissor Bite**
The situation in which several adjacent posterior teeth overlap vertically in habitual occlusion with their antagonists, without contact of their occlusal surfaces. The deviation of the affected teeth from their ideal position could occur either in a buccal or a lingual direction (Figure 2).

### ETIOLOGY

<table>
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<th>Skeletal origin</th>
<th>Dental origin</th>
<th>Functional</th>
<th>Soft tissue origin</th>
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<td>Genetic, i.e., syndromes</td>
<td>Traumatic injury to the permanent teeth that causes lingual displacement of permanent tooth bud</td>
<td>Occlusal prematurity</td>
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<td>Deficient growth of anterior maxilla</td>
<td>Prolonged retention of primary teeth</td>
<td>Lateral shift of mandible</td>
<td>Soft tissue infection (mumps, parotiditis)</td>
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<tr>
<td>Deficient growth of lateral maxilla</td>
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<td>Habitual forward positioning of mandible</td>
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<td>Excessive mandibular growth anteriorly</td>
<td>Ectopic eruption of the permanent 1st molar</td>
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### DIAGNOSIS

Different diagnostic aids are as follows:
- Clinical examination
- Functional examination
- Study models
- Radiographic examination.

#### Clinical Examination
- Extra oral examination
- Intraoral examination

#### Extra oral examination
1. Full face and profile evaluation are made with the head in the natural position
2. By relating the parts of face to one another, the patient’s principal esthetic problems are identified
3. Full-face examination typically discloses that the patient has an asymmetry or not
4. When jaws are at rest, or when the patient is asked to smile or speak, there is any cant of the occlusal plane or not
5. Check for posterior part of face if patient having hypo or hyper divergent growth tendency.

#### Intraoral examination
The general intra-oral examination of transverse as follows:
1. Constricted maxillary arch
2. Maxillary arch may be symmetrical or asymmetrical
3. Cross-bite in relation to one or more teeth
4. The tooth or a tooth which is in cross-bite may develop gingival recession in that particular area
5. Lingual path of eruption of maxillary anterior or posteriors.

#### Functional Examination
A functional analysis is important not only to determine the etiology of transverse discrepancy or asymmetry but also to plan the orthodontic treatment required.

A functional analysis includes:
1. Assessment of postural rest position and maximum intercuspation
2. Examination of the temporomandibular joint.

#### Study Models
The study model allows evaluation of static occlusion in all three dimension.
Model analysis
1. Pont’s analysis
2. Ashley Howe’s analysis
3. Linder Harth analysis.

P-A Cephalograms
Cephalometrically skeletal discrepancy or dentoalveolar discrepancy or soft tissue discrepancy can dedifferentiated from each other.

Methods of cephalometric analyses:
1. Ricketts analysis
2. Svanholt and Solow analysis
3. Grummon’s Analysis
4. Grayson analysis
5. Hewitt analysis.

TREATMENT MODALITIES

Treatment modalities for transverse discrepancy correction are as follows:

Skeletal Correction
The type and timing of treatment depend on the degree of deformation and the philosophy of treatment.

Hence, transverse asymmetries can be corrected by following ways:
• Correction of sagittal skeletal discrepancy
• Rapid maxillary expansion (RME)
• Asymmetric maxillary expansion (AME).

Correction of Sagittal Skeletal Discrepancy
In sagittal discrepancy, correction is done by:
• Skeletal correction
• Dental correction.

Skeletal correction is done by surgical treatment and orthopedic correction. In Surgical correction, if a patient having a transverse discrepancy in the form of Class II malocclusion, the patient may undergo maxillary set back surgical procedure or a patient having mandible prognathic and forward positioned, that case mandibular set back surgery is done. Basically, surgical procedure is done in non-growing patient and it depends on what type of malocclusion exists. Orthopedic appliances make use of the teeth as a “handle” to transmit forces to the underlying skeletal structures. Forces in excess of 400 gm. should be applied to bring about favorable skeletal change.

RME
RME or palatal expansion as it is sometimes called, occupies unique niche in dentofacial therapy. RME or Split palate is a skeletal type of expansion that involves the separation of the mid-palatal suture and movement of the maxillary shelves away from each other.

Broadly classified into:
According to the rate of expansion:
1. Slow expansion - W-arch, Quad Helix, Coffin spring
2. Rapid expansion - Hyrax, Minn Isaacson
3. Ultra rapid
4. Surgically assisted (SARPE; Segmental Le Fort I Osteotomy).

According to appliance attachment:
1. Removable-active plate and functional appliances
2. Fixed:
   • Tissue borne: Haas type expansion, Derichsweiler type
   • Tooth borne: Banded - Hyrax or Biedermann type. Bonded maxillary expansion. Minne Expander or Isaacson type.

EXPANSION WITH FIXED APPLIANCES

A number of different techniques can be employed using fixed appliances to expand the maxillary arch. The techniques to be discussed include:
1. Expansion with arch wires
2. Use of auxiliary arches
3. Cross elastics.

Expansion with Arch Wires
Significant expansion may be produced using over expanded stainless steel arch wires, particularly those with a large dimension (for example, 0.021” × 0.025”). The arch wire should be overexpanded by approximately 10 mm expansion as the rectangular arch wire maintains torque control.

Auxiliary Arches
Expansion arches, also known as jockey arches, are auxiliary wires. The advantages of using expansion arches are that their construction is cheap and can be carried out easily at the chair side without having to change the molar bands. Expansion is likely to be produced by a degree of molar tipping, and this may be reduced by incorporating molar buccal root torque into the main rectangular archwire.

Cross Elastics
To produce maxillary expansion, cross elastics run from the palatal aspect of one or more of the maxillary teeth to the buccal aspect of one or more of the mandibular teeth. In addition to producing lateral forces, a vertical force vector is also produced which tends to cause molar extrusion (Figure 3).
SURGICAL TECHNIQUES

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

The techniques available are as follows:
• Surgically assisted rapid palatal expansion (SARPE)
• Segmental maxillary surgery.

Surgically Assisted Rapid Palatal Expansion (SARPE)\textsuperscript{11,12}

The surgical technique for SARPE involving a mid-palatal split was described in 1938. In the first half of the 20\textsuperscript{th} century, there was no significant evolution of surgical techniques for orthognathic surgery or SARPE.

A LeFort I type of Osteotomy with a segmental split of the maxilla and the placement of a triangular unicortical iliac graft for correction of maxillary constriction was presented by Steinhauser in 1972. Many surgical procedures have been designed to resect the areas of resistance to lateral expansion in the mid-face. The areas of resistance have been classified as anterior support (piriform aperture pillars), lateral support (zygomatic buttresses), posterior support (pterygoid junctions), and median support (midpalatal synostosed suture). Initial reports described the midpalatal suture as the area of greatest resistance to maxillary expansion. Most authors recommend that appliance activation should be started intraoperatively. This is done to ensure that the appliance is stable and that the areas of resistance of the 2 halves of the maxilla have been removed.

Segmental Maxillary Surgery

Transverse expansion can be produced during a Le Fort I osteotomy by creating an additional surgical cut along the mid-palatal suture. The maxillary halves are then separated and retained in the new position. The relative inelasticity of the palatal mucoperiosteum limits the degree of expansion that may be achieved. Before surgery, orthodontic treatment involves moving the roots of the maxillary central incisors apart to improve surgical access to the osteotomy site. This is the technique of choice in patients who require expansion and have coexisting sagittal and/or vertical maxillary discrepancies.\textsuperscript{10}

AME\textsuperscript{13} (Figure 4)

An AMEX appliance was made of 0.036-in diameter stainless steel wire. At first, a quad-helix appliance, consisting of 2 helixes on the crossbite side, was constructed. The force arm of the appliance was extended to the most anterior teeth in crossbite.

On the non-crossbite side, a vertically extending “stopper” between the maxillary first molar and first premolar was bent and adapted to the lingual surfaces of the mandibular first molar and first and second premolars. The appliance was activated by expanding the force arm to a distance equivalent to 8 mm and keeping the arms parallel to each other. Necessary reactivations were performed at 4-week intervals until the posterior crossbite was corrected. For reactivations, the appliance was removed and re-cemented.

DENTAL CORRECTION

Patients with dentoalveolar asymmetries can present some of the most biomechanically challenging situations to the orthodontist. One creative approach for managing dental asymmetries is to extract a combination of teeth that will simplify intra-arch and interarch mechanics.

Dental correction is done by:

a. Asymmetric extractions used in the treatment of patients with asymmetries
b. Treatment of patients with asymmetries using asymmetric mechanics
c. Surgical correction.

Figure 3: Cross elastics

Figure 4: Asymmetric maxillary expansion
RETENTION AND RELAPSE

Diagnosis and treatment of the transverse dimension requires some insight into this problem. Expansion through maxillary suture widening by RME has been claimed to promote stability after retention. Stability has been attributed to the skeletal component of arch enlargement obtained by the expansion appliance as opposed to dental expansion as a result of edgewise appliance mechanotherapy.9

The causes of relapse are as follows:
• High stress accumulated between the articulations of the craniofacial complex
• Tension produced in the palatal mucosa
• Imbalance between the buccal and lingual pressures, which is created as a result of maxillary expansion
• The application of a fixed retainer immediately and subsequent to RME, then followed by an intermittent removable retention appliance is highly recommended.

CONCLUSION

Humans, like most other animals, are considered to display bilateral symmetry. This is probably an appropriate, albeit idealistic, goal for treatment because our patients view themselves from the frontal perspective, where right-left asymmetries can be easily detected.1

The treatment options for transverse problem may include arch coordination, asymmetric extraction, asymmetric mechanics, and skeletal correction by orthopedic or surgical procedure. However, it is crucial to determine that the observed asymmetry is genuine and not the product of a functional or habitual shift of the mandible as is often the case with unilateral crossbites due to reduced width of the maxillary arch.

Hence, I hope that this comprehensive look at one of the most challenging aspects of orthodontic therapy outlines the basic principles of diagnosis and treatment of transverse discrepancies.

REFERENCES


How to cite this article: Dutta M, Aggarwal V, Agarwal S, Singh S, Singh U. Transverse Discrepancy in Orthodontics: A Review. IJSS Case Reports & Reviews 2016;2(11):28-32.

Source of Support: Nil, Conflict of Interest: None declared.