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Maxillary Skeletal Expander–Assisted Correction of Transverse Maxillary Deficiency in an Adolescent: A Case Report

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Abstract

Introduction: Rapid palatal expansion is accomplished with the use of orthopaedic appliances like maxillary skeletal expander (MSE). A 14-year-old boy with a bilateral posterior crossbite caused by transverse maxillary deficit is the subject of this case study.

Methods: Four 10 mm ortho implants were positioned with MSE. For a month, the MSE was triggered twice daily. A fixed appliance (Damon Self Ligating) was used for arch alignment.

Results: Using MSE, an approximate expansion of 8 mm was obtained. The maxilla's transverse dimensions were increased in order to rectify the posterior crossbite. Ideal overjet and overbite of 2 mm were attained, as well as a sufficient inter-arch relationship with class I molar and canine relationships.

Conclusions: The use of the MSE with the assistance of ortho implants is an alternative method of treatment. This method avoids the use of surgical expansion and is less invasive, more economical and more comfortable for the patient.

Keywords: Lateral Cephalogram, malocclusion, MSE, maxillary arch

Introduction

Class III malocclusions represent a less frequent type of dental misalignment, but they tend to be more challenging to correct.[1] This condition may arise due to discrepancies in skeletal and dental structures and can be caused by 1) a retrognathic maxilla; 2) a prognathic mandible; or 3) a combination of both. It has a multifactorial etiology involving genetic and environmental reasons.[2] The prevalance of Class III malocclusion in Asian population ranges between 4% to 13%. [3]

Maxillary dysjunction or expansion is an orthodontic procedure that entails the splitting of the mid-palatal

suture. It was first described by Angell in 1860 and later brought to the U.S. by Hass in 1950. Numerous devices and treatment methods have been created for addressing Class III malocclusion, but the rapid maxillary expander is the most frequently used due to the quick results.[4] Maxillary expansion is usually performed with various types of devices, such as those that rest on the teeth with bands (such as the Hyrax-type appliance), those that are cemented with acrylic tracks on the occlusal surfaces (such as the McNamara appliance), and those that involve a mixture of tooth and palatal gum support (such as the Hass appliance). [4]

Currently, mini screw-assisted expansion is performed as an alternative method of applying force directly to the maxilla.[5] One of the appliances available for rapid palatal expansion is the maxillary skeletal expander (MSE), which was developed by Dr. Won Moon and his colleagues at the University of California, Los Angeles (UCLA). The MSE with four ortho implants acts when forces are applied directly to the centre of resistance with bi-cortical penetration and not directly to the teeth (convectional expansion). This system is more favourable because of the generation of homogeneous force dissipation, which avoids vestibular inclination of the teeth and produces a more parallel suture opening. [6]

This clinical case report demonstrates treatment using the MSE with the assistance of ortho implants and Damon Self Ligating appliance.

Case Presentation

A 14-year-old boy visited the Department of Orthodontics and Dentofacial Orthopaedics at ITS Dental College, Muradnagar with the chief complaint of forwardly placed lower front teeth.

Clinical findings

Extraoral

- Brachyfacial biotype with a slight concave profile.
- Retrusive upper lip (Figure 1) and prognathic chin.

Intraoral

- Presence of 53 and 63.
- A bilateral posterior crossbite caused by a transverse maxillary deficiency.
- Bilateral class I molar relationship and slight tendency for class III
- Class I canine relation on left side and Class III on right side,
- Moderate crowding in the maxillary arch and mild crowding in the mandibular arch
- -2mm overjet (reverse overjet) and -3mm overbite, and
- Maxillary midline shifted to right by 0.5 mm (Figure 2).

Figure 1: Pre-treatment extra-oral photographs

Figure 2: Pre-treatment intra-oral photographs

Panoramic radiograph

- Showed forming third molars in both the arches (Figure 3)

Cephalometric findings (Figure 4 and Table 1)

- **Skeletal**
  - Class III skeletal pattern (ANB, -3°) caused by retrusion of the maxilla and a vertical growth pattern. The SNA angle was 79°, and the SNB angle was 82°.
- **Dental**
  - The angle between the maxillary incisor and SN plane was 113°.
  - The angle between the mandibular incisor and mandibular plane was 87°.
  - The interincisal angle was 131°
  - Dental Proclined upper anteriors, retroclined lower anteriors.
- **Soft tissue**
  - Acute nasolabial angle,
  - protusive lower lip with average mentolabial sulcus.
- **Growth status** CVMI stage 4.

Figure 3: Panoramic Radiograph

Figure 4: Lateral Cephalogram

Table 1: Pre-treatment Cephalometric values

Dental readings	Normal range	Pre-treatment value	Inference
Maxillary			
U1-NA	22°, 4 mm	32°, 4 mm	Proclined and average position of upper incisors
U1-PP	112.5° ± 5.3°	121°	Proclined upper incisors
U1-SN	104°	113°	Proclined upper incisors
U1-A pog	22° , 2.7mm (-1-5mm)	27°, 3 mm	Proclined upper incisors
Mandibular			
IMPA	90°	87°	Retroclined lower incisors
LI-NB	25°, 4 mm	22°, 3 mm	Retroclined lower incisors
LI-Apog	25°, 1 – 3 mm	21°, 3 mm	Retroclined lower incisors
Maxillo-mandibular			
Interincisal angle	135.4°(130-150.5)	131°	Average inclination of incisors

Skeletal readings	Normal range	Pre-treatment value	Inference
Maxillary			
SNA	82°	79°	Retrognathic Maxilla
N⊥Pt A	0-1 mm	-3 mm	Backward position of maxilla
Mandibular			
SNB	80°	82°	Prognathic Mandible
N⊥Pog	-6.5 ± 5.1	-4 mm	Average position of mandible
FH - NPog	87.8° (82° -95°)	88°	Average position of chin
Maxillo-Mandibular			
ANB	2°	-3°	Skeletal Class III pattern
Angle of convexity	-8.5° to +10°	-3°	Average facial profile
Wits appraisal		BO 5 mm ahead of AO	Skeletal Class III pattern
Beta angle	27° - 35°	40°	Skeletal Class III pattern

Skeletal readings	Normal range	Pre-treatment value	Inference
Vertical			
SN-MP	32°	38°	Vertical Growth Pattern
Basal plane	25°	32°	Vertical Growth Pattern
FMA	25°	34°	Vertical Growth Pattern
Y-axis	59°(53-66)	61°	Vertical Growth Pattern
Jarabak's ratio	62-65%	57°	Vertical Growth Pattern

Soft tissue readings	Normal range	Pre-treatment value	Inference
Nasolabial angle	90°-110°	82°	Proclined Dentoalveolar complex
Upper lip – E plane	-4 mm	-5 mm	Retrusive upper lip
Lower lip – E plane	-2 mm	0 mm	Protrusive lower lip
Upper lip – Sn pog	3±1mm	3 mm	Average upper lip
Lower lip – sn pog	2±1mm	4 mm	Protrusive lower lip
Merrifield Z angle	80° ± 9°	82°	Average Chin Prominence

Treatment objectives

- correct the transverse deficiency of the maxilla with maxillary expansion,
- maintain the jaw size along with the SNB angle;
- correct the bilateral posterior crossbite with transverse maxillary expansion and coordinate the arches;
- obtain ideal molar class I and bilateral canine class I relationships; obtain an overjet of 2 mm and an overbite of 2 mm;
- correct the maxillary and mandibular deviated midline.

Treatment Progress

A 10-mm ortho implant and MSE device were placed and activated twice per day for a month according to Dr. Won Moon protocol, resulting in an approximate expansion of 7 mm (Figure 5-9). Subsequently, Damon Q fixed appliances were placed in first the upper arch followed by the lower arch from 6 to 6. The sequence of the arch wires in both arches was as follows: 0.014- inch CuNiTi; 14x25 CuNiTi; 18x25 CuNiTi and 19x25 S.S.

Figure 5: MSE on day of insertion

Figure 6: Progress after 15 days and appearance of Midline Diastema

Figure 7: Results after 1 month

Figure 8: Damon Q Self Ligating System

Figure 9: Progress Photographs

After 2 years of orthodontic treatment, facial congruence was achieved and the patient's profile improved (Figure 10). The posterior crossbite was corrected with the increased transverse dimension of the maxilla. Bilateral class I molar and canine relationships, an overjet of 2 mm, and an overbite of 2 mm were achieved (Figure 11).

Figure 10: Post-treatment extraoral photographs

Figure 11: Post-treatment intraoral photographs

A slight increase in the SNA angle (80°) was achieved while the SNB remain unchanged 82°. Additionally, there was an increase in the ANB angle (-1°), which represented a better relationship between the upper and lower jaw and an improvement in the soft tissues, resulting in better lip projection (Table 2 and figure 12). After treatment, stability was achieved. Post treatment the results were maintained using an essix retainer for the upper arch and a bonded lingual retainer for the lower arch.

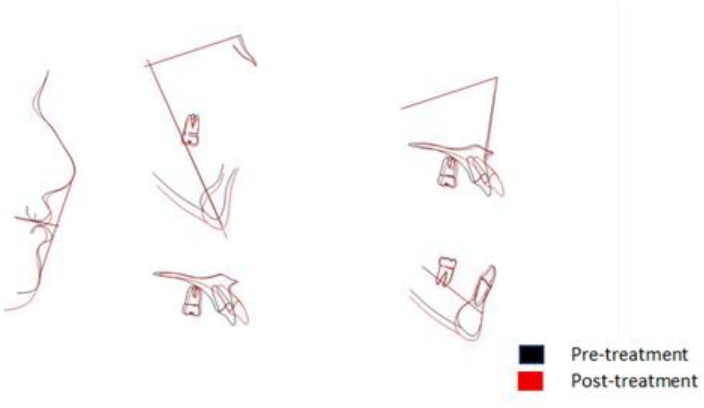
Table 2: Comparison of pre and post treatment cephalometric values

Skeletal readings	Normal range	Pre-treatment value	Present- treatment value
Maxillary			
SNA	82°	79°	80°
N⊥Pt A	0-1 mm	-3 mm	-2 mm
Mandibular			
SNB	80°	82°	82°
N⊥Pog	-6.5 ± 5.1	-4 mm	-3 mm
FH - NPog	87.8° (82°-95°)	88°	85°
Maxillo-Mandibular			
ANB	2°	-3°	-1°
Angle of convexity	-8.5° to +10°	-3°	-3°
Wits appraisal		BO 5 mm ahead of AO	BO 5 mm ahead of AO
Beta angle	27° - 35°	40°	39°

Skeletal readings	Normal range	Pre-treatment value	Present-treatment value
Vertical			
SN-MP	32°	38°	39°
Basal plane	25°	32°	33°
FMA	25°	34°	33°
Y-axis	59°(53-66)	61°	62°
Jarabak ratio	62-65%	57°	56°

Dental readings	Normal range	Pre-treatment value	Present-treatment value
Maxillary			
U1-NA	22°, 4 mm	32°, 4 mm	45°, 9 mm
U1-PP	112.5° ± 5.3°	121°	133°
U1-SN	104°	113°	132°
U1-A pog	22°, 2.7mm (-1-5mm)	27°, 3 mm	41°, 6 mm
Mandibular			
IMPA	90°	87°	85°
LI-NB	25°, 4 mm	22°, 3 mm	18°, 2 mm
LI-Apog	25°, 1 – 3 mm	21°, 3 mm	19°, 2 mm
Maxillo-mandibular			
Interincisal angle	135.4°(130 -150.5)	131°	125°

Soft tissue readings	Normal range	Pre-treatment value	Present treatment value
Nasolabial angle	90°-110°	82°	80°
Upper lip – E plane	-4 mm	-5 mm	-3 mm
Lower lip – E plane	-2 mm	0 mm	2 mm
Upper lip – Sn pog	3±1mm	3 mm	3 mm
Lower lip – sn pog	2±1mm	4 mm	3 mm
Merrifield Z angle	80° ± 9°	82°	81°



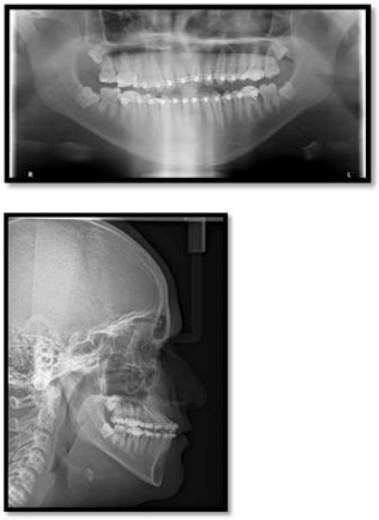


Figure 13: OPG and Lateral Cephalogram prior to de-bonding

Table 3: Pre and Post Treatment Expansion values

	Pre-treatment Values	Post-treatment Values
Inter-canine Width	34 mm	38 mm
Inter-premolar Width	41.5 mm	47.5 mm
Inter-molar Width	47 mm	54 mm

Discussion

This case report highlights the successful interdisciplinary orthodontic management of a patient presenting with maxillary transverse deficiency and moderate dental crowding using the Damon passive self-ligating bracket system in conjunction with a Maxillary Skeletal Expander (MSE). The combination of these two modalities allowed for efficient arch development, improved occlusal relationships, and enhanced facial balance with minimal need for dental extractions or invasive surgery.

The use of Damon braces in this case was integral to the non-extraction approach. As a passive self-ligating system, Damon brackets reduce frictional forces between the archwire and bracket, facilitating more physiologic tooth movement and efficient arch alignment. Several studies have indicated that Damon appliances can contribute to modest arch development and improved transverse dimensions through light, continuous forces

and reduced need for auxiliary expansion devices in mild to moderate cases of crowding.[7] However, for this patient, the underlying skeletal maxillary constriction warranted a more substantial orthopedic intervention.

To address the transverse skeletal discrepancy, a Maxillary Skeletal Expander (MSE) was employed. The MSE, developed by Dr. Won Moon, is a bone-borne expansion device anchored to the mid-palatal suture with four mini-implants.[8] Unlike traditional tooth-borne rapid palatal expanders (RPEs), the MSE exerts direct forces on the maxillary basal bone, facilitating a more parallel expansion of the midpalatal suture and minimizing dentoalveolar tipping. This is particularly advantageous in late adolescents or young adults, where suture maturation often limits the effectiveness of conventional RPEs.

In this case, the MSE successfully produced significant skeletal expansion, denoted by widening of the arch and resolution of crossbite. This resulted improved maxillary arch width and space gain for alignment.

The integration of Damon braces post-expansion allowed for precise alignment, leveling, and coordination of the arches. The synergy between skeletal expansion and low-friction mechanics helped reduce treatment time and enhanced the overall stability of results. Moreover, patient compliance was improved by minimizing the need for extraoral appliances or surgical intervention.

It is important to note that while both Damon braces and MSE have shown promising outcomes, their success is case-dependent and must be evaluated within the context of the patient's age, skeletal maturity, and specific anatomic considerations. Long-term follow-up is also essential to monitor stability, particularly with regard to transverse gains.

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