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CASE REPORT

ORTHODONTIC CORRECTION OF ANTERIOR AND POSTERIOR CROSSBITES IN A CLASS III PATIENT WITH SINGLE TOOTH EXTRACTION – A CASE REPORT

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Abstract

The present paper discussed the treatment of a 13-year-old female having a Class III molar and canine relationships (C3M) in the right side and complicated by anterior and unilateral posterior crossbite in the left side. After discussing treatment plans with the patient, a unilateral extraction of tooth #44 to shift her midline and treat her right C3M canine relationship was scheduled. Crossbite elastics were used for her left from palatal side of maxillary posterior teeth to buccal side of mandibular posterior teeth. 2 years post follow up, correction of both the anterior and posterior crossbites were achieved, leading to enhanced functional occlusion and improved overjet and overbite measurements.

Keywords: *Oral Health Status, Psycho-emotional stress, Periodontal disease, Oral hygiene, Hygiene index.*

INTRODUCTION

A crossbite is described as an improper labiolingual or buccolingual relationship between the upper and lower jaw teeth when both arches are in occlusion.[1] It can also be further described to indicate where in the mouth it develops, such as placed anteriorly or posteriorly, or whether the affected teeth are single or multiple.[2] Unilateral crossbites were fairly higher than that of bilateral crossbite, with the permanent maxillary lateral incisor accounting for 33.9% of cases.[3] According to reports, the crossbite prevalence in Saudi population ranges from 6.8% to 38.4%.[4,5] There are several proposed crossbite corrective techniques. These vary from the employment of protraction masks in the anterior region to basic removable appliances with springs or screws. Treatment options for posterior crossbite include rapid maxillary and slow expansions using appliances or removable expansion plates, grinding, or composite onlays.[6] In order to determine the dental and skeletal relationship of maxilla to mandible, a comprehensive clinical examination, orthopantomogram, study models, lateral and cephalometric radiographs are required to diagnose skeletal and dental crossbites.[7] It is advisable to address crossbite at an early stage, as it prevents excessive tooth wear, undesirable pressure on the periodontium, improper development of alveolar

ridges, and asymmetrical condylar growth.[8,9] The present paper discussed a C3M subdivision case and its management with unilateral extraction approach using fixed appliances and crossbite elastics.

CASE REPORT

A 13-year-old female patient reported to the orthodontic department with the chief complaint of crooked teeth. On examination, the patient exhibited a full unit class III molar and canine relationships, (Figure 1, 2) anterior crossbite, and unilateral posterior crossbite in the left side.

Figure 1. *Profile photo A: Frontal View B: Lateral view*

Figure 2. *Pretreatment intraoral photographs*

Radiological investigations were conducted and a class II skeletal relationships was confirmed alongwith an ANB angle of 5.07, Angle of convexity of 15.73, and MP-SN angle of 40.9.

The maxilla was protrusive in relation to the face and the mandibular body was found to be steep. This suggests that the patient has pseudo-class III malocclusion (Figure 3, Table1).

Figure 3. *Pretreatment radiological investigation. A: traced lateral cephalometric radiograph B: OPG*

Table 1. *Pre-treatment lateral cephalometric measurement*

Measurement	Normal	Standard Deviation	Value	Description of Measurement Results
SNA	82.8	4	85.38	Normal position of maxilla relative to the Sella-Nasion line
SNB	80.1	3.9	80.31	Normal position of maxilla relative to the Sella-Nasion line
ANB	2.7	2	5.07	Skeletal Class II tendency
FH-Npo (Facial Angle)	85.4	3.7	88.76	Normal menton
NA-Apo (Angle of Convexity)	6	4.4	15.73	Protrusion of the maxilla relative to the face
FH-MP (Mandibular Plane Angle)	31.1	5.6	29.08	Average growth pattern, normal mandibular body steepness
SGn-FH (Y-axis Angle)	66.3	7.1	59.95	Normal chin development
MP-SN	32.5	5.2	40.09	Mandibular body is steep
Po-NB (mm)	1	1.5	-4.7	Chin retrusion
U1-NA (mm)	5.1	2.4	3.21	Normal protrusion of the upper central incisor
U1-NA	22.8	5.7	23.39	Normal protrusion of the upper central incisor
L1-NB (mm)	6.7	2.1	11.31	Large protrusion of the lower central incisor
L1-NB	30.3	5.8	38.69	Labial inclination of the lower central incisor
U1-L1 (Upper & Lower Central Incisor Angle)	125.4	7.9	112.8	Large relative protrusion of upper and lower central incisor
U1-SN	105.7	6.3	108.8	Normal inclination of the upper central incisor relative of the Sella-Nasion line
IMPA (Lower Central Incisor-mandibular Plane Angle)	92.6	7	98.29	Normal labial inclination of the lower anterior teeth relative to the mandibular plane

Following a discussion of the benefits and drawbacks of several treatment approaches with the patient and weighing aesthetic and functional needs, a specific orthodontic treatment plan was developed and carried out once informed consent from the patient was obtained. Thus, an extraction of her right mandibular first premolar to shift her midline to correct the canine relationship to class I and resolve the anterior crossbite was approved. To precisely control the tooth movement, fixed appliances were employed with crossbite elastics and class III elastics. Cross bite elastics were used from palatal side of left maxillary posterior teeth to the buccal side of mandibular posterior teeth. These elastics were strategically employed to treat her anterior and posterior crossbite by providing the necessary force to reposition maxillary molars as well as incisors into a more favourable occlusal relationship (Figure 4-6).

Figure 4. *Intra-oral photos for initial bonding and levelling and alignment stage*

Figure 5. *Intraoral photos during space closure post extraction of mandibular right first premolar*

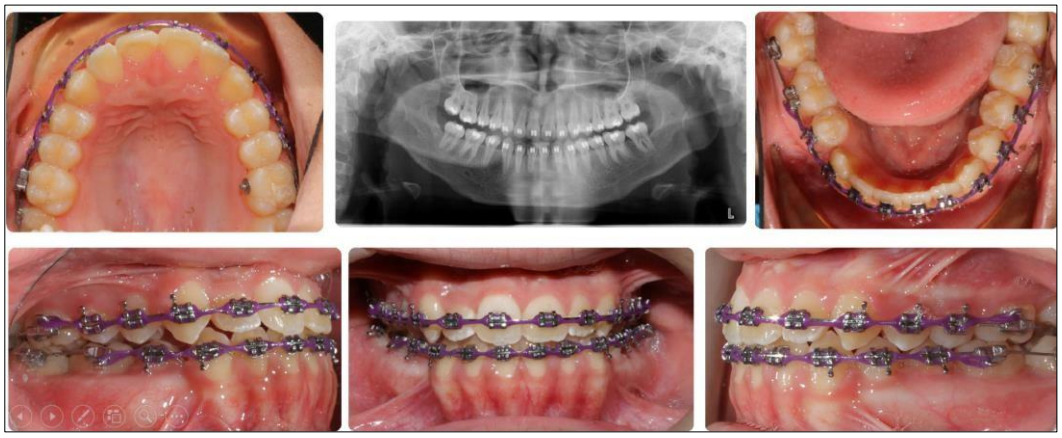

Figure 6. *Intraoral photographs post space closure during finishing stage*

TREATMENT OUTCOMES

The treatment duration was approximately for 24 months, during which the patient underwent significant improvements in both occlusion and skeletal relationships. Post-treatment evaluation revealed a stable right canine Class I relationship and a corrected lower midline. A correction of both the anterior and posterior crossbites were achieved, leading to enhanced functional occlusion and improved overjet and overbite measurements (Figure 7). Cephalometric analysis showed an ANB angle of 5.57, Angle of convexity of 16.19, and MP-SN angle of 40.16 thus demonstrating minor changes in the skeletal relationships, with a notable improvement in the maxillary position and overall facial harmony (Table 2, Figure 8).

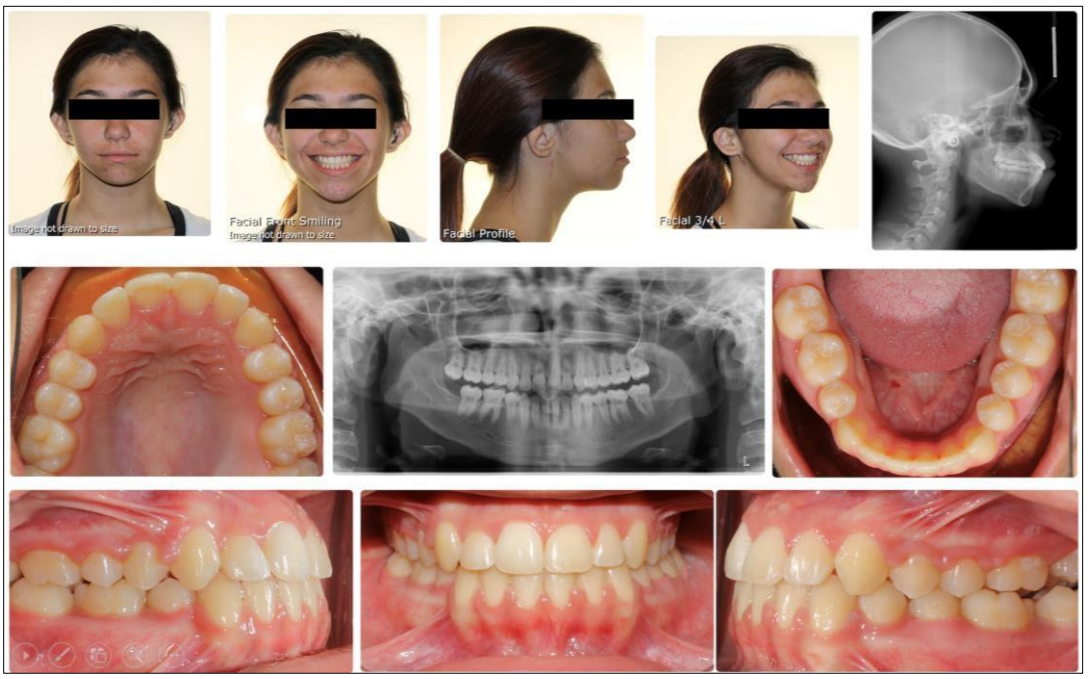

Figure 7. *Post-treatment facial and intraoral photographs at 1 year follow up*

Table 2. *Cephalometric measurements pre and post treatment*

Measurement	Normal	Standard Deviation	Pre-treatment	Post-treatment
SNA	82.8	4.0	85.38	86.31
SNB	80.1	3.9	80.31	80.75
ANB	2.7	2.0	5.07	5.57
FH-NPo (Facial Angle)	85.4	3.7	88.76	88.37
NA-APo (Angle of Convexity)	6.0	4.4	15.73	16.19
FH-MP (Mandibular Plane Angle)	31.1	5.6	29.08	30.19
SGn-FH (Y-axis Angle)	66.3	7.1	59.95	60.69
MP-SN	32.5	5.2	40.09	40.16
Po-NB(mm)	1.0	1.5	-4.70	-4.23
U1-NA(mm)	5.1	2.4	3.21	3.23
U1-NA	22.8	5.7	23.39	23.06
L1-NB(mm)	6.7	2.1	11.31	7.91
L1-NB	30.3	5.8	38.69	28.27
U1-L1 (Upper and Lower Central Incisor Angle)	125.4	7.9	112.84	123.10
U1-SN	105.7	6.3	108.77	109.37
IMPA (Lower Central Incisor-mandibular Plane Angle)	92.6	7.0	98.29	87.37

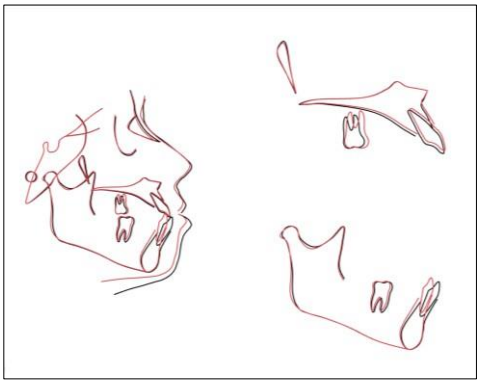

Figure 8. *Pretreatment-to-post-treatment cephalometric superimposition (Black, pretreatment; Red, posttreatment)*

DISCUSSION

Often resulting from mandibular protrusion, maxillary retrusion, or both, C3M is a maxillofacial disorder marked by a concave face profile.[10] The retroclination of the maxillary incisors leads to occlusal interference, triggering a forward shift of the mandible. This anterior positioning highlights an underlying skeletal imbalance.[11] Our case focused on effectively managing C3M subdivision using unilateral extraction approach using fixed appliances and crossbite elastics. While this patient exhibited C3M dental relationships, she displayed a Class II skeletal relationship based on ANB measurements and high-angle pattern as determined by the SN-MnPl angle. A high SN-MnPl angle indicates a high-angle skeletal pattern, which can significantly influence orthodontic treatment planning for C3M as they often exhibit a hyperdivergent growth pattern, characterized by raised lower anterior facial height and a steep mandibular plane angle.[12]

The vertical growth pattern can complicate orthodontic mechanics and limit the effectiveness of certain treatment modalities. High-angle patients often require more robust anchorage to control vertical movements such as temporary anchorage devices, extractions, and C3M elastics may be necessary to prevent extrusion of posterior teeth and further opening of the bite.[13] They may be at greater risk of relapse following orthodontic treatment due to the unfavourable skeletal pattern. Overcorrection of the malocclusion, combined with the use of fixed retainers and nighttime wear of removable retainers, is often recommended to improve long-term stability.[14]

Thus, as the patient had class II skeletal relationship but C3M dental relationship, we chose unilateral extraction of a lower bicuspid to facilitate the correction of the occlusal relationship in conjunction with crossbite elastics allowing for precise control of tooth movement. The elastics were strategically employed to correct the anterior and posterior crossbites by providing the necessary force to reposition the maxillary molars and incisors into a more favourable occlusal relationship.

The findings in this case are supported by literature that discusses the challenges and strategies in managing C3M, particularly in growing patients. Our approach is similar to the case reported by l-Hummayani who in 11 months, aligned teeth to correct deep anterior crossbite in an adult pseudo C3M using modified Hawley appliances with inverted labial bow and fixed appliances.[15] In a similar case reported by Ngoc et al., an adult skeletal C3M patient with lateral open bite, mandibular deviation to the left, zero overbite, negative overjet and unilateral posterior crossbite was successfully treated by mandibular molar extraction for retracting mandibular incisors as well as realigning patient's dental midline, alongwith using intermaxillary elastics over a 30-month period.[16]

A recent 2024 case report on a 22-year-old Vietnamese patient by Le LN et al. employed orthodontic camouflage treatment. This method included using box elastics and short C3M elastics in conjunction with anterior bite turbos. In under ten months, the treatment successfully treated severe skeletal malocclusions without the need for surgery, corrected the anterior crossbite through mandibular retraction, and established a Class I canine and molar relationship.[17] The camouflage orthodontic treatment of skeletal C3M enhances the facial profile by augmenting the vertical dimension and inducing clockwise rotation of the jaw. Wu TY et al in 2022 indicated that patients with a high mandibular plane angle exhibited a superior response to vertical dimension increment treatment mechanics compared to those with low and normal mandibular plane angles.[18]

The distinction between true skeletal C3M and pseudo- C3M is crucial for understanding the complexities involved in this case. Patients exhibiting pseudo- C3M most often show a normal skeletal relationship when in centric occlusion but display a functional shift due to dental positioning or neuromuscular influences. This differentiation is critical because it affects treatment planning; pseudo-C3M cases can often be managed effectively with orthodontic treatment alone, while true C3M cases may require surgical intervention for optimal results.[19] Thus, our treatment plan is especially suited for adolescent patients with a pseudo-class III malocclusion requiring only orthodontic interventions to achieve optimal results.

CONCLUSION

To conclude, a high SN-MnPl angle is an important consideration in for correcting C3M, requiring tailored approaches that addresses the vertical discrepancy, anchorage requirements, and

stability concerns to achieve a successful outcome. Any discrepancy in skeletal relationships can limit the effectiveness of orthodontic movements alone, as it may require careful management to avoid exacerbating any existing issues.

FUTURE SCOPE / CLINICAL SIGNIFICANCE

The present case exemplifies the effectiveness of using fixed appliances and unilateral extractions in managing C3M subdivision with posterior and anterior crossbites in growing patients. This comprehensive orthodontic strategy is customised to age and growth potential of patients, providing balanced approach to treatment. It underscores the importance of individualized treatment planning and the effective use of growth modification techniques.

DECLARATIONS

Conflicts of interest and financial disclosures

The author declares that he has no conflict percent and there was no external source of funding for the research in question.

Ethical approval

The study was approved by the Institutional Ethics Committee and was conducted in accordance with the Declaration of the World Medical Association.

Informed consent

Informed consent was obtained from all individual participants included in the study.

Source of funding

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