

Case Report**Orthodontic Correction of Anterior Crossbite in an Adult Patient**

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Abstract: Anterior crossbite is a malocclusion resulting from the lingual positioning of maxillary anterior teeth in relationship to mandibular anterior teeth. It is also known as underbite or reverse overjet. The reported prevalence of anterior crossbites varies between 2.2% and 12%, depending on the age of the subjects, whether an edge-to-edge relationship is included in the data, and the ethnicity of the subject is studied. This case report presents the fixed non extraction orthodontic treatment of an adult patient with skeletal Class III malocclusion, Angle's class I molar relation, an anterior crossbite and a mild spacing in mandibular anteriors. The treatment was done by orthodontic camouflage by fixed mechanotherapy. The crossbite was corrected simply by giving third order bends in coordinated archwires and mandibular spacing was closed with frictionless mechanics. At the end of the treatment, ideal overjet and overbite, pleasing harmonious profile and an esthetic smile were achieved.

Keywords: Crossbite; Orthodontic Treatment; Torque.

INTRODUCTION

Anterior crossbite is defined as a malocclusion resulting from the lingual positioning of maxillary anterior teeth in relationship to mandibular anterior teeth.¹ The reported prevalence of anterior crossbites varies between 2.2% and 12%, depending on the age of the subjects, whether an edge-to-edge relationship is included in the data, and the ethnicity of the subject studied.² This malocclusion does not only have a great impact on the facial appearance of a patient, but is also functionally unacceptable.

Etiology of anterior cross bite is multifactorial but the main factor is the skeletal prognathism. Others are retained deciduous teeth, dental malpositions and faulty incisor inclinations in both jaws can result in anterior crossbite.³ If this dental problem simultaneously leads to anterior positioning of the mandible, it is called a "pseudoprogathism",¹ or a "pseudo-Class III".

The pseudo-Class III malocclusion has been defined as a positional malrelationship with an acquired neuro-muscular reflex. Premature contact between the maxillary and mandibular incisors results in forward displacement of the mandible so as to disengage the incisors and also dental malpositions and faulty incisor inclinations in both jaws can result in anterior crossbite.⁴

However, in mild expressions of mandibular prognathism, where the facial appearance is tolerable, patients tend to live with their malocclusion rather than to accept jaw surgery. In these cases orthodontic camouflage can be done.

CASE REPORT

A 26-year old female patient came to the department of Orthodontics with the chief complaint of an unpleasing smile, particularly because of an anterior crossbite and difficulties associated with mastication. On initial examination she was in good general health, her dental history included the restorations in relation to 18, 28, 37, 38, 47 and 28.

Extraoral Facial examination revealed: Mesoprosopic facial form, straight facial profile with anterior divergence, symmetric features and an adequate lip seal. However, a sagittal maxillo-mandibular deficiency was also noted. There was also a discrete predominance of maxillary deficiency. The smile was complex and non-consonant. (Figure 2a and 3a)

The examination of temporomandibular joints revealed bilateral clicking at mandibular opening and closing, maximal mouth opening of 48 mm and a regular path, but no pain. Intraoral examination revealed an adequate oral hygiene and a permanent dentition with presence of anterior crossbite.

Molars and canines were in a Class I relationship bilaterally. There was spacing in relation to mandibular anterior region. Radiographs showed that the patient had good dental and periodontal health and no endodontic problem or bone loss. (Figure 4a). Cephalometric analysis revealed that the maxillo-mandibular relationship was class III (ANB = - 2°) and that a few angles were slightly greater than normal (SNB = 84°) However, the ANB angle is known to be markedly affected by geometrical factors.¹ When the cranial base is short, maxillo-mandibular discrepancies cannot be evaluated on the sagittal plane using the ANB angle.(Table 1).

Horizontal growth pattern was seen (GoGn-SN 19°, FMA 14°). Other cephalometric parameters (Wits = -4 mm; S-N = 67 mm) and particularly facial analysis should be used to elucidate this confounding factor.^{5,6,7} When evaluated by cephalometry and having the cranial base as reference, the upper incisors were retroclined and normally placed (UI-NA 20°/4mm) and lower incisors were proclined and forwardly placed (LI-NB 29°/5mm). In contrast, the inclination of mandibular incisors in relation to the mandibular plane was more (IMPA = 106°). (Figure 1a)

Study model analysis revealed discrepancy in maxillary arch by 2.5 mm and tooth material excess in mandibular arch by 3 mm. According to Bolton's analysis, there was 0.98 mm of mandibular anterior excess and 0.7 mm of mandibular overall excess. The patient was diagnosed to have a skeletal class III relationship with normal maxilla and a prognathic mandible, Horizontal growth pattern, Angle's class I malocclusion, Rickett's Class I canine relationship, anterior crossbite in relation to 11,12, 21, 22, retroclined maxillary and proclined mandibular anteriors with spacing in relation to 33,42.

Treatment options were to correct the anterior crossbite either with a removable Hawley's appliance with a Z spring or a Catalans appliance. In fixed mechanotherapy, multiple loop archwires and third order bends were the options. The treatment objectives were to achieve

pleasing and harmonious profile, enhance facial esthetics, to achieve normal axial inclination and align teeth in the arch, to correct the anterior crossbite and maintain the class I molar and canine relation. Treatment plan selected was non extraction fixed mechanotherapy using preadjusted appliance with 0.022X0.028 MBT ceramic bracket setup. In mechano-therapy, multiple loop archwires were not selected because of the esthetic reasons, so third order bends were selected to correct the crossbite. Transpalatal arch was planned in the upper arch for anchorage.

TREATMENT PROGRESS:

The first treatment plan presented to the patient was the orthodontic treatment combined with orthognathic surgery, which the patient promptly refused. For this reason, an alternative plan was suggested. It included orthodontic camouflage with orthodontic appliances in both arches without extractions. Following objectives for the treatment were selected: preservation of maxillary and mandibular bones position, alignment of maxillary teeth, alignment of mandibular teeth, normal occlusion, correction of negative overjet and functional occlusion, esthetic improvement after anterior crossbite correction, and achievement of a pleasant smile.

The maxillary and mandibular arch was prepared by banding 16, 26, 36 and 46. Transpalatal arch was given for anchorage preservation. Orthodontic ceramic brackets were bonded in both arches using the straight-wire system and 0.022 x 0.028inch slots; tooth leveling and alignment started with 0.014 inch and 0.016 inch, 0.018 inch, and 0.020 inch nickel-titanium wires. The vertical dimension had to be temporarily increased with glass-ionomer cement built-up on posterior teeth. Anterior crossbite correction was done simply by incorporating third order bends (progressive lingual root torque) in relation to maxillary anteriors and (buccal root torque) in mandibular anteriors on : 0.017 x 0.025 inch, 0.019 x 0.025 inch and 0.021 x 0.025 stainless steel wires.

Spaces were closed by means of frictionless mechanics (0.019 x 0.025 inch wire) by

vertical closing loops in relation lower 33, 43 region for space closure in subsequent wires, viz: 0.017 x 0.025 inch , 0.019 x 0.025inch and 0.019 x 0.025 stainless steel wires.

No skeletal anchorage was used. Elastic chains were used in both arches to retain interproximal contacts. Orthodontic treatment finishing with 0.014 inch NiTi wires were done. Treatment progression was in accordance with the plan. Settling of occlusion was done by using settling elastics (2-ounce). After orthodontic completion, intercuspation was good, and canine and molar occlusion relationships, as well as overjet, were normal. As, corrected anterior cross bite is self retentive ⁸ , no retention appliance was given for maxillary arch Fixed Lingual bonded retainers were planned in mandibular arch from canine to canine. (Figure 1b, 2b,3b and 4b)

Table 1: Comparison of pre and post treatment cephalometric variables.

Cephalometric Variables	Pre-Treatment Values	Post Treatment Values
SNA	82°	80°
SNB	84°	82°
ANB	-2°	-2°
SN-GoGn	19°	23°
FMA	14°	16°
Facial Convexity	2mm	1mm
UI-NA	20°/4mm	30°/6mm
LI-NB	29°/6mm	28°/5mm
Nasolabial angle	90°	87°
Upper lip to E plane	-1.0mm	-1mm
Lower lip to E plane	2mm	0mm



Figure 1: Lateral Cephalogram showing Pre (A) and post (B) treatment skeletal and dental characteristics of the patient



Figure 2: Frontal smile photographs showing Pre (A) and post (B) treatment facial and smile characteristics of the patient.



Figure 3: Profile photographs showing Pre (A) and post (B) treatment profile characteristics of the patient.



Figure 4: Intraoral frontal photographs showing Pre (A) and post (B) treatment changes in dental features of the patient after correction of the anterior crossbite.

DISCUSSION

Cranial base abnormalities strongly affect the interpretation of cephalometric variables in this region, particularly SNA, SNB, ANB and convexity angle. Other cephalometric parameters, correction factors and above all,

facial analysis findings contributed to making the diagnosis and developing a treatment plan.(Table 1) Anterior dental crossbite is a habitual established crossbite of anterior teeth, without any skeletal discrepancy, resulting from functional forward shift of the mandible on closure. When the mandible is guided into a normal centric relation, a normal overjet or an edge-to-edge position of incisors can be obtained. If correction is delayed to a later stage of maturity, it may lead to a skeletal malocclusion and require more complex treatment which exactly happened in this case. Lee⁹ outlined 4 factors to consider before selecting a treatment approach: Adequate space in the arch to reposition the tooth, sufficient overbite to hold the tooth in position following correction, an apical position of the tooth in crossbite that is the same as it would be in normal occlusion and a Class I occlusion.

Different treatment modalities have been used to correct anterior dental crossbite, including tongue blades, composite inclined planes, reversed stainless steel crowns, removable acrylic appliances with lingual springs and fixed appliances. According to Graber TM the most basic form of treatment for anterior crossbite is the tongue blade, which the patient is instructed to bite on during leisure hours. The biting force is applied to the lingual aspect of the involved maxillary tooth to move the tooth forward, with the incisal edges of the mandibular teeth acting as a fulcrum to absorb the reciprocal lingual forces. However, this technique is rarely sufficient when more than one tooth is involved.¹⁰

Croll TP found out in his study that crossbite may also be corrected using a reversed, pre-fabricated stainless steel crown. The chief disadvantage with this treatment is the difficulty adapting a preformed crown to fit the tooth in crossbite. Furthermore, because of its unaesthetic appearance, this form of treatment is often rejected by children and their relatives.¹¹ Sari S said that a composite inclined bite-plane is another effective treatment method that is simple and non-invasive, making it the first choice of treatment in some cases. However, a composite plane cannot be used in cases

where the anterior crossbite exceeds 1/3 the crown length.¹² Moreover, the cement used with this type of appliance may cause gingivitis.¹³ In the present case, the use of a composite inclined plane was inappropriate, as the anterior crossbite exceeded 1/3 of the crown length.

In adults, Class III skeletal patterns may often be treated with either orthodontic camouflage or orthognathic surgery.^{14,15} In the case reported here, the treatment chosen was orthodontic camouflage without extraction. The final radiograph showed that root parallelism was good after space closure and that root size was preserved. In the maxillary arch, anterior crossbite was corrected, molars were maintained in class I relation, intercanine and intermolar distance was preserved (from 43.5 mm to 42.0 mm).

There were no significant changes in the position of the maxilla or the mandible. Facial esthetics improved due to less marked lower lip protrusion, confirmed by reduction of 1 mm in the cephalometric variable that describes the lower lip (S line). The relationship between the maxilla and the mandible showed good inter-cuspatation and coordination, although sagittal skeletal discrepancy was camouflaged by dental compensation. The above case report represents the orthodontic management of the anterior crossbite case by fixed mechanotherapy. Overjet and overbite were fully corrected, and the criteria for ideal functional occlusion were met. Lateral cephalogram and OPG, dental impressions and photographs confirmed the positive results. Treatment results were satisfactory, and the occlusal objectives were achieved. The final harmonious smile pleased the patient and improved herself-esteem and quality of life.

CONCLUSION: Anterior crossbite present whether in primary dentition or permanent dentition should be corrected as soon as diagnosed for the esthetic as well as functional harmony of the patients. Fixed mechanotherapy is the best option in adults with anterior crossbite involving more than 2 teeth. Third order bends when incorporated properly can correct the crossbite completely.

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