

Management of Anterior Crossbite

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Abstract

Introduction: One of the commonest orthodontic problems encountered in dental practice is anterior crossbite which is often seen in growing children. The most common causes are skeletal and functional class III malocclusion. Among these two, the functional class III malocclusion presents a major imbalance in jaw size, which is a result of a mesial thrust of the mandible. The origin for such malocclusion is multifactorial, starting from abnormal eruption of primary or permanent incisors to low position of the tongue, which is lingual dysfunction. Therefore, anterior crossbite poses a major functional and esthetic concern to the patient as well as parents during the growing stage of a child. Its one of the major challenges for an orthodontist and pediatric dentist since it requires an appropriate diagnosis and treatment plan, especially in the developing dentition stage, to establish proper oral-facial growth and development.

Aim of the Study: The aim of the present review is to understand various causative factors and interventions for the same in anterior crossbite.

Methodology: The review is a comprehensive research of PUBMED since the year 1978 to 2015.

Conclusion: There are various treatment options available for anterior crossbite depending on the timing of intervention, among which interceptive orthodontic treatment aims to recognize in early-stage and eliminate malpositions and irregularities of a developing oro-facial complex. The treatment should begin as early as possible so as to allow normal growth and improve the facial characteristics, attractiveness and psychosocial well-being of children. Treatment of class III malocclusion in the early phases is one of the most challenging problems faced by orthodontists. There is less prevalence of functional class III, but despite its less prevalence, it must be detected and treated early to prevent future skeletal anomalies. A prompt clinical and radiographic examination showing skeletal class I allows the clinician to make appropriate treatment choices. The time for treatment intervention and various treatment modalities influence therapy.

Keywords: Anterior Crossbite; Class III Malocclusion; Pseudo-Prognathism

Introduction

According to Graber, crossbite is defined as a condition where one or more teeth may be abnormally malposed either labially or lingually with respect to opposing teeth [1]. Anterior crossbite is also defined as a malocclusion resulting from the lingual positioning of the anterior maxillary teeth with respect to mandibular anterior teeth [2]. Another way to define it is as upper frontal deciduous or individual permanent teeth in lingual position with respect to lower incisor teeth [3].

The case of severe anterior crossbite, in comparison to a posterior crossbite, is difficult to intervene in and is often not corrected until conventional treatment reach stage 2 or it may remain pending for surgical correction. The ideal platform to use this Catlan's appliance and reverse the bite in the early mixed dentition stage. But prior to the use of this appliance, the clinician must differentiate between crossbite of dental origin and skeletal origin [4].

In a dental crossbite, only localized tipping of a tooth or teeth is present, and it does not involve basal bone underneath. In an anterior dental crossbite, the patient should show a normal skeletal pattern and some abnormalities in the axial inclination confined to teeth that are affected. According to Profitt, anterior crossbite should be corrected by opening up enough space, followed by bringing the displaced tooth or teeth into proper position and occlusion [5,6].

Approximately 4 - 5% anterior dental crossbite has been reported, but it usually becomes evident during the early dentition or early mixed-dentition period. The occurrence of anterior crossbite is multifactorial such as a repaired cleft lip, lingual eruption path of the maxillary anterior incisors, supernumerary anterior teeth, trauma to the deciduous incisor resulting in the lingual displacement of the permanent tooth germ, an over-retained necrotic primary tooth or root, presence of odontomas and crowding in the incisor region, a habit of biting the upper lip or inadequate arch length. Enamel abrasion is often produced in lower incisors due to anterior crossbite; compensation of mandibular incisors leads to thinning of the alveolar plate in the labial aspect and causes periodontal problems such as a gingival recession [7].

Anterior dental crossbite requires early intervention and immediate treatment to prevent anterior teeth mobility and fracture, periodontal pathosis, and temporomandibular joint disturbance. The main objective of the treatment is to tip the affected maxillary tooth labially to achieve a stable overbite relationship exists. Treatment modalities for correction of anterior crossbite may include tongue blades, reversed stainless steel crowns, bonded resin-composite slopes, fixed acrylic inclined planes, removable acrylic appliances with finger springs and Bruckl appliances [8].

Etiology

Skeletal causes

One of the main causes of anterior crossbite is an anterior-posterior skeletal discrepancy. For example, any excessive mandibular growth may lead to a segment crossbite on the anterior incisors. In addition, the retarded development of the maxilla in the sagittal plane may also result in an anterior crossbite. For instance, the small or collapsed maxillary arch associated with the cleft palate will also cause an anterior crossbite in the majority of these patients. The skeletal causes of the anterior crossbite are generally inherited. They are manifested as size or position discrepancies in the maxilla, the mandible or both. A long mandible or anteriorly positioned glenoid fossa, short or posteriorly positioned maxilla and even a short anterior cranial base should be considered indicators of the skeletal nature of the anterior crossbite. The skeletal etiological factors can be further explained by the following three categories or any combination of any of these that is genetic/syndromic causes, mandibular excess, and maxillary deficiency [9].

Genetic factors: Many syndromes that affect facial development have at least some basis in genetics. Syndromes such as cleft lip and palate, Crouzon syndrome, and Apert syndrome are associated with a degree of midface deficiency that, in many instances, results in an anterior crossbite due to the maxillary skeletal deficiency. The midface deficiency observed in these syndromic patients can be aggravated by the restriction of maxillary growth that may result from scar tissue associated with the surgical correction of the cleft lip and/or palate [10].

Congenital maxillary deficiency: Prenatally, undue pressure against the developing fetal face can lead to distortion of the rapidly growing facial areas. On rare occasions, a limb is pressed across the face in utero, resulting in a severe maxillary deficiency at birth and a class III malocclusion. If the maxilla is small or positioned posteriorly, the effect is direct. If it lacks vertical growth, the effect is indirect and, due to the fact that the mandible rotates upward and forward, produces a mandibular prognathism that is not due primarily to the size of the mandible [11].

Mandibular excess: Mandibular prognathism can be familial, in which case there is the belief that the etiology in these instances can be of a hereditary nature. On rare occasions, endocrinal disturbance, such as an increase in circulating growth hormone, may result in acromegaly, which is characterized by an abnormally large mandible [11].

Dental causes

The most common etiologic factor for non-skeletal anterior crossbites is a lack of space for permanent incisors. The early loss of maxillary deciduous teeth impacted or lost permanent posterior teeth or impacted canines would allow the anterior maxillary teeth to drift distally and palatally. In most children with anterior crossbites involving multiple teeth, a skeletal discrepancy should be considered. A labially positioned supernumerary tooth, an over-retained deciduous tooth with delayed exfoliation, trauma to the deciduous teeth or permanent tooth bud, or even a lip-biting habit may lead to an abnormal axial inclination of upper incisors that can result in dental anterior crossbites. In addition, premature tooth contact during mandibular closure may lead to a pseudo-class III, another cause of dental anterior crossbites [12].

Diagnosis

In order to determine the main cause of an anterior crossbite, it is important to differentiate between skeletal and dental problems. In this regard, midface deficiency or mandibular overgrowth will result in a class III tendency, which is usually manifested in the sagittal plane. A prominent feature of the class III facial pattern is an anterior crossbite dental relationship. A single tooth in an anterior crossbite is usually associated with some degree of dental crowding. This generally results from a dental etiological factor [13].

On the other hand, a segment crossbite (which involves several teeth rather than a single tooth) is more likely to result from a skeletal etiological factor, which can be confirmed by radiographs such as lateral cephalograms. Moreover, if an anterior crossbite is associated with a bilateral posterior crossbite, the skeletal factor should be considered where the retropositioned or small maxilla relative to the mandible could be the main etiological cause. However, a radiographic confirmation is always required [13].

A lateral cephalometric X-ray offers an important diagnostic tool, particularly if it is suspected that a skeletal imbalance may be responsible for an anterior crossbite and an incipient class III malocclusion. The Steiner and the McNamara analyses provide two different cephalometric methods for measuring the severity of skeletal jaw imbalances in the sagittal plane. Whenever the cephalometric analysis shows radiographic evidence of moderate to severe skeletal anterior-posterior discrepancy associated with an anterior crossbite, the skeletal cause should be taken into consideration [3,14].



Figure 1: The figure shows lateral cephalogram prior to treatment in maximum intercuspation position and in the position of initial contact with anterior edge to edge, suggesting that cephalometric values are in favor of a middle-class I [15].

Exobuccal evaluation

The signs evaluated under exobuccal assessment are similar for both types of dysmorphia (functional class III and skeletal). These findings are often misleading. The facial profile is concavely represented as an inversion of the labial relationship and projection at the front of the mandible. Many times soft tissues may camouflage skeletal discrepancy, as a result of which the patient's profile appears either normal or concave in centric occlusion. In the majority of skeletal class III, whether mandibular or maxillary, there is always some degree of maxillary deficiency present. Skeletal class III thus can be characterized and differentiated by a retrusive nasomaxillary area and protrusive lower lip and face. Further evaluation is to be done by assessment of profile changes from the postural rest position to habitual occlusion, and in such evaluation, the skeletal class III profile remains concave in both positions, but the pseudo-class III profile is straight or becomes concave as the mandible shifts forward into the habitual occlusion [16].



Figure 2: Figure shows an 8 years old patient presents pseudo-class III malocclusion presented by classic retrusion of the upper lip in relation to lower lip [15].

Endobuccal evaluation

The endobuccal exam allows the orthodontist to identify the case as a class I. In skeletal class III discrepancy, proclined maxillary incisors and retroclined mandibular incisors compensate for the dento-alveolar discrepancy. This is different in the case of pseudo-class III cases, where Angle’s class III molars and canines are related to dental compensations of class II in anterior crossbite. Assessment of dental relation is done in mandible centric occlusion. This aids in differential diagnosis that is in the De Nevreze procedure, in which a more retrusive position of the mandible is obtained to minimize the dental relations in pseudo-prognathism cases. Contrary to that, in true mesio-occlusion, this maneuver is not successful. The mandible cannot be retruded and therefore, has no modification [17].



Figure 3: Figure showing pre-treatment intra-oral photographs in habitual occlusion, the vertical axis of the maxillary incisors, characteristics of Angle’s class III molars and canines and anterior crossbite [15].

It can be stated that when the anterior crossbite has a functional shift that is in a centric relationship, if interincisal contact is possible, then it is a pseudo class III malocclusion with no inherent skeletal class III discrepancy [11].



Figure 4: Figure showing pre-treatment intra-oral photographs showing edge-to-edge occlusion and Angle’s class I molars and canines relationship in centric occlusion [15].

The location of the tooth having crossbite can be used as a diagnostic indicator of skeletal or dental etiology of the anterior crossbite. In the skeletal crossbite, the teeth are often normally positioned on the basal bone of the jaw. On the other hand, a deflection of a tooth from the normal position is most likely to be associated with the dental crossbite. In addition, the closure pathway should be examined for any premature contact, which could be the cause of an anterior dental crossbite associated with a pseudo class III relationship. As an example, premature incisor contact during closure may result in the development of anterior mandibular displacement manifested as a dental anterior crossbite. At the same time, dental study models provide an important tool when it comes to diagnosing dental problems, such as crowding and lack of space due to tooth size arch length discrepancy (TSALD) that may result in an anterior dental crossbite. The study

models allow clinicians to measure and compare the relationship that exists between the combined sizes of the teeth and the amount of space that is available to accommodate them. In the past, measurements were made directly on plaster study models. Nowadays, digital models, in combination with specific software, make it possible to determine tooth and arch sizes with greater ease [16,17].

Treatment

Interceptive treatment timing

Optimum treatment timing remains one of the orthodontic problems and is a controversial topic; this is especially in cases of class III malocclusion. However, sudden worsening during the transition from primary to permanent dentition has been seen. Therefore, pseudo class III malocclusion should be treated as early as possible. The early intervention of pseudo-class III malocclusion will increase maxillary arch length and reduce the functional shift of the mandible. According to many clinicians, early intervention has many advantages, and early correction of anterior crossbite, even in the primary dentition, possesses a better prognosis. The suggested period for treatment is between 6 years and 9 years; intervention done at this period allows normal growth [18].

Objectives

During the mixed dentition period, interceptive orthodontic treatment is more effective in improving malocclusions than no treatment. Early intervention in such cases is, therefore, highly recommended to prevent adverse effects on the development and growth of the jaws and disturbance of masticatory muscles such as temporalis and masseter muscle activity. Since disturbance inactivity of muscles and jaw makes the patient prone to craniomandibular disorders during the adolescence phase. A pseudo class III malocclusion is treated early to increase maxillary arch length and reduce the functional shift of the mandible. Early interventions, apart from being effective and efficient, may have positive effects on the quality of life for patients in terms of self-esteem and social acceptance. The proclination of upper incisors or retroclination of lower incisors aims to correct anterior crossbite in pseudo-class III malocclusion and eliminate further mandibular displacement. A front stop to lock the occlusion permits creating conditions that lead to normal occlusal development in such cases [9,10].

Modalities of treatment Various appliances have been used for early intervention of a pseudo class III; these include fixed or removable inclined planes, removable plates, face masks, functional appliances and simply fixed appliances, each of which has a specific indication, advantages, and disadvantages [17].

Removable appliances

The earliest appliance used is the Hawley appliance with auxiliary springs to produce proclination of upper incisors. Adams clasps stabilize the plate, and the heightening of occlusion is a must requirement to correct and resolve an anterior crossbite. A modified Hawley appliance uses an inverted labial bow for the management of pseudo class III malocclusion. The appliance can be easily fabricated and require transferring of a bite by guiding the mandible distally in an edge-to-edge position [17].



Figure 5: Correction of anterior crossbite by Hawley appliance with auxiliary springs [15].



Figure 6: Figure shows correction of anterior crossbite, in primary dentition, by Hawley appliance with an inverted labial bow [15].

A modified quad helix appliance

For the required posterior expansion, it is one of the earliest appliances introduced, which is made of 0.036 Blue Elgiloy wire and soldered to the bands of the first permanent maxillary molars. The anterior extension arm is added to modify the appliance, which is further expanded and cemented. Posterior bite-blocks are given to relieve occlusion and to allow crossbite correction. When both arms are activated, activation gradually leads to the proclination of maxillary incisors. A combination of anterior and posterior crossbites is one major indication for this appliance [12].

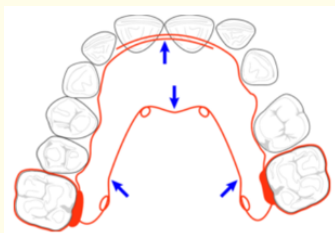


Figure 7: Figure illustrating activation of modified quad helix [15].

Inclined plane

Some other treatment modalities to correct anterior crossbite include fixed or removable acrylic inclined planes (Croll, 1984), composite slopes [5] and bonded resin. These are functional appliances placed on the mandibular arch for quicker results. One of the added advantages of such a removable appliance is that it can also be used as a retention appliance after active treatment is done. Acrylic teeth can be added whenever necessary [3].

Fixed appliance

Anterior crossbite secondary to pseudo-prognathism can also be treated using a simple fixed appliance with partial bonding of brackets along with placement of elastics simultaneously. The brackets are bonded on the labial surfaces of the mandibular incisors and the palatal surfaces of the maxillary incisors. Then further, to create an earlier proclination maxillary incisors and retroclination mandibular incisors, intermaxillary elastics are used. This can also be made up of bands or tubes on the first permanent maxillary molars, brackets on the maxillary, and the use of wire with open coil springs. Brackets are also bonded on the mandibular incisors; in this way, anterior crossbite is simultaneously managed with class III elastics [3].



Figure 8: The components of a standard edgewise appliance to resolve an anterior crossbite [15].

Conclusion

There are various treatment options available for anterior crossbite depending on the timing of intervention, among which interceptive orthodontic treatment aims to recognize in the early stage and eliminate malpositions and irregularities of a developing oro-facial complex. The treatment should begin as early as possible so as to allow normal growth and improve the facial characteristics, attractiveness and psychosocial well-being of children.

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