

2×4 Appliance for Correction of Anterior Crossbite: A Case Series

Abstract:

Anterior crossbite is quite a common problem in the mixed dentition stage. If left untreated, it can cause a number of dental problems and may complicate future orthodontic treatment. One of the major complications in performing anterior crossbite correction in young children is treatment compliance and patient's cooperation. In most cases, poor compliance is due to the unacceptability of the removable appliance used. This article describes three cases of successful correction of anterior crossbite of patients in mixed dentition using short-span wire-fixed orthodontic appliances. This 2x4 appliance provides an alternative method of correcting anterior crossbite of dental origin and proposes many advantages compared to the use of removable appliances. It allows rapid positioning and alignment of the teeth and patient's cooperation is not much required.

Key-words: 2×4 Appliance, Anterior CrossBite, Interceptive Orthodontics, Mixed Dentition, Angle's Class I Malocclusion

Introduction:

Anterior crossbite refers to 'an abnormal labiolingual relationship between one or more maxillary and mandibular anterior incisor teeth'. Clinically, it is expressed as a reverse overjet in which one or more maxillary teeth are positioned palatal to the mandibular incisor teeth when the patient closes his mouth into centric occlusion.[1] Many factors may contribute toward the development of anterior crossbite, and the contributory factors can be categorised based on the nature of the crossbite into skeletal, dental, and functional entities.[2]

Anterior crossbite can affect periodontal health, and this could lead to the gingival recession with thinning of the alveolar bone and mobility of the opposing mandibular tooth/teeth. Functional crossbite due to the premature contact could lead to a possible jaw deviation and temporomandibular pain dysfunction.[3]

Correction of anterior crossbite is recommended at the mixed dentition stage in order to avoid a compromising dentofacial condition which could result in the development of a true class III malocclusion. Various treatment options are available,

such as removable appliances with Z springs for the maxillary incisors, Hawley's appliance with auxiliary spring, inverted labial bow, acrylic inclined planes, catlan's appliance, fixed appliances with a multi-bracket technique, bonded resin composite slopes and 2×4 appliance.[4]

The 2x4 appliance offers many advantages over alternative techniques as it provides complete control of anterior tooth position, is extremely well tolerated, requires no adjustment by the patient and allows accurate and rapid positioning of the teeth. It comprises bonds on the maxillary incisors, bands on the first permanent maxillary molars and a continuous

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archwire. The appliance is used in the early mixed dentition for treatment of both anterior crossbites and alignment of ectopic incisors.[5] Thus presenting three cases using 2/4 appliance for correction of anterior cross bite.

Case Report - 1

History:

A 10 year old girl reported to the Department of Pediatric and Preventive Dentistry with a chief complaint of irregularly placed teeth in upper front region.

There was no significant family or medical history. Extra oral examination revealed a bilaterally symmetrical face with a convex profile. On intra oral examination maxillary left lateral incisor was palatally placed resulting in a anterior cross bite. The patient is in mixed dentition stage with the first permanent molars in a Class I relationship.

Diagnosis- Angle's class 1 malocclusion with anterior crossbite in relation to [11].

Treatment Plan:

2X4 appliance therapy was considered.

Treatment done:

Space analysis using the Moyer's mixed dentition analysis showed the availability of adequate space within the arch for realignment of teeth. After discussing the treatment modalities with parents, we selected a short-span wire-fixed orthodontic treatment with 6 preadjusted edgewise brackets with a 0.022" slot. The brackets were bonded on the labial aspects of the four maxillary permanent incisors and two canines. A short-span nickel-titanium (Ni-Ti) 0.012" round archwire is cut equally on both sides of the centreline and placed into the bracket slots. The wire was stabilised in its position using elastic ties. The patient's bite was raised using 2" mm thickness of composite placed on the incisal aspects of both the mandibular left central incisor (tooth 31). At 15 days review, the incisor teeth were in positive overjet. All the four incisors had been aligned in proper position. Then brackets were debonded and bite raising composite also removed. The patient is kept on follow-up for 6 months.

Case Report - 2

History:

A 10 year old boy reported to the Department of Pediatric and Preventive Dentistry, with a chief complaint of irregularly placed teeth in upper front region.

There was no significant family or medical history. Extra oral examination revealed a bilaterally symmetrical face with a convex profile. On intra oral examination maxillary right central incisor was palatally placed resulting in a anterior cross bite. The patient is in mixed dentition stage with the first permanent molars in a Class I relationship.

Diagnosis- Angle's class 1 malocclusion with anterior crossbite in relation to [22].

Treatment Plan:

2X4 appliance therapy was considered.

Treatment done:

Space analysis using the Moyer's mixed dentition analysis showed the availability of adequate space within the arch for realignment of teeth. After discussing the treatment modalities with parents, we selected a short-span wire-fixed orthodontic treatment with four preadjusted edgewise brackets with a 0.022" slot. The brackets were bonded on the labial aspects of the four maxillary permanent incisors. A short-span nickel-titanium (Ni-Ti) 0.012" round archwire is cut equally on both sides of the centreline and placed into the bracket slots. The wire was stabilised in its position using elastic ties. The patient's bite was raised using 2" mm thickness of composite placed on the incisal aspects of both the mandibular left central incisor (tooth 31). At 1.5 month review, the incisor teeth were in positive overjet. All the four incisors had been aligned in proper position. Then brackets were debonded and bite raising composite also removed. The patient is kept on follow-up for 6 months.

Case Report - 3

History:

A 9 year old girl reported to the Department of Pediatric and Preventive Dentistry, with a chief complaint of irregularly placed teeth in upper front region.

There was no significant family or medical history. Extra oral examination revealed a bilaterally symmetrical face with a convex profile. On intra oral examination maxillary right central incisor was palatally placed resulting in a anterior cross bite. The patient is in mixed dentition stage with the first permanent molars in a Class I relationship.

Diagnosis- Angle's class 1 malocclusion with anterior crossbite in relation to 11.

Treatment Plan:

2X4 appliance therapy was considered.

Treatment done:

Space analysis using the Moyer's mixed dentition analysis showed the availability of adequate space within the arch for realignment of teeth. After discussing the treatment modalities with parents, we selected a short-span wire-fixed orthodontic treatment with four preadjusted edgewise brackets with a 0.022" slot. The brackets were bonded on the labial aspects of the four maxillary permanent incisors. A short-span nickel-titanium (Ni-Ti) 0.012" round archwire is cut equally on both sides of the centreline and placed into the bracket slots. The wire was stabilised in its position using elastic ties. The patient's bite was raised using 2" mm thickness of composite placed on the incisal aspects of both the mandibular left central incisor (tooth 31). At 1.5 month review, the incisor teeth were in positive overjet. All the four incisors had been aligned in proper position. The patient is kept on follow-up for 6 months.

CASE-1



Pre-operative Photographs Intra-operative Photographs Post-operative Photographs

CASE-2



Pre-operative Photographs Intra-operative Photographs Post-operative Photographs

CASE-3



Pre-operative Photographs Intra-operative Photographs Post-operative Photographs

Discussion:

Anterior crossbite is a common problem in children during the early mixed dentition stage, and a majority of the cases are of dental origin (Nagaranjan S. et al.,2018)[6]. Anterior

crossbite is defined as an abnormal labiolingual relationship between one or more maxillary and mandibular incisor teeth (Subramanayam D. et al.)[7]. Anterior cross bites should be intercepted and treated at an early stage because it is self-perpetuating condition which if not treated in early stage has the potential of growing into skeletal malocclusion and might at a later stage require major orthodontic treatment combined with surgical procedures.(Gawali P. et al., 2019)[8].

Possible causes of dental related anterior crossbite are the presence of supernumerary tooth/teeth, odontomas, trauma to the primary predecessor, ectopic position of permanent tooth germ, retained primary teeth, anomalies in tooth shape and size, arch length inadequacy, and upper lip biting habit. Early treatment allows harmonisation of the occlusion with time, as the permanent teeth are still erupting during this stage of the dentition. (Nagaranjan S. et al., 2018)[6] It prevent some of the common detrimental effects of anterior crossbite such as enamel wear, gingival striping, attachment loss, tooth mobility, and jaw deviation.

Removable appliance is one of the most common method of treatment during the mixed dentition period.⁷The following treatment methods have been suggested for correction of simple anterior dental crossbite; Tongue blade therapy, lower inclined plane, stainless steel or composite crowns, Hawley retainer with auxiliary springs (Asher R. S. et al, 1986)[9]. Removable appliances although easy to wear and patient comfort is satisfactory, there are few drawbacks which includes 2 or 3 appointments, less control of tooth movements, improper activation can lead to unwanted tooth movements and requires immense patient cooperation (Erdinc A. E. et al., 2007)[10]. In contrast to this fixed appliance treatment can be initiated immediately as soon as the permanent molars and incisors have erupted and have minimal patient discomfort and produces active and controlled tooth movement in less time. Due to the high application of force the treatment duration is comparatively faster compared to the removable appliances (Nidu S. et al., 2005).

The 2x4 appliance is a sectional fixed appliance, results in more effective and efficient positioning of teeth as three dimensional control is possible during correction of malaligned anterior teeth.[1] It comprises bonds on the

maxillary incisors, bands on the first permanent maxillary molars and a continuous archwire. The appliance is used in the early mixed dentition for treatment of both anterior crossbites and alignment of ectopic incisors. Besides that, it is also suitable for mixed dentition patients with a reduced number of teeth, where the retention of the removable appliance used can be a problem (Nagarajan S. et al., 2018). Therefore diastemas, rotations and improper inclinations of teeth can be treated very easily and quickly using this technique. Lee et al outlined four factors to consider before selecting a treatment approach; Adequate space in the dental 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 Class I occlusion.(Lee et al.)¹. Advantages of using 2x4 appliance includes patient's cooperation is not much needed, treatment time gets reduced, no laboratory cost and versatile orthodontic tooth movement as well as correction.

So in present case, we have used 2x4 appliance for the correction of anterior cross which was less time consuming, gave patient satisfaction and also satisfactory result seen in a short time period like all the authors have advocated earlier.

Conclusion:

The above mentioned case reports clearly demonstrate the versatility of using the 2x4 appliance. Even though there may be slightly more chairside time required to fit the appliance, there is no laboratory cost involved as with a removable appliance. The advantages over this type of appliance are significant and include:

- Bodily movement of teeth if space needs to be created for an instanding incisor or recreated for an impacted late erupting incisor
- Torque of the incisor roots palatally to decrease the chance of relapse, as well as maximize the aesthetic result
- Efficient and effective derotation of incisors

The functional improvement coupled with the obvious psychological benefit gives this simple and easily placed appliance a significant advantage over the traditional method of treating these potentially challenging mixed dentition problems.

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