



## Early Orthodontics Interception in Mixed Dentition Using 2x4 Appliance: A Series of 3 Case Report

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### Abstract

*Mixed dentition period is considered as one of the most essential age for undergoing orthodontic treatment. One of the common myth's parents have is that orthodontic treatment should be done only after the complete eruption of all the permanent teeth. A mixed dentition treatment can proficiently and meritoriously be provided using a 2x4 appliance. The indications for early treatment are discussed. These three case report illustrates 2 x 4 appliance in treating certain malocclusions in mixed dentition period.*

**Keywords:** 2x4 appliance, mixed dentition, early treatment.

### Introduction

Children having malocclusion in the mixed dentition period are frequently delayed for treatment until all permanent teeth erupt or are given removable appliances which only result in limited tooth movement.<sup>1</sup>

A stage of transition from primary to permanent dentition is the time period which mainly presents with malocclusion due to various factors. Among the problems most frequently seen in the mixed dentition period is the anterior cross bite. This transition period has always been controversial, with regard to the appropriate time to initiate the treatment and type of treatment to be undertaken.<sup>2</sup>

Interceptive procedures not only simplify but also eliminate the need for later treatment procedure.

Mixed dentition is the most crucial period because early treatment would correct the occlusion as well as ensure normal development of teeth and jaws.<sup>3</sup>

Interceptive treatment is usually carried out in order to decrease the severity of a increasing malocclusion. This type of treatment is very often indicated and carried out in the mixed dentition and brings with it unique challenges. Timing of orthodontic treatment has always been the subject of much debate over the years.<sup>4</sup>

Most important advantage of early interception is that the majority of the malocclusion can be corrected non surgically and without extraction of permanent teeth.

The 2x4 appliance used in the mixed dentition is a flexible appliance, consisting of bands on the first permanent molars and bonded brackets on the erupted maxillary permanent incisors. Continuous archwire is used to provide complete control of the arch form. Recently, much discussion in the literature regarding the ideal timing of initiating orthodontic treatment is observed.

Many aspects of orthodontics have been taken into consideration, such as the clinical effectiveness, the orthodontists' preference, the outcome of early treatment, and psychological influences associated with it (Tulloch et al., 1997; Yang, 1998).<sup>5</sup>

Treatment of younger children in the early mixed dentition period offers advantages in terms of stability and avoidance of future complications, which helps them build their self-respect and aesthetic appearance, thus improving their overall personality (Tung et al., 1998). Complex malocclusions can also be modified, which are to be treated in two steps i.e early correction of mild malocclusions by 2x4 appliance which is a fixed partial appliance and complete treatment in the second step (Profitt et al., 1986).<sup>6</sup> This article presents 3 case reports of patients with different forms of malocclusion treated by 2x4 appliances.

### Case 1

A 10 year old female reported to the Department Of Pedodontics and Preventive Dentistry, Narsinhbhai Patel Dental Collage and Hospital, Visnagar with a chief complaint of irregularly placed upper front teeth since 1 year. There was no significant family or medical history. Extra oral examination revealed straight profile of the patient. Intra oral examination revealed U-shaped arch with Class II molar relationship and maxillary central incisors were palatally placed. Orthopantomograph of the patient was taken and space analysis was done to measure the arch length discrepancy. Clinical examination revealed Class II molar relation, with deep bite. 2x4 fixed orthodontic treatment was planned. Initial alignment was done using 0.014 NiTi followed by 0.017x0.025 niti and 0.017x0.025 stainless steel

wire. Results were achieved in 4 months. In upper jaw after labial repositioning of central incisor, placed a 16 X 22'' rectangular SS arch wire with labial crown torque for 3 months.



**Figure 1** Pre- operative photograph



**Figure 2** post-operative photograph

### Case-2

A 12-year-old boy was referred to the Department of paediatric and preventive dentistry Visnagar, with a complaint of a malpositioned permanent mandibular right lateral incisor. Extra-oral examination revealed that he had convex profile. In addition, the permanent mandibular lateral incisor was positioned at the primary mandibular second molar with a 90° mesiolingual rotation. Dental analysis showed there was enough space for eruption of all permanent teeth. In the upper arch teeth were erupting in correct anatomical position and well aligned. He was in the mixed dentition stage and had a Class I dental and Class II skeletal relationship on both sides with 3 mm overjet and 3 mm overbite. The mandibular midline was coincident with the facial midline. Based on the intraoral and radiographic examination, (showed the root to be in its original position in the arch) it was decided to correct the transposition of the permanent mandibular lateral incisor, correct the axial inclination and rotation of the lateral incisor, and provide a Class I molar relationship. Treatment consisted of uprighting the

permanent lateral incisor to its normal position in the arch.

Treatment began with a 2X4 fixed appliance system that incorporated all teeth. NiTi arch wires were used for initial levelling and alignment, and rectangular stainless steel arch wires were inserted to achieve acceptable occlusion. E-chain elastics were used to correct the position of lateral incisor. The patient was seen at 2-week intervals during active treatment. The final radiographic evaluation showed the roots of the transposed 42 to be parallel, and there were no signs of complications. After debonding, lingual arch was delivered. The patient is on continuous follow up.



**Figure 3** Pre-operative photograph



**Figure 4** Pre-operative photograph



**Figure 5** Post-operative photograph

**Case 3**

A 12 year old female had reported to the department of pedodontics and preventive dentistry with the chief complaint of Crowding and unesthetic appearance. On examination, 12 and 22 were found in cross bite. This was treated using a, 2x4 appliance, as it engages both the maxillary first permanent molars and central incisors, lateral incisors in its set up. 0.022” slot

brackets were bonded onto the six anterior teeth and buccal tube was cemented on maxillary first permanent molars of both quadrants. 0.012 Round NiTi wire was used initially for alignment for 3 weeks followed by 0.014 NiTi wire for 2 weeks. One important modification done in this case was rotation of brackets by 180° and then bonding it on both the lateral incisors.

This was done to counteract the exaggerated palatal root torque of maxillary lateral incisors. 0.017”x 0.023” rectangular NiTi wire was used over period of 4 week as final finishing and retention of the correction. . Bite was raised on both the sides by bonding Glass ionomer cements on the occlusal surface of mandibular first permanent molars. Recall examination after every 1 month is continued without any relapse.



**Figure 6** Pre-operative photograph



**Figure 7** Post-operative photograph



**Figure 8** Post-operative photograph

**Discussion**

The 2X4 is a fixed appliance which is made of bands on the first permanent molars, brackets

bonded to the erupted maxillary incisors and continuous arch wires to provide/maintain good arch form, as well as control of anterior teeth. Some limits of removable appliances in children are often lack of cooperation from the patient, lack of retention and improper activation. Instead, fixed appliances in mixed dentition do not necessitate much patient cooperation.<sup>7</sup>

Advantages of fixed appliances to mention a few are-minimal discomfort, reduces need for patient co-operation, increase control of tooth movements, movement possible in all three planes of space.

The appliance described is versatile, easy to use and well tolerated by all patients. One of the important aspects while selecting a 2 x 4 appliance is the eruption of permanent molars and incisors. The 2 x 4 appliance can be stated as partial fixed orthodontic treatment during the early stages to correct many malocclusions which are common during the mixed dentition period.

Anterior crossbite can be a major esthetic and functional concern during the early stages of dental development. Anterior crossbite is defined as a situation in which one or more primary or permanent mandibular incisors occlude labially to their antagonists (or when one or more maxillary incisors are lingual to their antagonists) (Daskalogiannakis, 2000).<sup>9</sup>

Anterior crossbites in the early mixed dentition are believed to be transferred from the primary to the permanent dentition and can have long-term effects on the growth and development of the teeth and jaws (McNamara, 2002). Anterior crossbite may lead to abnormal enamel abrasion or proclination of the mandibular incisors, which, in turn, leads to thinning of the labial alveolar plate and/or gingival recession (Valentine and Howitt, 1970).<sup>10</sup>

As in case 1, the objectives of treatment mainly focused on correction of anterior deepbite and inclination of upper incisors. Clinically, correction of deep overbite can be achieved by molar extrusion, incisor intrusion, or a combination of these two types of tooth movement. Extrusion of

posterior teeth is stable in growing patients when the growth potential of mandibular condylar remains. In adult patients, posterior teeth extrusion is probably counteracted by the posterior occlusion, especially in the hypo divergent skeletal pattern.

In case 3, Light continuous force was applied by using a small round Ni-Ti wire (0.012 inches), allowing the teeth to shift without patient discomfort. Palatally displaced lateral incisors are typically extruded. Elimination of occlusal interference, during alignment is a pre requisite for correction of the cross bite. Occlusal interference associated with such extrusion can prevent proper tooth positioning, and therefore, the temporary use of a bite plane may be necessary. Park et al. achieved alignment in such cases by intruding the lateral incisors using tubes without additional appliances and minimizing occlusal interference during the correction of cross bite.

Tooth transposition is a form of ectopia and characterized by the abnormal eruption of a tooth in the place of a nonadjacent tooth or positional interchange of two adjacent teeth. Mandibular lateral-canine transpositions have a strong relationship with other dental anomalies, such as pegshaped maxillary lateral incisor and tooth agenesis. The multifactorial etiologies of a transposition abnormality may include prolonged retention of primary teeth, early loss of primary teeth, lack of root resorption of primary canine teeth and genetic interchange in the position of the developing tooth buds.<sup>11</sup>

Mandibular tooth transpositions are seen less frequently and with less variety than those in the maxilla. Mandibular tooth transpositions account for approximately 20% of all tooth transpositions. Based on data from published surveys, transposition in the mandible generally involves lateral incisor and canine teeth, which is caused by distal migration of mandibular lateral incisors. In the case presented, the typical characteristics of mandibular lateral transposition, described by

Peck, were observed both clinically and radiographically.<sup>12</sup>

Due to the crown-root positions of the transposed teeth, transpositions may be complete or incomplete. In a complete transposition, the teeth interchange their positions as a whole, whereas, in an incomplete transposition, only the crowns or roots of the teeth are transposed. In cases 2, the mandibular lateral incisor had migrated distally, but the root tip was situated in original position. Hence, this was considered incomplete transpositions.<sup>13</sup>

In the case 2, the diagnosis of the transposition anomaly was performed before the eruption of the permanent mandibular canine by a conventional radiograph. As a general principle, transposition should be prevented by uprighting and mesial movement of the lateral incisor, when incipient transposition is detected before eruption of the permanent canine tooth.

### Summary

The three case reports described clearly demonstrate the versatility of using the 2x4 appliance. Even though greater chairside time would be required for placement of 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 by efficient and effective de-rotation of incisors.<sup>14</sup>

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.<sup>5</sup>

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