

## REVIEW ARTICLE

# Correction of Malaligned Maxillary Anterior Teeth during Mixed Dentition Period using 2 x 4 Appliance: An Esthetic Makeover

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### ABSTRACT

**The correction of malpositioned teeth in the mixed-dentition is a challenging task. If not done correctly it can be detrimental to the developing dentition and increase the probability of a complex orthodontic treatment in future. Factors such as severity of the malocclusion, patient's compliance, availability of bone and space, type of treatment appliance used may dictate the success of treatment. The 2 × 4 orthodontic appliance has shown to produce a positive effect with de-rotation of the rotated/ malpositioned teeth and bringing them into correct arch alignment. Use of this appliance also eliminates the detrimental effects to the developing dentition and enhances patient's smile with confidence. The 2x4 appliance consists of four brackets bonded on permanent maxillary incisors; bands with buccal tubes cemented on permanent maxillary first molars and a continuous arch wire. It has advantages over conventional techniques such as it provides total control of anterior tooth position, does not require any adjustment, allows precise and rapid positioning of the teeth and is very well accepted by the patient. This article illustrates the use of 2 x 4 appliance for correcting malocclusion in maxillary anterior teeth during mixed dentition period. The results achieved were satisfactory in regard to the esthetic demands of the patient as well as parents.**

**Keywords: mixed dentition, 2x4 appliance, esthetics**

### INTRODUCTION

Mixed dentition period marks the transition from primary to permanent dentition. This time period is most likely to present with malocclusion due to various changes occurring in the developing dento-alveolar structures. Management of malpositioned teeth in the early stage of mixed dentition phase possesses a great dilemma to dentists. This transition period has always been controversial with regard to initiating the treatment and type of treatment to be undertaken. The type of treatment depends on the severity of the malocclusion, availability of space, alveolar bone architecture, eruption path, and patient's compliance for treatment.<sup>1</sup>

Children having malocclusion during mixed dentition period are usually delayed for treatment until eruption of all the permanent teeth or are given removable appliances which only result in limited tooth movements (Jalis Fatima, 2015). Mixed dentition is very crucial period because early treatment would result in the correct occlusion as well as ensure normal

development of teeth and jaws. Interceptive procedures decrease the severity of an increasing malocclusion as well as eliminate the need for later treatment procedure. Most important advantage of early interception is that the majority of the malocclusion can be corrected non-surgically and without need for extraction of permanent teeth.<sup>2,3</sup> An ideal orthodontic appliance for interceptive procedures should intercept a developing malocclusion and correct it definitively, eliminating the need for additional extensive treatment. It should start and finish its operation while children are in elementary school (mixed dentition phase). At this age, the tissue adaptation and response is optimal and children are also enthusiastic about braces. Therefore, they are willing to cooperate with their treatment. The ideal appliance should also minimize cost factor and treatment time.<sup>4</sup>

The 2x4 appliance used in the mixed dentition is a versatile appliance, consisting of bands on the maxillary first permanent molars with buccal tubes; bonded brackets on four maxillary permanent incisors and continuous arch wire which is used to provide complete control of the arch form (Fiona, 2001). With this approach, a single short phase of fixed appliance therapy in the mixed dentition period helps in rapid correction of early malocclusions (Tulloch et al., 1997).<sup>5</sup> The versatility of this appliance allows resolving various problems affecting the upper incisors in a simple manner within a relatively short time period. It can be used for rapid correction of crossbites in the anterior teeth, reduce overjet and align ectopic incisors. 2 x 4 fixed appliance offers more effective and efficient tooth positioning as it allows three-dimensional control of the involved teeth during correction phase. This appliance not only quickly restores anterior aesthetics of teeth but it also reduces the complexity and duration of any further treatment<sup>6</sup> The present case report focuses on 2X4 appliance which was used for the correction of malaligned maxillary anterior teeth in mixed dentition stage.

## CASE REPORT

A 9 year old boy patient reported to the department with his mother with the chief complaint of irregularly placed upper front teeth and decayed upper back teeth. There was no significant medical or family history. Extra oral examination revealed a straight profile of the patient (Fig 1). The patient appeared to be ectomorphic, mesocephalic, mesoprosopic with no significantly visible facial asymmetry. No abnormality was detected during soft tissue examination. Intra oral examination revealed U-shaped arch with Angle's Class I molar and Class I canine relationship with overjet of 4mm and 76% of overbite. Crowding and rotation were present w.r.t. upper anterior teeth. Maxillary central incisors were seen to be rotated and placed palatally (Fig 2 & 3). No anterior crossbite was present. Midline showed mild deviation towards the right. The no. of teeth present was 26. Maxillary left second primary molar was found to be carious involving pulp. Root stumps of both right and left upper primary first molars were seen along with erupting premolars. Treatment plan included oral prophylaxis; root canal treatment w.r.t. maxillary left second primary molar followed by stainless crown restoration, extraction of right and left upper primary first molars remaining root stumps and correction of the malaligned upper anterior teeth using 2x4 orthodontic appliance.



**Fig 1: Extraoral view Fig 2 & 3: Pre-treatment crowding and rotation present w.r.t. upper anterior teeth**

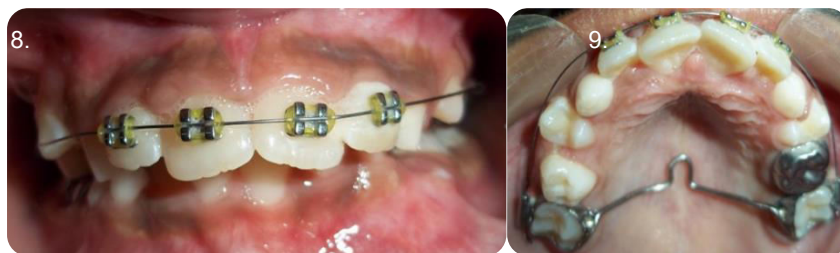


**Fig 4 & 5: 2X4 Appliance placed along with Transpalatal arch**

Firstly oral prophylaxis was performed. Intra occlusal periapical radiograph was taken wrt left upper primary second molar. Root canal treatment was done followed by stainless crown restoration. Extraction w.r.t. right and left upper primary first molars root stumps was done. 2x4 orthodontic appliance was placed for correction of rotated and palatally placed maxillary incisors. This fixed appliance comprised of stainless steel bands on the first permanent molars with buccal tubings and brackets bonded on the erupted maxillary central and lateral incisors. 0.022" slot brackets were bonded onto the four anterior teeth. A 0.012" nickel titanium arch wire was used for the correct alignment of maxillary incisors. Transpalatal arch was given for the stabilization of arch.(Fig 4 & 5) The initial wire was eventually replaced by 0.016" NiTi arch wire. Follow up after 2 weeks and 4 weeks was done (Fig 6,7,8 & 9). The final correction and alignment of the upper anterior teeth was seen after 6 weeks (Fig 10). The appliance was removed and patient was given fixed palatal retainer for retention. The results were satisfactory for the patient as well as parents with improved dental esthetics boosting the confidence of the child.



**Fig: 6 & 7: Follow up after 2 weeks**



**Fig: 8 & 9: Follow up after 4 weeks**



**Fig 10: Post treatment results**

## DISCUSSION

The mixed dentition period between 6 and 12 years of age is often a worrisome period for parents as most of the malocclusions come to surface around this time. Parents expect their children's permanent teeth to erupt into perfect dentition following shedding of the primary teeth. Children are also aware of dental aesthetics and their looks. Treatment of younger children in the early mixed dentition period leads to benefits in terms of stability and avoidance of future complications, which helps them build their self-esteem, confidence, aesthetic appearance, thus improving their overall personality (Tung et al., 1998). Simple discrepancies in the teeth alignment can be corrected with methods such as use of a wooden spatula tongue blade, Catlan's appliance and removable appliance with z-spring, composite or glass ionomer cement incline plane, and expansion screw. However, correction of severely rotated or malposition teeth away from the arch alignment requires slight improvisation in the methods because the use of simple and removable appliances may not be effective in correcting these teeth effectively.<sup>1,3</sup> Also, the removable appliances can be cumbersome and if they are either too loose or too tight, they will not be worn by the patient. Breakage of the clasps or other components may also occur as the appliances are to be put in and out of mouth frequently, thus resulting loss of retention will discourage the patient to wear the appliance (O'Brien, 1997). According to Ninou and Stephens, the success of removable appliances depends mostly on patient's compliance for wearing as well as adjusting the appliance. So, a substitute to these removable appliances had to be found so that all the above problems could be solved (Ninou, 1994). The 2x4 appliance is a sectional fixed appliance which produces promising results. Use of this appliance results in effective and efficient positioning of teeth as three dimensional control is possible during correction of malaligned/ rotated anterior teeth. Midline diastemas, rotations and improper inclinations of teeth can be treated easily and quickly using this technique (Dowsing, 2004). Interceptive therapy provided by 2x4 appliance in such cases, prevents further complications in future.<sup>5</sup>

The concept of sectional appliances is not recent. Johnson introduced the twin-wire arch in the 1930s, which included incisor and molar bands and small-diameter twin wires attached in buccal tubing along with various auxiliaries such as palatal arches, intermaxillary hooks and coil springs. This resulted in an appliance with a flexible anterior section allowing alignment of incisors and buccal sections to prevent distortion [Johnson, 1934]. A study conducted by Dowsing and Sandler [2004], highlights the versatility of the 2 x 4 appliance and how it can be used for correction of retroclined central incisors, ectopic or rotated incisors, and the correction of a posterior crossbite with central incisors in crossbite in combination with a soldered quadhelix.<sup>6</sup> White stated that both anterior and posterior crossbites require early correction for functional reasons and aesthetic reasons. It has been found that the fourth most common target for teasing was dental features and the comments made about teeth were considered to be more hurtful than any other feature, especially in the 9–10 year age group. Impacted or ectopic incisor teeth can have a significant effect on the psychological well-being of an individual, especially at a young age. Also, there is some potential for speech problems to occur thus should be managed as early as possible. The major advantages in carrying out this treatment with a 2x4 appliance are the ease with which space opening can be controlled with a fixed appliance, and also that the force magnitude and vector can be controlled much more precisely than with a removable appliance.<sup>7</sup> Another advantage of fixed appliance is that no laboratory facilities are required. Treatment can be initiated as soon as sufficient permanent teeth have erupted and the child is co-operative enough to have separators placed, bands cemented and brackets bonded. Placement of a fixed appliance takes a little longer than the time required to fit a removable appliance. Although, patient co-operation for the placement, adjustment and removal of the appliance is needed, the importance of patient compliance during active treatment is minimal as compared to that for a

removable appliance. It is still essential to maintain a high standard of oral health in view of the increased risk of demineralization associated with a fixed appliance.<sup>8</sup> Treatment carried out in this mixed dentition stage may take a couple of weeks whereas more difficult cases can take longer. In the majority of cases, however, the end result can be more effectively and efficiently achieved than if a removable appliance was used. Definitive treatment will probably still be necessary in the permanent dentition, but the complexity and duration of this can be significantly reduced.

## CONCLUSION

Dental esthetics plays a major role in one's psychological well-being at a young age. Mixed dentition period may show various types of malocclusions. Removable and partial fixed appliances are the options which help in correction of minor malocclusions. Early treatment in such cases will not only quickly restore anterior aesthetics but may also reduce the complexity and duration of any subsequent treatment. The 2x4 appliance is versatile, easy to use and well tolerated by most of the patients. When used correctly, the 2x4 appliance gives a better controlled approach to tooth movement in all three dimensions and a more predictable outcome.

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