

Interceptive Correction of Midline Diastema in Children Using 2 X 4 Appliance Therapy: A Case Series

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ABSTRACT

Various malocclusions are evident right from the mixed dentition stage up to the eruption of all the permanent teeth in the oral cavity. Many of these anomalies are self correcting in the mixed dentition stage but few needs immediate intervention such as presence of a midline diastema. If left untreated, it can lead to a multitude of problems and may complicate future orthodontic treatment. So whenever a midline diastema is evident the muscular activity is to be assessed followed for consideration of esthetic rehabilitation. Keeping in mind these perspectives two cases are presented here that have been treated using sectional appliance method. Such treatment for successful outcomes requires patient compliance and therefore fixed orthodontic therapy was undertaken instead of removable appliances.

INTRODUCTION-

The increasing esthetic demands of patients in this day and age has lead to a widespread and frequent utilisation of fixed orthodontic therapy. Even children seem to be having a lot of worry regarding their appearance from a much juvenile age. The presence of midline diastema is a concern for most patients as they consider it unpleasant looking and they seek treatment for the same. Depending on the etiology it can be many a times treated successfully using interceptive orthodontic therapy especially in mixed dentition period. However , proper case selection, appropriate treatment option, adequate patient cooperation, and good oral hygiene all of importance for fruitful results of the treatment .

The midline diastema is defined is a space (or gap) between the maxillary central incisors (Fig 1). The space can be a normal growth characteristic during the primary and mixed dentition and generally is closed by the time the maxillary canines erupt. For most children, the medial erupting path of the maxillary lateral incisors and maxillary canines, as described by Broadbent , results in normal closure of this space. For some individuals, however, the diastema does not close spontaneously.

A popular treatment modality for such cases is the use of sectional appliance therapy that was introduced in the early 1930's by Johnson. 2 x 4 appliance therapy, usually comprises placement of the brackets on the maxillary anterior four teeth along with molar bands positioned on the maxillary first molars having attached molar tubes on them. Wires are then fixed using elastic modules or ligature wires to bring about the desired interception. Numerous studies in the literature have revealed the versatility of this appliance in correcting anterior posterior crossbites, rotations, diastemas incorrect inclinations of teeth etc. This appliance not only swiftly restores anterior aesthetics but it may also reduce the complexity and duration of any subsequent treatment at a later age.



Figure 1: Midline diastema in a 15 year old girl between maxillary central incisors

This article highlights two cases of successful correction of midline diastema using simple sectional fixed orthodontic appliances. The use of this type of appliance provides an alternative treatment modality to correct midline diastema with good patient compliance and minimal disruption of oral functions.

CASE REPORT 1:

A 10 year old girl came with her parents to the pediatric and preventive dentistry department, ITS dental college Muradnagar, with a primary complaint of presence of extra tooth between maxillary central incisors. Parents noticed that there was a mesiodens present between the maxillary centrals which gave her an unpleasant appearance. There was no significant past dental history and medical history of the patient.

Intraoral examination revealed the patient in mixed dentition stage with the first permanent molars in a Class I relationship. There was a mesiodens (Figure 2) present between 11 and 21, 11,21 were in a rotated state and the permanent canines were not erupted yet. Due to this the patient was in the ugly duckling stage and we planned the treatment continuation till the eruption of permanent canines was completed so that the diastema does not reopen. The patient had the presence of primary canine on one side as well as a deep bite. Space analysis using the Moyer's mixed dentition analysis showed the availability of adequate space within the arch for realignment of teeth.



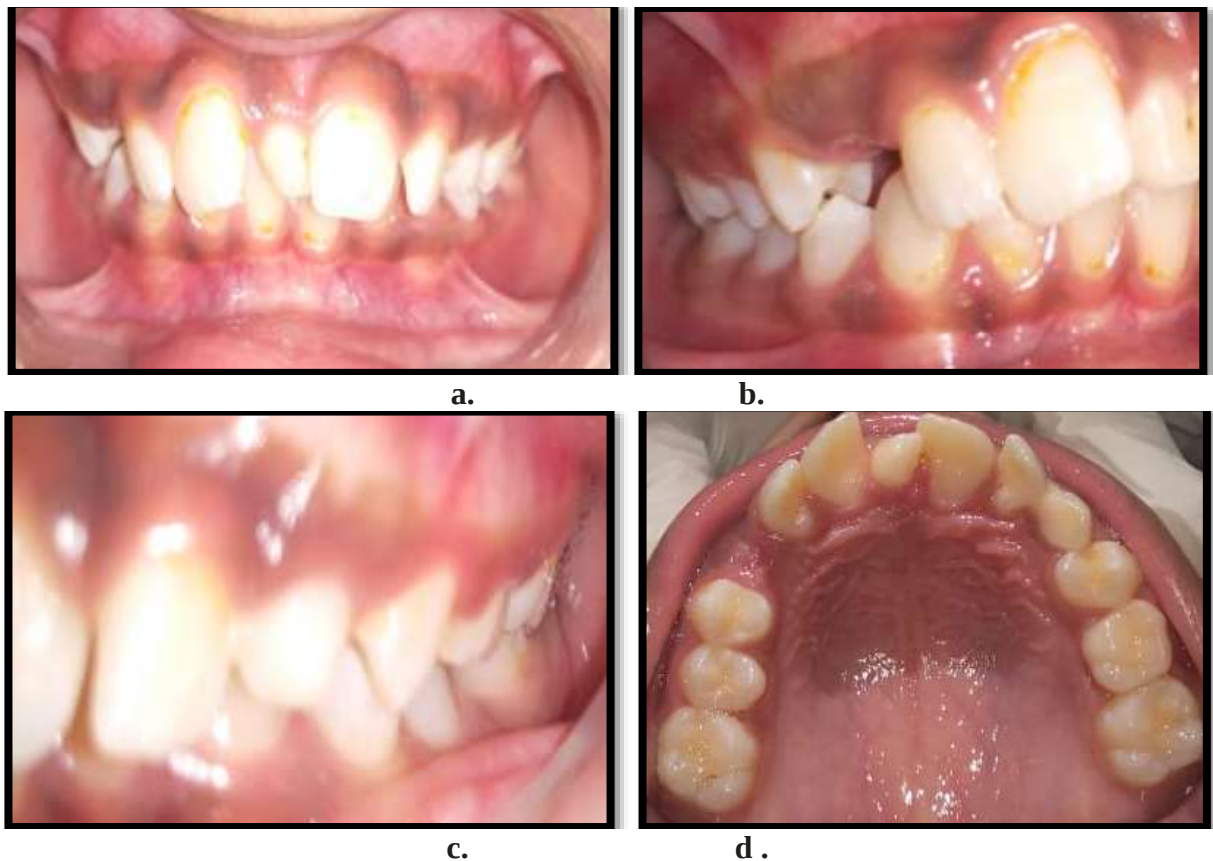
Figure 2: Presence of supernumerary between the maxillary central incisors.

After discussing the treatment modalities with parents, extraction of mesiodens was planned followed by fixed orthodontic treatment with four preadjusted edgewise brackets with a 0.022" slot. Preformed bands with welded molar tubes were luted to the maxillary first molars. The brackets were bonded on the labial

aspects of the four maxillary permanent incisors. A short-span nickel-titanium (Ni-Ti) 0.014" 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 modules. The patient was recalled after 21 days to monitor the changes and changing of wire component. Follow up showed slight space closure and derotation of the rotated teeth. Within 8 months after the initiation of treatment, the midline diastema and rotation was corrected successfully. The 0.014" round Ni-Ti archwire was changed to the 0.016", 0.018" in the follow up visits. An e-chain was placed in between for space closure and final wire before debonding was 0.014" for final finishing of the case. The final outcome was very promising and the patient as well as her parents were extremely satisfied with the results. A removable Hawley's appliance was delivered to the patient for retention.

PRE OPERATIVE RECORDS:

FIGURE 3:





e.

a) Frontal view showing mesiodens and rotated 11 and 21. b)c) Right and left lateral views depicting class 1 molar relationship d) Maxillary view e) Mandibular view.

INTERMEDIATE TREATMENT RECORDS:

FIGURE 4:



a.



b.



c.



d.

a) Frontal view showing after initiation of treatment b) Maxillary view c) Placement of e-chain d) Maxillary view after space closure with e-chain.

POSTOPERATIVE RECORDS:

FIGURE 5:



a) Frontal view b) Maxillary view c) After placing Hawley's retainer

CASE REPORT 2:

A 15 year old girl came with her parents to the pediatric and preventive dentistry department, ITS dental college Muradnagar, with a primary complaint of forwardly placed tooth and spacing between the maxillary central incisors. The patient as well as her parents were very concerned about the esthetic appearance and wanted to get the corrections done as early as possible. There was no significant past dental history and medical history of the patient.

Intraoral examination revealed the patient was in permanent dentition stage with the first permanent molars in a Class I relationship. There was a papillary penetrating frenal attachment (Figure 6) present between 11 and 21, that caused the occurrence of midline diastema. The patient also had proclination of the anterior maxillary teeth. Space analysis showed the availability of adequate space within the arch for realignment of teeth.

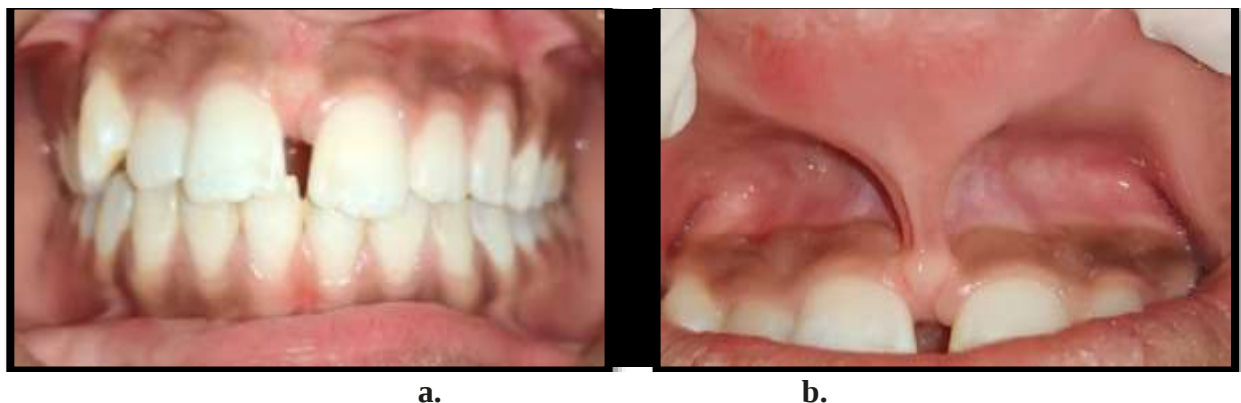


Figure 6: Presence of midline diastema due to papillary penetrating frenal attachment.

After discussing the treatment modalities with parents, we decided to treat the case using fixed orthodontic treatment with preadjusted edgewise brackets with a 0.022" slot in the upper arch. Preformed bands with welded molar tubes were luted to the maxillary first molars. The brackets were bonded on the labial aspects of the maxillary permanent teeth to treat the proclination. A short-span nickel-titanium (Ni-Ti) 0.014" 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 modules. The patient was recalled after 21 days to monitor the changes and changing of wire component. Follow up showed slight space closure and reduction of the proclination. As the treatment was progressing we decided to go for frenectomy of the labial frenum that was obstructing space closure. The frenectomy was done using LASER and there was rapid space closure noticed subsequently. Within 6 months after the initiation of treatment, the midline diastema and proclination was corrected successfully. The 0.014" round Ni-Ti archwire was changed to the 0.016", 0.018" in the follow up visits. An e-chain was placed in between for space closure and final wire before debonding was 0.014" for final finishing of the case. The final outcome was very promising and the patient as well as her parents were extremely satisfied with the results. A essix retainer was delivered to the patient for retention.

PREOPERATIVE RECORDS:

FIGURE 6:





c.

d.

a) Frontal view showing presence of diastema b) Papillary frenal attachment c) radiograph showing diastema due to high frenal attachment d) Maxillary view showing proclination

INTERMEDIATE TREATMENT RECORDS:

FIGURE 7:



a.

b.



c.

d.

a) Frontal view showing after initiation of treatment b) Maxillary view c) After frenectomy d) Maxillary view after space closure and reduced proclination.

POSTOPERATIVE RECORDS:

FIGURE 8:



a) Frontal view after treatment completion b) After placing essix retainer

After completion of the treatment a step was visible between the incisal edges of 11 and 21 for which the patient was asked to continue the treatment for few more days but the patient and parents did not want the teeth to be in perfect alignment as they believed that it will not have a natural look and they were very satisfied with the above results.

DISCUSSION:

Researchers and clinicians found in various studies that multiple factors may contribute to a midline space including pernicious oral habits, soft tissue imbalances, physical impediments, dental anomalies and abnormal maxillary arch structure. Due to the various possible etiologies the diagnosis of these cases has to be made with careful medical and dental history, clinical and radiographic examinations. The medical/dental history should elucidate any pertinent medical conditions (such as hormonal imbalances), oral habits, previous dental treatment and/or surgeries, and family history of diastemas or other related dental problems. The clinical examination should include evaluation of possible pernicious oral habits, soft tissue imbalances (e.g., macroglossia), improper dental alignment (rotated teeth, excessive overbite/overjet), missing teeth, or other dental anomalies. The "blanching test" may be used to evaluate the frenal attachments. Proper treatment of a midline diastema will depend upon its etiology. Several treatment protocols have been proposed ranging from the classic frenectomy or orthodontic treatment, to even more radical procedures of subapical osteotomies, corticoectomies, septotomies, and reverse-bevel gingivectomies. No single method can be used to treat all diastema cases.

The presence of diastema mostly appears to be unesthetic and in young patients may have a psychological impact which may lead them to be underconfident to smile. They may start criticising themselves regarding their appearance and may also cause lowering of self esteem and more introvertedness. All these factors signifies that a conducive and comprehensive treatment planning be done for such young patients who might be in the mixed dentition as well. Orthodontic treatment provides excellent results but depends on several factors like patient compliance, maintenance of proper oral hygiene conditions, the likelihood that the patient may require treatment again after growth completion as well as some amount of pain and soft tissue injuries that may make the patient apprehensive regarding getting the treatment done. Removable appliances are mostly uncomfortable to wear and requires a lot of patient compliance for successful treatment outcomes. Correction of midline diastemas has not been reported much during the preadolescent period, and most reports reveal fixed therapy undertaken after growth has ceased. Fixed interceptive orthodontics provides definite advantages over removable appliances and has proven to have achieved

desired favourable outcomes. Two-by-four (2×4) appliance is a simple fixed treatment option which allows three-dimensional tooth movement enabling correction of wide range of malocclusion like diastema, rotated teeth, teeth with incorrect angulations and inclination, as well as cross bites. Besides these, the appliance is also suitable for mixed dentition patients with a reduced number of teeth, where the retention of the removable appliance used can be an obstacle.

However, it is worthy to note few of the downsides of this appliance as well, such as difficulty in the placement of bands on the maxillary first permanent molars during the early mixed dentition stage, as it may not be fully erupted or may have a short clinical crown height. At times, placement of the band can cause discomfort, and some children may refuse further treatment. Furthermore, as the brackets are only bonded to the permanent incisors, there will be a long span of a flexible 0.014" round Ni-Ti archwire extending from the molar bands to the incisors. The swinging wire could pose a problem to the young patients especially during eating and tooth brushing as it can easily come out from the molar tube. Another disadvantage is plaque retention around the bands and brackets because of which maintenance of oral hygiene becomes challenging. However, this could easily be overcome with good oral hygiene care.

CONCLUSION

Effective diastema treatment requires correct diagnosis of its etiology and intervention relevant to the specific etiology. Correct diagnosis includes medical, and dental histories, radiographic and clinical examinations. Timing often is important to achieve satisfactory results. Removal of the etiologic agent along with appropriate orthodontic intervention leads to a satisfactory outcome of the therapy. Within the limitations of this case series it can be concluded that this fixed appliance therapy can be widely utilised and has a tremendous success rate when done with precision and accuracy along with proper diagnosis and planning.

Why this paper is important in pediatric dentists?

1. It gives an insight to treatment of midline diastema cases in different age groups.
2. Tells about when to go for frenectomy while correcting midline diastema.
3. Approximate duration of treatment required to achieve complete correction of the malocclusion.

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