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Research Paper

Early Intervention with Short-Span Fixed Orthodontics for Anterior Esthetic Corrections: Case Reports Involving Modified 2 By 4 Appliance

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ABSTRACT: *A 2 by 4 appliance is a fixed sectional orthodontic appliance that allows for short-span treatment. Generally recommended in early intervention cases, it helps to bring about esthetic corrections in the adolescent age group thereby having a positive impact on their psychological development. This article presents two cases involving esthetic correction using modified 2 by 4 appliance. The results achieved are esthetically favorable, with both patient and parent satisfaction.*

KEYWORDS: *2 by 4 appliance, midline diastema, anterior crowding*

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I. Introduction:

Esthetics and facial beauty are often associated with dental appearance in modern society, especially among the young population. There is a perceived need for orthodontic treatment among adolescents, the common determinant of it being awareness of malocclusion and dissatisfaction with dental appearance[1]. Some of the common malocclusions that necessitate correction from an esthetic point of view include crowding and/or rotations of anterior teeth, spacings, and midline diastema.

The very purpose of early orthodontic intervention is to resolve dentoalveolar irregularities and harmonize the occlusion before the complete eruption of permanent teeth thereby preventing complications in the future. Early treatment also has the added advantage of building the self-esteem of the young patient by improving their esthetic appearance.

2 by 4 appliance is a short-span fixed therapy that comprises bands on permanent 1st molars, bonded brackets on the erupted anterior teeth, and continuous archwire to provide a good arch form as well as to align the anterior teeth[2]. Depending on the technique and the operator's preferences, some accessory components such as nickel-titanium coil springs and power chains between the bands/tubes and brackets can be used. 2 x 4 can also be combined with space management devices, such as rapid palatal expander (RPE), quad-helix, and lingual arch to correct crowding /posterior crossbite[3]. It offers more effective and efficient tooth positioning as it allows three-dimensional control of the involved teeth during correction of anterior crossbites or aligning

ectopic incisors. Rotations, diastemas, and incorrect tooth inclinations and angulations may therefore be treated very quickly using this versatile technique[4].
The current article presents two cases with different malocclusions in the adolescent age group, corrected with short-span fixed orthodontic treatment.

CASE REPORT 1

A 12-year-old female patient reported to the Department of Pediatric & Preventive Dentistry with the chief complaint of irregularly placed upper front teeth that resulted in poor esthetics (Figure 1a). Medical and family history were non-contributory. Extraoral examination showed competent lips, a straight profile, and a bilaterally symmetrical face. On intra-oral examination, the patient had Angle's class 1 molar relation, and the maxillary anteriors were revealed to be malaligned. The upper right central incisor showed distobuccal rotation, upper right lateral incisors were palatally placed and upper right canine was erupting buccally (Figure 1b). Model analysis revealed a space requirement of 3mm in the anterior and 1mm in the posterior region. 2 by 4 appliance combined with rapid maxillary expander was considered, keeping in view the need for space to align the anterior teeth. Treatment modality was thoroughly discussed with the parent and patient including the need for maintenance of proper oral hygiene.

Orthodontic molar bands were fabricated to maxillary 1st molars & 1st premolars bilaterally to which hyrax

Figure 1a &1b. Pre-operative photograph showing malaligned upper anteriors

screw was soldered. The rapid maxillary expansion appliance was cemented and the parent was instructed to activate the screw by a quarter turn every day.
With favorable patient cooperation, the required expansion was achieved in 6 weeks (indicated by spacing between two central incisors) (Figure 2). The Hyrax screw was retained in the arch after fixation with composite resin, to prevent relapse.
Now, brackets were bonded onto the facial surface of incisors and a 0.014" NiTi round archwire was engaged into the bracket slots (2 x 4 appliance) (Figure 3). After the initial movement of teeth, achieved in 1 month(Figure 4), the 0.014" archwire was replaced with 0.016" NiTi archwire. Orthodontic closed elastomeric chains were engaged along with the archwire to correct a shift in the midline.
In 4 months, the incisors had been aligned into the proper position in the arch. Transpalatal arch and lingual bonded retainer were placed for retention (Figure 5). The patient is kept on monthly follow-up.

Figure 2. Maxillary arch following expansion with fixed hyrax screw

Figure 3. Intra-operative photograph of 2x4 appliance

Figure 4. 1 month follow-up

Figure 5. Post-operative photograph of aligned upper arch

CASE REPORT 2

A 16-year-old female patient reported to the Department of Pediatric and Preventive Dentistry with the chief complaint of increased spacing between the upper front teeth. The patient was influenced by the opinion of peers in her school and thereby perceived a need for orthodontic correction to improve her smile.

Clinical examination revealed a thick and high frenal attachment in the maxillary arch with associated midline diastema (Figures 6a and 6b). Both the upper and lower arches showed generalized spacing confined to the anterior region, with posterior teeth in Angle's class 1 molar relation. Extra-orally, the patient had a straight profile, a bilaterally symmetrical face, and competent lips. There was no significant medical or family history, nor any associated habits. An OPG was used to rule out the presence of any impacted mesiodens.

A treatment involving labial frenectomy followed by orthodontic correction was planned and explained to the patient and parent. Blood investigation reports were within normal limits and frenectomy was performed under local anesthesia with informed consent. Healing was uneventful and the patient presented with no post-operative complications.

Orthodontic treatment was initiated by bonding buccal tubes on bilateral mandibular permanent 1^{st} molars. Metal brackets were bonded on the facial surface of mandibular teeth from the right 2^{nd} premolar extending to the left 2^{nd} premolar. NiTi 0.014" and 0.016" round archwires were consecutively engaged into the bracket slots and molar tubes. Required space closure in the lower arch was obtained in 6 weeks.

For space closure in the upper arch, a modified 2 by 4 appliance involving brackets in the canines (2 x 6 appliance) was initiated. Following the bonding of buccal tubes on maxillary 1^{st} molars, metal brackets were bonded onto the labial surface of incisors and canines. A NiTi 0.014" round archwire was engaged into the bracket slots (Figure 7). Closure of midline diastema was observed in less than a month (Figure 8). After this initial closure, 0.016" NiTi round archwire was placed for another 2 months. Required correction was achieved in a total of 6 months duration. Lingual bonded retainer is placed and the patient is under regular follow-up.

Figure 6a & 6b. Pre-operative photographs showing midline diastema due to high frenum

Figure 7. Upper 2 by 6 appliance

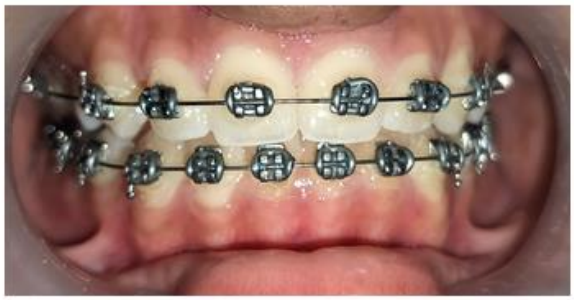

Figure 8. One month review

Figure 9. Post-operative photograph showing corrected midline diastema

II. Discussion:

There has been much debate in the literature recently regarding the ideal timing of orthodontic treatment. Studies have looked at many aspects of orthodontics, including clinical effectiveness and psychological outcomes[4]. Currently, however, great emphasis is given to the early correction of malocclusions to prevent further complications if left untreated. Malocclusions can be detected at any stage of dentition and they do not self-correct, so early treatment is recommended[5].

Though removable appliance is suggested for early treatment, the success of it depends largely on patient compliance both in wearing and adjustment; removable appliances are rarely worn as instructed. Removable appliances might lead to tipping movements due to single-point contact or other unhelpful changes due to incorrect activation. Fixed appliance therapy is gaining popularity in this regard[6],[7].A variety of benefits from early fixed orthodontic treatment has been proposed in the dental literature – including patients' enhanced psychosocial development and self-esteem owing to improved esthetic appearance, better access to oral hygiene, cost-effectiveness, and stability[5].

The concept of using sectional appliances dates back to the 1930s with the introduction of the Twin-wire Arch and today stands at the 2 by 4 appliance. It usually takes anchorage from molars and has brackets bonded into the anterior teeth – the number of anterior teeth bonded varies with each case. Continuous archwires are used to provide/maintain good arch form as well as to control anterior teeth; excess archwires protruding from the molar tube should be turned down against the tube. Ideally, supporting stainless steel tubing should be placed to support the long span of wire between anterior teeth and molars. When a fixed appliance includes only some of the teeth, archwire spans are longer. This gives biomechanical advantages as large movements are easy to create and the wires themselves are springier[7].

A 2x4 appliance can be modified depending on the type of correction required. The appliance combined with a rapid maxillary expansion screw offers efficient and controlled tooth movement allowing both correction of arch form as well as alignment of anterior teeth in an esthetically pleasing manner, in a short span. The major advantages of carrying out this treatment with a 2 by 4 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[6].

A 2 by 6 appliance involving brackets on canines is yet another modification that allows utilization of space distal to canine to close spacing in anterior teeth. A midline diastema is one of the most common reasons for which patients seek orthodontic correction, the common etiology of it being abnormal frenal attachment. Closure of maxillary median diastema is more prominent when it is performed by using combined frenectomy and orthodontic treatment; it increases stability and reduces relapse[8]. The use of 2 x 6 appliance helps to correct the malocclusion in a short period, with minimal patient discomfort. It helps to achieve a better-controlled space closure and alignment and leveling of the upper incisors.

One of the disadvantages of using 2 by 4 appliance is the fabrication of molar bands which might cause discomfort to the patient. Furthermore, retention of the bonded brackets in the anterior teeth requires considerable patient cooperation. The brackets and bands may become the sites for plaque accumulation if proper oral hygiene is not maintained. Nevertheless, with proper case selection and patient management, 2 by 4 appliance can be effectively used in a variety of clinical conditions, with minor design modifications.

III. Conclusion:

Early orthodontic treatment with 2 by 4 appliances can help to achieve necessary esthetic and functional corrections in the arch in a short span. The versatility of 2 by 4 allows it to be used for different types of malocclusions, with slight changes or additions to the original design. Early intervention not only prevents late complications of malocclusion, but it also helps in the psychological development of pediatric patients.

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