The Two by Four Appliance: A Versatile Appliance

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Abstract: The 2x4 appliance 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. Four cases using this appliance are presented. This 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.

Clinical Relevance: The 2x4 appliance is used to correct anterior crossbites and restore anterior aesthetics in the mixed dentition stage.

Active interceptive measures in mixed dentition treatment are usually confined to correction of anterior and posterior crossbites and alignment of ectopic incisors. In this regard the 2x4 appliance (combined with a quad helix for posterior expansion) used in the mixed dentition is an extremely versatile appliance.

This fixed appliance comprises bands on the first permanent molars and bonds on the erupted maxillary permanent incisors. Continuous archwires are used to provide complete control of the anterior dentition as well as a good archform. The deciduous teeth are generally unsuitable for bonding, therefore supporting steel tubing is placed in the long spans between the lateral incisors and first permanent molars. This tubing, if carefully shaped, maintains correct archform and strengthens the long unsupported span of wire, protecting it from occlusal forces and potential distortion during function. This appliance allows rapid correction of many incipient malocclusions in a single short phase of fixed appliance therapy in the early mixed dentition stage.

The concept of using sectional appliances is not new. Johnson introduced the Twin-wire Arch in the 1930s, which comprised incisor and molar bands and small-diameter twin wires sheathed 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 to allow alignment of imbricated incisors and rigid buccal sections to prevent distortion.

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:

- the clinical effectiveness;
- the influences on the outcome of early treatment;
- the orthodontists’ preference; and
- psychological influences.

Many of these studies have tried to evaluate the most appropriate time to start treatment of Class II malocclusions; however, the timing of crossbite correction has also caused much concern. White states that anterior and posterior crossbites require early treatment for functional reasons and anterior crossbites also for aesthetic reasons. Ninou and Stephens conclude that posterior crossbites with functional mandibular displacements require treatment, and recommend that a maxillary fixed appliance is used. They also conclude that early mixed dentition treatment offers advantages in stability but point out that some of these crossbites may resolve spontaneously.

Yang and Kiyak surveyed orthodontists, most of whom were in private practice in the USA, regarding their preferences on treatment timing for crossbites. Approximately 80% stated that they would treat anterior crossbites as well as ectopic development and delayed eruption of the incisors in the early mixed dentition.

Tung and Kiyak also investigated psychological influences on treatment timing. They questioned 75 children (mean age of 10.85 years) and their parents and concluded that younger children are good candidates for early treatment, have high self-esteem and body image and expect orthodontics to improve their lives.

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Shaw et al. investigated the extent to which dental features expose children to nicknaming, teasing and harassment. They found that dental features were the fourth most common target for teasing. However, comments about teeth were considered more hurtful than other features, especially in the 9–10-year-old group, and a short phase of orthodontic treatment in the mixed dentition may prevent this hurtful teasing.

The four cases outlined below illustrate the effectiveness and versatility of the appliance.

CASE 1
An 8-year-old girl was referred by her GDP regarding a retained deciduous central incisor and delayed eruption of the maxillary right central incisor. She presented with a Class I incisor relationship on a skeletal Class I base with an average maxillary mandibular planes angle. She was in the early mixed dentition phase, both the upper and lower arches were well aligned and the overjet and overbite within normal limits. Radiographs revealed a compound odontome preventing the eruption of the permanent maxillary right central incisor (Figure 1).

Surgical removal of the odontome and extraction of the deciduous maxillary right central and lateral incisors were carried out in the hope that this would encourage the eruption of the permanent incisors. At review 1 year later, both maxillary lateral incisors had erupted; however, the right central incisor was unerupted and palpable labially. This tooth was therefore exposed with an apically repositioned flap (Figure 2) and aligned using a 2x4 appliance. Maxillary first permanent molars were banded and the maxillary incisors bonded and a 0.016 nickel titanium archwire with stainless steel tubing supporting the spans placed between the incisors and molars (Figure 3). The archwire sequence was 0.016 nickel titanium, 0.016 stainless steel and 0.018 stainless steel. Unfortunately, 2 weeks before debond the archwire was lost, although, apart from some slight spacing of the incisors, there was no evidence of any relapse of the right central incisor. She was therefore debonded and it was decided not to place a bonded retainer in this case but to monitor the position of this tooth and the developing dentition (Figure 4).

The total time of active treatment was six visits over an 8-month period.

CASE 2
A 10-year-old boy was referred by his GDP who was concerned about excessive toothwear on the upper left central incisor. He presented with a Class III incisor relationship on a mild Class III skeletal base. He was in the mixed dentition stage with mild crowding of the upper labial segment and moderate crowding of the lower labial segment. There was premature contact on the upper and lower central incisors resulting in an anterior mandibular displacement and toothwear of the labial surface of the upper left central incisor (Figure 5).

A 2x4 appliance was placed with...
bands on the first molars and bonds on the incisors and an initial 0.016 nickel titanium aligning archwire (Figure 6). The archwire sequence was 0.016 nickel titanium, 0.018 x 0.025 nickel titanium and 0.019 x 0.025 stainless steel. Active treatment time involved five visits over an 8-month period.

At debond a bonded retainer was placed on the palatal surfaces of the maxillary incisors. At 6-month review this retainer had been lost but the positive overbite had maintained the overjet correction (Figure 7).

CASE 3
A 9-year-old girl was referred with a retained deciduous central incisor. She was in the mixed dentition and had a Class I incisor relationship on a Class I skeletal base, moderate crowding of both upper and lower labial segments and overjet and overbite within normal range. She had a retained deciduous left central incisor and radiographs revealed the presence of two supernumerary teeth lying palatal to the permanent central incisor preventing its eruption (Figure 8).

The supernumerary teeth were removed under general anaesthetic and a gold chain bonded to the labial surface of the maxillary left central incisor. A 2x4 appliance was placed with bands on the first molars and bonds on the erupted incisors. The archwire sequence was 0.016 nickel titanium, 0.018 x 0.025 nickel titanium and 0.019 x 0.025 stainless steel. When in a rectangular nickel titanium archwire, a 0.016 nickel titanium ‘piggy back’ archwire was used to provide traction to the left central incisor and align it (Figure 9). The tooth was aligned in only 10 months (Figure 10) and at debond a bonded retainer (Figure 11) was placed on the palatal surfaces of the maxillary incisors.

CASE 4
A 9-year-old girl was referred by her dentist regarding a unilateral crossbite. She presented with a Class III incisor relationship on a mild skeletal III base. She was in the mixed dentition stage, with moderate crowding of the upper labial segment and mild crowding of the lower labial segment. She had a unilateral crossbite on the right side extending from the right central incisor to the right permanent molar. The upper left lateral incisor was also in crossbite and there was an associated anterior displacement of 2 mm.

A removable quad helix was placed to expand the upper arch and to derotate the mesiopatally rotated maxillary first permanent molars (Figure 12). Brackets were then placed on the upper incisors and a 0.016 nickel titanium aligning archwire placed (Figure 13), followed by 0.018 x 0.025 nickel titanium. On a 0.018 stainless steel base arch a section of pushcoil was placed in the spans between the lateral incisors and first permanent molars to procline the upper labial segment and elastic chain was used to close the anterior spacing.

Correction of the posterior crossbite, alignment of the maxillary incisors and space closure required nine visits over a 13-month period (Figure 14).

DISCUSSION
It has been suggested that the use of removable appliances is an appropriate method of correcting anterior tooth malpositions, teeth behind the bite or narrow maxillary arches.9 The problems with removable appliances are the lack...
of control they have over tooth position and the fact that they can exert only single-point contact on teeth, leading to unsophisticated tipping movements in most cases. In addition, these appliances can be difficult and awkward for the patients to fit and will not be worn if they are either too loose or too tight causing excessive pressures on the teeth. Patients often have a tendency to flick the appliances in and out, which leads to stress fracture of the retaining cibrs or clasps, and the resulting loss of retention will encourage the patients to leave them out.

Ninou and Stephens’ listed the main problems of removable expansion appliances as patient co-operation and retention of the appliance. The success of removable appliances obviously depends upon patient compliance, both for wearing and adjusting the appliance; the treatment will not work if this co-operation is not forthcoming. Removable appliances produce only buccal tipping of the molars during expansion, compared with quad helices, which may produce some buccal translation of the teeth during crossbite correction.

All the above listed problems can be overcome if an alternative to the removable appliances is found. A 2x4 sectional fixed appliance (combined with a quad helix for posterior expansion) 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.

CONCLUSION

The four cases above demonstrate the versatility of the 2x4 appliance in the correction of anterior crossbites and alignment of the incisors. The treatment objectives are achieved with a short course of treatment and alignment is maintained with a bonded retainer. Further treatment may be required in the permanent dentition, but early treatment in these cases will not only quickly restore anterior aesthetics but may also reduce the complexity and duration of any subsequent treatment required.

REFERENCES


ABSTRACT

DOES THAT RESTORATION REALLY NEED REPLACING?


This paper reviews the data of ten surveys from Scandinavia, UK and USA, which together address the reasons for the placement and replacement of 32,777 restorations. It was found that the ratio of new to replacement restorations was 1:24 for amalgam, and 1:38 for composite materials. Not surprisingly, caries has consistently been found to be the principal reason for the placement of the initial restoration, and secondary caries the principal reason for their replacement. However, material failure (marginal degradation, discoloration, bulk fracture and loss of anatomic form) accounted for the replacement of more composite restorations than amalgam.

It is observed that, in spite of modern dental education emphasizing a preventive approach, repair and refurbishment of restorations as opposed to their total replacement is not widely reported. It is also observed that younger and less-experienced dentists tend to replace restorations more frequently. Sadly, there is no evidence presented from the surveys as to whether the secondary caries necessitating replacement was recurrent or residual. The authors suggest that direct educational endeavours should be made to reinforce a preventive approach to restorative dentistry.

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