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Asymmetric Expansion using Quad Helix for the Correction of Unilateral Cross bite- A Case Report

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Abstract

Maxillary transverse deficiency results in a posterior crossbite which can be orthodontically or orthopaedically corrected using expansion appliances. Expansion can be either produced symmetrically such that the arch expands uniformly, or asymmetrically, where one section of the arch expands more than the other. Unilateral crossbites that may or may not be isolated to a single tooth are more challenging to correct than bilateral crossbites. Quad helix is a slow maxillary expansion appliance that has been very effective over the years. This case report shows the use of a quad helix for asymmetric expansion to correct a unilateral crossbite.

Keywords: Quad helix, Crossbite, Unilateral, Asymmetric expansion, Slow expansion.

Background

An inadequate transversal relationship between maxillary and mandibular teeth is identified as any abnormal buccal-lingual relation between opposing molars, premolars or both in centric occlusion. When the buccal cusps of the maxillary teeth are in contact with the central fossae of the mandibular teeth, it is defined as a posterior crossbite. According to some studies, the prevalence of posterior crossbite ranges from 8 to 16 percent. A

posterior crossbite is believed to be transferred from the deciduous to the permanent dentition and can have long-term effects on the growth of jaws. The etiology of this malocclusion could be most commonly due to potentially damaging oral habits or early primary tooth loss. The probability of posterior crossbite correcting itself is very small without any intervention (0-9%). [1,2]

Expanders for treating maxillary transverse deficiency have been used for over a century. There are four expansion treatment modalities that are used, namely rapid maxillary expansion (RME), slow maxillary expansion (SME), surgically assisted rapid palatal expansion (SARPE) and mini-implant assisted rapid palatal expansion (MARPE) with each having their own indications, contraindications, advantages and disadvantages. [2,3]

Slow maxillary expansion appliances basically produce dentoal¬veolar expansion or changes. The rate of expansion produced by the appliance is less when compared to the rapid maxil-lary expansion appliances. They usually provide few hundred grams of force around 2 lb of pressure, with the expansion carried out at the rate of 1 mm/week. Slow expansion appliances can be removable or fixed. [4,5]

The quad helix appliance was introduced by Ricketts and popularised by Bench.6 It is made of 0.038 inch (0.975 mm) stainless steel or elgiloy wire soldered to the molar bands. It incorporates four helices or coils to increase its flexibility. The parts of a quad helix include: (1) posterior helix, (2) palatal bridge, (3) anterior helix, (4) anterior bridge and (5) outer arm The anterior bridge lies in between the two anterior helices in the canine region. The palatal bridges lie on either side between the anterior and posterior helices. The posterior helix should not extend more than 2 mm distal to the permanent first molar and the outer or the buccal arms are soldered to the molar bands. An initial expansion of 8 mm will produce 14 oz of force. Average force is 200–400 g depending upon the amount of expansion or activation.4,5,6 It has a fan-like sweeping action that is attributed to the appliance design, which helps in achieving expansion in the premolar region as well. It also has a distal rotation effect on the molars and can also be used for molar derotation. [6]

Apart from arch expansion, quad helix is modified for other purposes. Bending the anterior bridge down¬ward or adding additional anterior bridge, it can be used for breaking thumb sucking habit. If tongue spikes are sol¬dered to the anterior bridge, it is used for intercepting tongue thrusting habit. Incorporating helices in lateral arms, near the anterior end, can be used for anterior expansion. [4,6]

In this case report, we have used a quad helix that has been activated asymmetrically to correct a unilateral crossbite.

Case Report

A 16-year-old boy reported to the Department of Orthodontics complaining of irregular teeth and desired to get it corrected orthodontically. His history elicited no relevant past medical or dental history and he is in good general health. Extraoral examination showed symmetrical vertical and horizontal facial proportions, mesocephalic facial type, straight facial profile, with competent lips. Intraoral examination showed the presence of 28 teeth except the third molars, with fair oral hygiene. He had U-shaped dental arches with a buccally blocked out upper right canine and mild crowding in the lower anteriors.

The upper midline was shifted to the right by 3mm and the lower midline to the left by 2mm of the facial midline. The molar and canine relationships were class I on both sides with reduced overbite and overjet. He had a unilateral posterior crossbite on the left side affecting 25 and 26. The case was diagnosed with Class 1 malocclusion with crowding in upper and lower anteriors with unilateral posterior crossbite on the left side. (Figure 1) The patient was advised to undergo fixed orthodontic treatment.

Figure 1: Intraoral photographs

The treatment plan was to use MBT .022 bracket prescription using the non-extraction approach as the patient had a pleasing profile with lip competency and an average nasolabial angle. Extraction as a method of space gaining to relieve the crowding would be inappropriate in this case as it would leave a dished-in profile and reduced lip support due to over-retraction of teeth. A quad helix was planned to correct the unilateral posterior crossbite.

In the first visit, oral prophylaxis was done and elastic separators placed to create space for banding the upper molars. In the second visit, the separators were removed and band adaptation was done. Alginate impressions were taken and the bands were transferred to the impression and dental models made. This was used for the laboratory fabrication of the quad helix. Upper and lower dental arches were bonded with stainless steel brackets. The quad helix was fabricated in the laboratory using an 0.038 inch (0.975 mm) stainless steel wire. The standard design of the quad helix was used and soldered to the bands. (Figure 2a,2b) In the third visit, the quad helix was installed into the patient's mouth and archwires placed. (Figure 3) The quad helix was activated extraorally before insertion. The quad helix was activated by opening the left anterior and posterior helices to move the left outer arm laterally which will produce a unilateral expansion effect. An activation of 5mm was done initially. (Figure 2b) Reactivation was done by 2mm every 6 weeks until the correction was achieved. It should be kept in mind that unilateral activation of the appliance will have a distalising effect on the opposite side molar. This turned out favourable in this case to increase the dental arch length to correct the crowding and correct the midline.

Figure 2a: Quad helix design

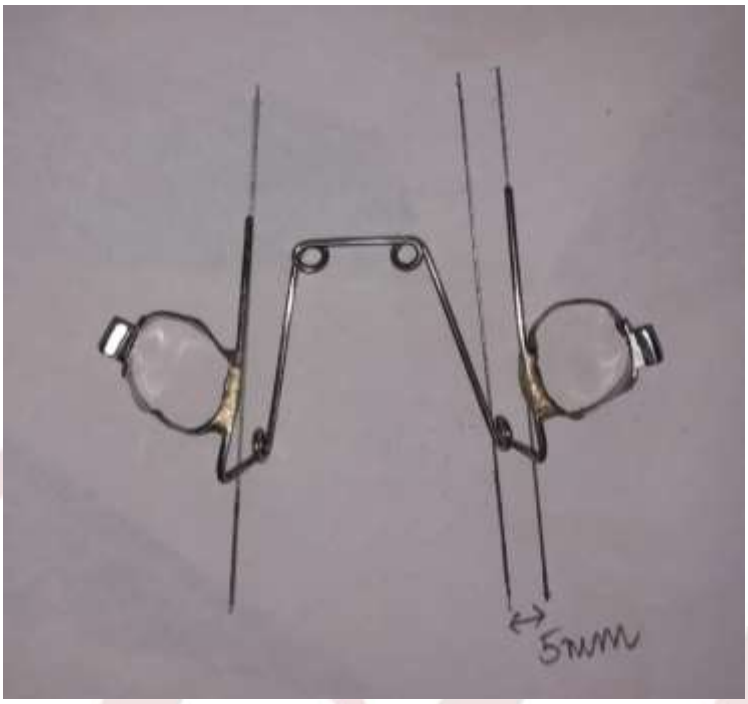

Figure 2b: Quad helix activated

Figure 3: Quad helix appliance installed and fixed orthodontic treatment started.

Figure 4a: Before and after posterior crossbite correction

Figure 4b: Before and after use of quad helix for unilateral expansion.

7 months into treatment, the unilateral posterior crossbite was corrected and the appliance was left to remain in place passively for another 3 months as a supportive phase. After quad helix expansion, 25 and 26 were corrected from the crossbite condition and the upper midline was also corrected. The before and after expansion photographs are presented in figures 4a and 4b.

Discussion

Quad-helix is one of the slow maxillary expansion (SME) appliances that gives a more continuous action of force at low levels. Frank7 (1982) states that the movements produced in quad-helix treatment are predominantly orthodontic with 6:1 ratio with skeletal movement. The advantages of quad-helix are good retention, wide working range, differential expansion, breaking oral habit, molar rotation effect, less patient compliance, and durable. Expansion is smooth and controlled and in young children, skeletal expansion can be achieved. It provides excellent expansion in cleft palate patients. One major disadvantage of this appliance is buccal tipping of molars during excessive activation. This can be prevented by torquing the roots buccally.

Unilateral posterior crossbite treatment using quad-helix in this case produced satisfactory progress. This appliance was tolerated well by the patient although ulceration of palatal mucosa due to left posterior helix occurred, but treated successfully.

This is one of the disadvantages of quad-helix, i.e. irritating soft tissues. Quad-helix wasn't damaged, didn't cause difficulty talking, oral health issue or masticatory difficulty. Some authors in the past have also reported the successful use of a quad helix appliance for unilateral posterior crossbite correction. [8,9,10]

In this case, the quad helix proved to be a very efficient appliance to correct the unilateral posterior crossbite, which was less cost-effective, and well-tolerated by the patient.

Conclusion

Quad-helix can be used for correction of unilateral posterior crossbite by asymmetric expansion. However, an appropriate diagnosis, problem list and integrated treatment plan should first be developed.

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