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Case Report

Utilising Rapid Maxillary Expansion (RME) to Correct Bilateral Posterior Crossbites and Crowding

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Abstract

Maxillary hypoplasia can result in crowding of the maxilla and posterior crossbites, which is a common occurrence. Careful treatment planning is required for comprehensive correction but if utilised well can be successful and stable. RME is a treatment method with the aim of achieving skeletal transverse expansion in patients with posterior crossbites. This case report demonstrates a classic example when RME is useful and discusses essential criteria factors to consider this treatment choice.

Keywords: *Crossbite, expansion, Rapid maxillary expansion (RME), Orthodontics*

Introduction

Posterior crossbites are a common type of malocclusion seen by both specialist orthodontists and general dental practitioners. The aetiological cause is often due to maxillary hypoplasia, particularly those patients with a class III skeletal discrepancy. Careful management of transverse discrepancy is important when treatment planning in orthodontics. If done successfully, both relief of crowding and crossbite correction can occur at the same time due to transverse expansion.

Currently there is limited evidence on the best method to treat posterior crossbites. The most recent Cochrane review published in 2021 concluded that the quad helix is more effective at treating posterior crossbites than removable plates (1). However, both these appliances use slow maxillary expansion (SME) which is mainly dental movement; RME uses heavy forces delivered to the maxilla via the appliance. The high level of forces exceeds the limit needed for orthodontic tooth movement and sutural resistance, separating the palate at the mid palatal suture. The separated suture then forms newly developed bone in time.

The first recorded use of RME was in 1860, published by American Dentist Emerson C Angell (1822-1903) (2). Despite Angell being largely ignored by the profession and disbelieved, he later become known as the founding father of RME. RME is now used in orthodontics since being reintroduced by Andrew J.Haas who used his own ‘Haas’ expander in 1956 (3). This case report demonstrates the uses of RME and a standard protocol for dentists to consider in their practice.

Case Report

A 14-year-old Caucasian, medically fit and well patient was referred by her specialist orthodontist to secondary care following concerns of her underlying class III skeletal discrepancy. The patient presented with a class III incisal relationship on a mild skeletal III base with average vertical proportions. Her malocclusion was complicated by moderate crowding, bilateral posterior buccal crossbites without displacement on contact, a reduce overjet and overbite and a narrow maxilla arch form. We concluded her IOTN was a 4d (Figure 1). The patient's concerns were the crowding in the upper arch, and she was anxious regarding extractions.

Figure 1. Frontal, buccal and upper occlusal intra oral views. The patient has bilateral posterior crossbites, alongside moderate crowding with palatal displacement of the UL2.

The patient and her parents understood that she may have unfavourable mandibular growth in the future, which might make her beyond the treatment of orthodontics alone. However, interceptive treatment was agreed to relieve crowding in her upper arch and to correct her bilateral posterior buccal crossbites, whilst we monitored her growth.

Dental radiographs were taken which included a dental panoramic tomogram, lateral cephalogram and an upper standard occlusal radiograph (Figure 2). The dental panoramic tomogram confirmed no other pathologies or impacted teeth, whilst the lateral cephalogram confirmed dental compensation of her incisors and a skeletal III base which correlated with my clinical examination. The upper standard occlusal confirmed visibility of an unfused maxillary mid palatal suture, and the root health of the upper maxillary incisors.

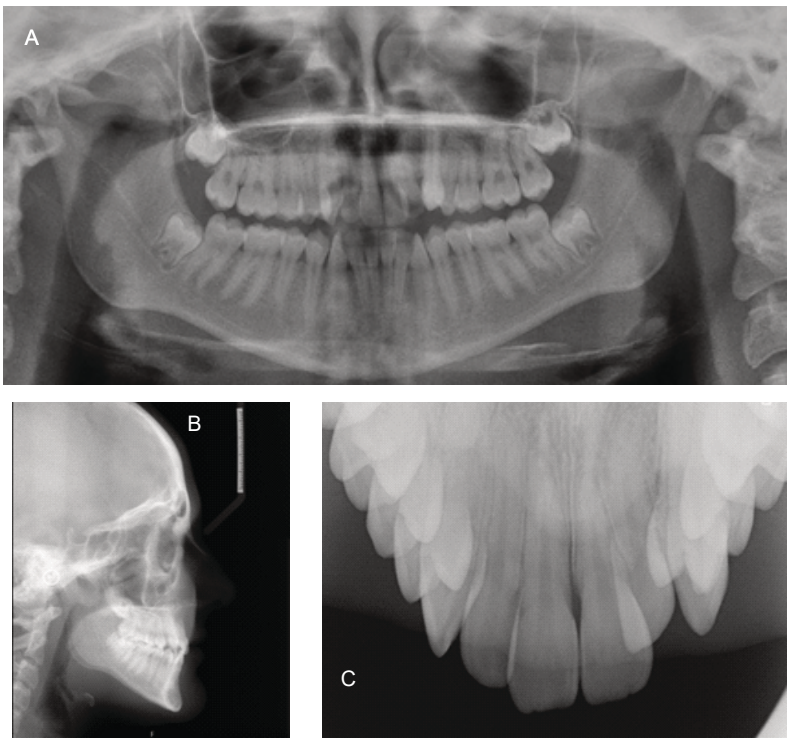

Figure 2.

(a) Panoramic dental tomogram. Confirming no hidden pathologies and the natural development of the patient's dentition

(b) Lateral cephalogram radiograph. Showing dental compensation and a mild skeletal III base.

(c) Upper standard occlusal radiograph. Showing the maxillary mid palatal suture presence and no abnormal features of the maxillary incisor's roots.

To achieve skeletal change in the transverse dimension a RME hyrax screw was constructed in a lab, 3D printed using an intraoral scan of the patient's dentition. The RME was designed to have bands on the upper first molars and have palatal connector bar on the palatal surfaces of the premolars. The RME was fitted using glass ionomer cement (Figure 3). The patient was advised to turn the screw twice a day, which gave 0.25mm expansion per turn (0.50mm expansion per day) until opening of the midline suture and posterior overexpansion occurred. The patient was reviewed once a week, for three weeks until overexpansion was achieved. An upper standard occlusal was then taken to check the maxillary mid palatal suture (Figure 4). Flowable composite was placed in the screw to prevent further expansion. The patient still had the passive RME insitu for 3 months to act as a retainer for relapse (figure 4). The patient was also reassured that the large midline diastema would start to close naturally due to relapse.

Figure 3. Occlusal photograph showing the cemented RME insitu.

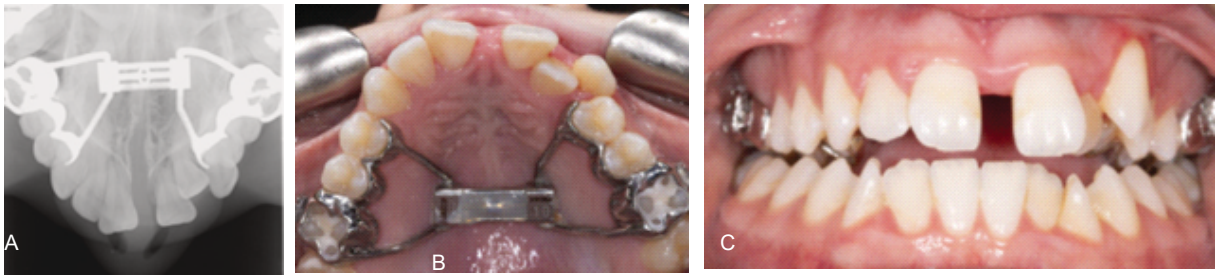

Figure 4.
(a) Upper standard occlusal radiograph. Showing patency of the maxillary mid palatal caused by the RME.
(b) Intraoral occlusal photograph with RME insitu. Flowable composite is in the screw and the anterior space created is visible.
(c) Intraoral frontal photograph. Demonstrating the midline diastema created by RME.

At the 3-month review appointment, it is apparent the patients posterior crossbites have remained corrected and there is improvement in the original archform (Figure 5). The spacing requirements had decreased due to the transverse expansion, which now allowed upper arch alignment without extractions. The patient was fitted with fixed orthodontic appliances, a preadjusted edgewise appliance with a bracket slot of 0.22 x 0.28" was used. The UL2 was not included in the original bond up due to maintain the archform and due to space requirements. The original archwire used was an 0.14" NiTi archwire and the patient was reviewed every 6 weeks. The patients RME was also removed and replaced with a Transpalatal arch (TPA) for comfort whilst maintaining anchorage. The following archwire sequence included moving to 0.18" NiTi archwire, then following an 0.18" SS archwire. Once the patient was in a rigid stainless steel archwire, pushcoil was placed in the span of the archwire were the UL2 was displaced to create more space whilst a palatal button was place on the UL2. Elastic powerchain was placed on the palatal button and the brackets on the adjacent teeth. Metal ligatures were placed on these adjacent teeth to increase friction, to prevent unwanted rotations (Figure 6).

Figure 5. Frontal and occlusal intra oral photographs. Demonstrating closure of the midline diastema 3 months after passive retention of the RME due to relapse. The bilateral posterior crossbites have also been corrected.

Figure 6. Frontal and occlusal intra oral photographs. Showing the patient with fixed orthodontic appliance and a TPA whilst using the 'slingshot' method to align the UL2.

Discussion

This case demonstrates the use of RME to correct bilateral posterior crossbites and crowding in the upper arch. The patient will be reviewed and once the UL2 is closer aligned within the arch a buccal bracket will be placed on the tooth and any required bracket repositioning's will occur. The archwire sequence will include working down to a 0.14" NiTi to a 0.18"NiTi to fully align the maxillary dentition. Torque expression will then be achieved by moving to rectangular NiTi archwires before finishing in a working archwire,19x25 SS. The reason for torque expression is to increase the patient's overjet to resist her underlying class III skeletal base as she continues to grow and to improve stability. Fixed retainers will be provided from the upper 2-2 as well as removable retainers for indefinite retention.

There are multiple designs of RME however, the majority are fitted with a jackscrew such as in this case. 0.5mm daily expansion, generates between 2-10kg of force (4). Force delivery is high, exceeding the limit required for tooth movement allowing opening of the mid palatal suture as shown in this case. A midline diastema is created with relatively minimal tooth movement (4). An increase in maxillary arch width up to 10 mm has been reported with RME with active daily expansion of 0.3 -0.5mm being complete within 4 weeks.

Care should be taken on determining the immaturity of the midline suture and patient selection. Optimum age of expansion is relative to ossification at the mid-palatal suture, with studies concluding optimum age was prior 15 years old with minimal relapse (5). There has been however, evidence of palatal ossification occurring as late as 35 years old (6). CBCT may offer an opportunity for precise planning between a non-surgical or surgical intervention, although radiation dosage is an important consideration. The risks of attempting RME in a skeletally mature patient have been reported however there is as an increase in the tendency for periodontal attachment loss, unequal expansion, resorption and increased relapse (7).

Conclusion

RME should be considered in adolescence who have bilateral posterior crossbites, especially in patients who have crowding in the maxilla due to maxillary hypoplasia. Correcting of posterior crossbites and relieving of crowding can be beneficial to patients even on an interceptive level. Correct protocols do need to be followed to ensure expansion is achieved safely, including, documentation of correct radiographs (especially upper standard occlusal radiographs) and prolonged retention regime once overexpansion has been achieved.

Conflict of Interest

The author declare no conflict of interest.

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