Spontaneous correction of anterior crossbite by RPE anchored on deciduous teeth in the early mixed dentition

Abstract

Aim The purpose of this study was to evaluate the effectiveness of Haas RPE anchored on deciduous teeth in the early mixed dentition, for inducing the spontaneous correction of permanent incisor's crossbite, without compliance, without post bite-plane and no involvement of the permanent teeth.

Materials and methods The sample group comprised 50 consecutive patients (mean age 8y 5m, SD 2y 1m), 31 males, 19 females. They showed a cross-bite affecting one or more permanent incisors, for a total of 70 teeth. The patients were treated with Haas RPE appliance anchored on second deciduous molars and bonded on deciduous canines. No direct forces were applied on the permanent teeth.

Results Anterior crossbite self-corrected 'spontaneously' in 84% of the cases. Lateral incisors had a higher rate of self-correction than central incisors. All hyper-divergent subjects showed a spontaneous crossbite self-correction.

Conclusion The early maxillary expansion by Haas RPE anchored on deciduous teeth is an efficient and effective procedure to induce the anterior crossbite self-correction in the early mixed dentition without the need of a bite-plane, no involvement of the permanent teeth and without compliance.

Keywords Anchorage on deciduous teeth; Anterior crossbite; Early treatment; Mixed dentition; Rapid Palatal Expansion (RPE).

Introduction

Anterior crossbite is commonly noticed in the early mixed dentition and refers to a condition where, in centric occlusion, one or more upper incisors are palatally positioned in relationship to the mandibular teeth [Graber, 1988]. The prevalence reported in the literature ranges from 2.2% to 11.9%, depending on the age of the children observed [Major and Glover, 1992; O’Brien, 1993; Karaiskos et al., 2005; Lux et al., 2009].

Causes of anterior crossbite can be multiple and related to many factors: anterior crowding, lingual eruption path of upper incisors, sequelae of traumatic injuries on the deciduous incisors, dental anomalies (such as supernumerary, cysts or odontomas), inadequate arch form and length, over-retained or decayed deciduous teeth or bad habits such as biting the upper lip. The anterior crossbite is often also associated with other malocclusions such as crowding, posterior crossbite, rotations, mandibular shifts and asymmetries and Class III malocclusion.

It is a commonly held opinion, that anterior crossbite should be corrected as soon as possible. Furthermore many clinical reports concluded that early treatment appears to be most effective, especially when the crossbite is associated to occlusal trauma due to CO/CR discrepancy [Popovich and Thompson, 1973; Kocadereli, 1998]. The main goal of early treatment is to prevent dentoalveolar compensation, enamel abrasion or crown fracture, periodontal breakdown (mostly gingival recession on proclined lower incisors), teeth mobility and TMJ disorders [Jones and O’Neill, 1996; Rubio et al., 2002]. Furthermore, this situation also involves unfavourable aesthetics, which usually is the parents’ main concern [Lee, 1978].

Many different treatment options such as fixed and/or removable appliances, which act directly on the malpositioned teeth, have been used and suggested by several authors. Borrie and Bearn, in 2011, published the results of a systematic literature review and “…highlighted the lack of high quality evidence for the management of anterior cross-bites in children. Although the level of evidence is low, there is similarity in the length of time it took to successfully treat anterior cross-bites using similar treatment modalities...”.

We believe that early treatment should involve simple and non-invasive procedures, minimal chair-side time and it should be predictably successful (i.e. it should not require any compliance).

With this in mind the aim of this study was to evaluate the effectiveness of HAAS Rapid Palatal Expansion (RPE) anchored on deciduous teeth in the early mixed dentition, for inducing the spontaneous correction of permanent incisor’s crossbite with no involvement of the permanent teeth and without relying on the patient’s compliance.
Subjects and methods

This study was a retrospective clinical investigation. The sample group consisted of 50 children (31 males and 19 females) consecutively treated by the same clinician (MR). The mean age of the sample was 8y 5m (SD 2y 1m).

All patients showed crowding in the upper arch associated with the crossbite of one or more permanent incisors. There was a total of 70 teeth, divided into 10 upper right lateral incisors, 19 upper right central incisors, 28 upper left central incisors and 13 upper left lateral incisors. Twenty out of the 50 patients (40%) also showed a posterior crossbite.

Crowding of upper permanent incisors was evaluated on casts with space analysis from the upper right to the upper left first molars, from mesial to mesial. All patients were then classified into severely crowded (lack of space >8 mm), mildly crowded (lack of space 4-8 mm) and slightly crowded (lack of space <4 mm). The sample was split into 6 severely crowded, 30 mildly crowded and 14 slightly crowded subjects.

The vertical pattern of growth of the subjects was evaluated tracing lateral cephalograms using GoGn:SN (mean normal value $30^\circ \pm 2^\circ$). The study group was divided into 20 hypo-divergent, 17 normal and 13 hyper-divergent subjects.

The patients were all treated with the same appliance using the same clinical procedure: a Haas RPE appliance was anchored with second deciduous molars bands and bonded onto the deciduous canines using acrylic resin [Rosa and Cozzani, 1995]. Regarding the type of appliances, 47 were manufactured using Leone screw 11mm ref. AO620 (Leone SpA, Sesto Fiorentino, Italy) and 3 using Forestadent screw 10 mm ref. A167-1326 (Forestadent Gmbh, Pforzheim, Germany).

All appliances were manufactured by the same dental lab (Orthocheck / Trento / Italy).

In the patients with posterior crossbite, all appliances were activated twice a day during the first 2 weeks, then once a day; in the patients with no posterior crossbite the screw was activated once a day during the first 3 weeks, and then every other day. Expansion was carried out until posterior crossbite on permanent molars selfcorrected and adequate space for upper incisors eruption and alignment was achieved. The mean activation was 9.8 mm in the posterior crossbite cases and 8.2 mm in the non-posterior crossbite cases. Patients were monitored every week by the clinician during the active expansion phase.

Transverse overcorrection was obtained in the maxillary arch on deciduous molars (a scissor bite in some cases), but not on the untouched permanent molars, whose transverse relationship was within a normal range, at the end of active phase.

The posterior crossbite (permanent molars) self-corrected in all patients during the active phase.

No direct forces were applied on the permanent teeth: first molars or incisors. No posterior bite plane was used in any patient.

A descriptive statistical analysis was conducted.

**FIG. 1, 2, 3** Anterior crossbite on both permanent lateral incisors self-corrected during RPE anchored on deciduous canine and second deciduous molars in the early mixed dentition. At the end of the transition, before the second phase of treatment, the crossbite self-correction is stable without any retention strategy.

**FIGG. 4-6** Before treatment the anterior crossbite is established on fully erupted permanent lateral incisors. Crowding is also evident on maxillary permanent incisors with no posterior crossbite.
Results

The results of dental crossbite correction are shown in Table 1 and 2.

As shown in Table 1, the anterior crossbite self-corrected in 84% of the cases: 42 patients (31 males, 19 females) out of 50.

Looking at the different teeth, the correct position was obtained in 84%. For 11 teeth that did not self-correct, other devices were used in order to correct the crossbite. In 4 cases the clinician used Class I elastics, 2 crossbites were solved using resin bite-block bonded on deciduous molars and 5 with fixed appliances (brackets bonded onto the incisors in crossbite using, the RPE bonded on deciduous canines and molars as anchorage).

The crossbite self-correction was achieved within the first 6 weeks of treatment in all cases.

As reported in Table 1, both, right and left lateral incisors, showed a higher rate of self-correction when compared to central incisors. Only 2 lateral incisors remained in crossbite at the end of RPE activation.

All hyper-divergent patients had a spontaneous resolution of the anterior crossbite, whereas the lowest success rate was observed in the hypo-divergent group.

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**Table 1** Distribution of success and failure rates for different type of upper incisors.
Discussion

All the patients of the sample were treated with RPE in order to correct the crowding and/or the posterior crossbite. The RPE-Haas appliance was anchored only on the deciduous teeth (bands on deciduous second molars and bonded with resin on the palatal surface of the deciduous canines) without involving the permanent molars and permanent incisors. The main reasons for anchoring the RPE on deciduous teeth [Rosa, 2011; Rosa and Cozzani, 2003] are:

› prevention of any damage and/or unwanted side-effects to permanent teeth: enamel demineralisation, periodontal attachment loss, external root resorption;
› untouched permanent molars move spontaneously not only during the active expansion, but also in the following months and adjust spontaneously within stable occlusion;
› spontaneous correction of the posterior crossbite on untouched permanent molars with no dentoalveolar compensation (i.e. buccal tip);
› no need of permanent molars anchorage: deciduous teeth can effectively support the load of the RPE.

It has been stated in the literature that the posterior crossbite on untouched permanent molars self-corrected in all cases [Cozzani et al., 1999; Cozzani et al., 2003], and this was also observed in our sample.

We also agree that anterior crossbite is an indication for early treatment. Most of the appliances proposed in the literature to solve anterior crossbite, require patient’s cooperation in wearing appliances, mechanics which acts directly on the incisors and sometimes time-consuming chairside treatment. RPE anchored on deciduous teeth in the mixed dentition is a procedure that is easy to manage with short visits and does not require any compliance. Furthermore it allows increasing the perimeter of upper arch and inducing the self-improvement of the crowding and permanent incisors’ rotation [Rosa, 2003 a; Cozzani et al., 2003; Rosa, 2003 b].

The mean time for anterior crossbite correction was 5 weeks (SD 2w 4d), according with those reported in literature. When correction did not occur in the first 3-6 weeks of treatment, direct forces were applied on incisors, having as an anchorage the RPE bonded on the deciduous teeth. Indeed, as shown by Borrie and Bearn [2011], cemented appliances had a tendency to work within 3-4 weeks and fixed appliances correcting the crossbite within 6 weeks to 3 months.

The anterior crossbite corrected in 84% of the consecutively treated patients without raising the bite by mean of bite planes or bonded devices. Actually, during the active expansion, posterior occlusion changed from a cusp-fossa relationship to a cusp-to-cusp relationship. As a consequence the vertical dimension increases, the bite opens and a slight relocation of the condyles could occur, which is the occlusal condition required for the anterior crossbite’s ‘spontaneous’ correction. In the months following the active expansion, permanent molars will adjusts to a correct occlusion (sometimes after selective grinding of the deciduous molars) and the vertical dimension returns to the pre-treatment values. This also helps the stabilisation of the anterior crossbite self-correction.

No retention appliance or strategy was required after active treatment. None of the self-corrected incisors and permanent molars relapsed.

Also the higher amount of self-correction (100%) in all hyper-divergent cases could be explained (and expected) for the same reason. Furthermore, in this type of subjects, the occlusal and muscle forces could be lower than in the hypodivergent patients, promoting a more rapid and easier movement of the teeth.

Lastly we want to underline that also a spontaneous (total or partial) de-rotation of the permanent crossbite and crowded incisors was observed in all rotated incisors. The early spontaneous de-rotation is stable with no need of retention or circumferential supracrestal fiberotomy. This point is for crucial interest in the smiling area and could represent itself an indication for early maxillary expansion [Rosa, 2003 a; Cozzani et al., 2003; Rosa, 2003 b].

Conclusion

According to our data, in the large majority of cases...
Rosa M. et al.

(84%), RPE anchored on deciduous teeth in the early mixed dentition is, in itself, an effective procedure to induce crossbite spontaneous correction of permanent incisors (87,15% of central incisors and 97,15% of lateral incisors), when it is associated to crowding and/or posterior crossbite.

The main advantage is:

› predictability (no compliance required);
› prevention (spontaneous correction without involving the permanent teeth);
› effectiveness (no dentoalveolar compensation and the achievement of a spontaneously established, stable occlusion);
› efficiency (little chairside time and high cost-benefit ratio);
› long-term stability.

Further prospective investigations are needed to confirm our findings and clarify other clinical points: effectiveness in spontaneous de-rotation of crowded incisors, stability of early de-rotation, regarding the best treatment timing and the relationship between dental crowding and success.

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References