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Bilateral cross-bite treated by repeated rapid maxillary expansions: a 17-year follow-up case

ABSTRACT

Background *The objective of this paper is to show the clinical results after the repeated application of a Haas expander for rapid maxillary expansion (RME) anchored onto deciduous teeth in a 7-year-old patient that presented bilateral cross-bite, superior crowding and no space for permanent lateral incisors eruption.*
Case report *A first Haas expander was applied to the patient. She was told to activate it once a day, each activation was equal to 0.20 mm. After the first RME, the bilateral cross-bite was solved but still there was not enough space for lateral incisor eruption. A second and then a third Haas expander were applied, with the same activation protocol as the first one, in order to gain space in the anterior region and to achieve proper eruption of the lateral incisors. The patient was then treated with fixed appliances. At debonding the patient presented well aligned arch-forms: space for lateral incisor eruption was gained and superior crowding was solved. Bilateral cross-bite was also corrected. She was seen again 10 years and 17 years after expansions: she showed no relapse and presented a good functional occlusion that had remained stable, and an aesthetically pleasant smile, however she exhibited gingival recessions.*
Conclusion *Repeated rapid maxillary expansion, anchored onto deciduous teeth, performed in early mixed dentition represents a safe and successful treatment to correct severe bilateral cross-bites and to create space for maxillary incisor eruption.*

Keywords *Deciduous teeth used as anchorage; Incisor spontaneous alignment; Long-term stability; Repeated Rapid Maxillary Expansion; Permanent molar spontaneous movement.*

Introduction

Posterior cross bites develop between 19 months and 5 years of age and are often associated with a narrow maxilla [Leighton, 1966]. A suitable and effective procedure to treat arch size discrepancies, such as a narrow maxilla, is widening the mid-palatal suture by rapid maxillary expansion (RME) [Kutin and Hawes, 1969; Schiffman and Tuncay, 2001; Giuca et al., 2009].

RME appliances, which among the other devices designed to increase the transverse dimension of the maxilla are the most efficient [Haas, 1965], are usually anchored to the first premolars and permanent molars [Haas, 1970], but studies have shown that expansion can cause undesirable effects such as a buccal tipping of these teeth [Haas, 1970; Silva Filho et al., 1995] that partially relapses during the post-retention phase. It also may cause exostosis, pulp stones, root resorption [Timms and Moss, 1971; Vardimon et al., 1991], and periodontal damage such as gingival recession of the anchoring teeth [Vanarsdall, 1994]. These undesirable effects can be prevented by treating the patient in mixed dentition, anchoring the RME appliance to the primary second molars and canines (as these teeth will be replaced): by doing so, permanent molars are not subjected to a direct force [Cozzani et al., 2003]. It is also advisable to apply such forces in mixed dentition because in young patients palatal sutures are not as interdigitate as in adults [Melsen, 1975].

Other authors provided studies with a long follow-up and showed that maxillary arch constriction can be treated from five years of age onwards with the Haas expander when such constrictions lead to crossbites [Silva Filho et al., 2000]: primary teeth in fact can be used as anchor teeth [Cozzani et al., 2007]. Prior studies have shown that trans-septal fibers are not determined by the tooth anatomy itself, but by the tooth position and its orientation in the dental arch during trans-septal fiber development, which happens after teeth eruption [Kusters et al., 1991]. Also these fibers have more difficulties in adapting to derotations once they have developed [Edwards, 1988]. This is one of the reasons why it may be advisable to expand before eruption of permanent lateral incisors [Mutinelli et al., 2008], because, by doing so, trans-septal fibers would develop after lateral incisors have erupted in a correct position, reducing relapse. Furthermore RME is more effective in the incisor region than in the posterior region [Timms, 1983; Silva Filho et al., 1995] 1995], reason why RME could be indicated also in non crossbite patients in cases of anterior crowding.

The aim of this case report is to show the clinical results after the repeated application of a Haas expander for

FIG. 1 Initial: intraoral right, frontal, left and maxillary arch occlusal views.

RME in a 7 year old patient.

Case report

A 7-year-old patient came to our attention for a check up visit. The intraoral exam showed a bilateral crossbite extending on the right from the first permanent molar to the primary canine and on the left from the first permanent molar to the first primary molar, together with a narrow maxilla, and a deep palatal vault. It was also present superior crowding and lack of space for a correct lateral incisor eruption. Inferior teeth were inclined lingually, and there was inferior crowding. The patient also showed a dental right Class II subdivision relationship (Fig. 1 A, B, C, D). The patient was in early mixed dentition: permanent upper central incisors were erupting while upper lateral incisors were exfoliating; for this reason it was not possible to determine overjet and overbite.

Treatment plan

Treatment goals were the following.

- Solving superior and inferior crowding, aligning the arches and achieving Class I canine and molar relationship, with a mutually protected occlusion.
- Solving the posterior bilateral cross-bite.
- Gaining space for lateral incisor eruption.

Posterior crossbite, maxillary arch constriction and skeletal discrepancy between the mandible and the maxilla were the major concern in this case: the maxilla was so constricted that at the beginning of treatment there was no space for lateral incisors to erupt (Fig. 1D).

Treatment progress

A first Haas-type RME appliance modified to be anchored on the primary second molars and canines was applied to the patient (Fig. 2A). She was told to activate the appliance once a day, each activation was equal to 0.20 mm. the appliance was blocked after 30 days (32 total activations) and was left as a retainer (Fig. 2B). After this first expansion: posterior crossbite was solved, but not enough space for eruption of lateral incisors was gained; dental Class I was achieved, probably, because the right dental Class II was caused by a mandibular shift.

After three months the first Haas-type RME appliance was removed and on the same day the patient was applied a second Haas-type RME appliance with the same activation protocol (Fig. 2C, 3A). This appliance was blocked 29 days and 31 activations later and left as a retainer for 8 months (Fig. 3B, 3C). After this expansion, still there was not enough space for lateral incisors to erupt properly, so after 4 months without any RME appliance, the patient was applied a 3rd Haas-type RME appliance, with the same activation protocol as the other ones, to continue the early treatment (Fig. 4A). A lingual arch was also applied to preserve leeway space and to improve inferior crowding. This last RME appliance was blocked after 32 days and 32 activations and kept for 8 months (Fig. 4B); after removal no retention was given to the patient. Being the early

FIG. 2 A Maxillary arch occlusal view: Haas-type RME appliance modified to be anchored on the primary second molars and canines.
FIG. 2 B The first appliance blocked after 30 days (32 total activations) and left in place as a retainer.
FIG. 2 C The first Haas-type RME appliance before removal.

FIG. 3 The patient was applied a second Haas-type RME appliance (A) that was blocked 29 days and 31 activations later (B) and left as a retainer for 8 months (C).

FIG. 4 A-B The third Haas-type RME was applied (A) and blocked after 32 days and 32 activations and kept for 8 months as retainer (B).
FIG. 4 C-F Intraoral right, frontal, left and maxillary arch occlusal views at the end of comprehensive orthodontic treatment (end of phase II).

treatment over, the patient was then visited regularly until complete permanent dentition. She was then treated with fixed appliances for leveling and aligning.

Treatment results

At debonding, superior and inferior crowding were corrected and symmetric and well-aligned arch-forms were achieved along with a centered midline. Class I canine and molar relationship was also achieved together with an ideal overjet and overbite and a mutually protected occlusion (Fig. 4 C-F). The bilateral crossbite and the maxillary transverse deficiency were also corrected and space for lateral incisor eruption was gained. There was no sign of any undesired effect that we could be aware of: no root resorption, no periodontal damage, and no buccal tipping on permanent teeth. The patient was seen six years later (10 years after expansion): her occlusions had remained stable, a cuspid-rise and a dental Class I relationship on the right and on the left side were maintained (Fig. 5). Again the patient was seen 12 years post-treatment (17 years post-expansion).

FIG. 5 Intraoral right, frontal, left and maxillary arch occlusal views 10 years after rapid maxillary expansion.

There were no signs of relapse, but gingival recession on teeth 13, 14, 23, 24, 33, 34, 35, 36, 44, 45 (Fig. 6).

Discussion and conclusion

When the maxilla is narrow as in this patient, often space for eruption of lateral incisors in not available. Furthermore when expanding, the maxilla splits in a

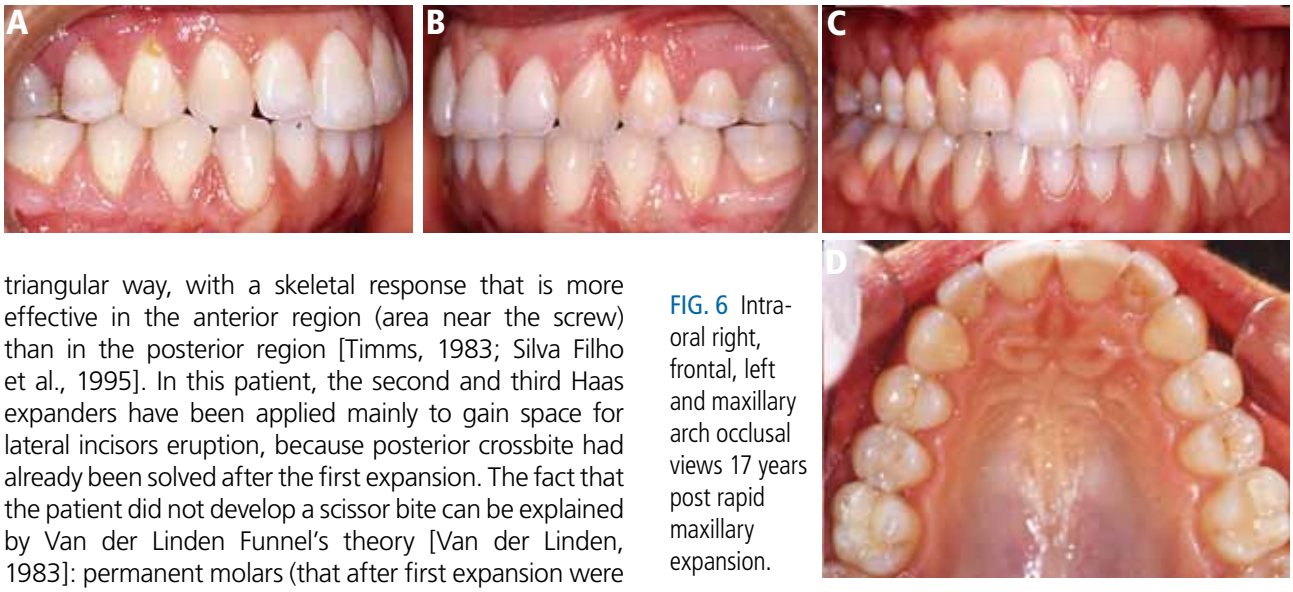

FIG. 6 Intra-oral right, frontal, left and maxillary arch occlusal views 17 years post rapid maxillary expansion.

triangular way, with a skeletal response that is more effective in the anterior region (area near the screw) than in the posterior region [Timms, 1983; Silva Filho et al., 1995]. In this patient, the second and third Haas expanders have been applied mainly to gain space for lateral incisors eruption, because posterior crossbite had already been solved after the first expansion. The fact that the patient did not develop a scissor bite can be explained by Van der Linden Funnel's theory [Van der Linden, 1983]: permanent molars (that after first expansion were in non crossbite relation) after the second and the third expansion were over-expanded, but each time during the retention period they re-established a correct and more stable cusp-fossa relationship [Cozzani et al., 2003].

One could say that, with growth, the patient would have gained space for lateral incisor eruption; on the contrary, other studies reported that Haas appliance is effective in expanding intercanine width, and when a group of patient treated was compared with an untreated sample the treated group exhibited a better incisor alignment [Cozzani et al., 2003]. When our patient was seen 17 years after expansion she had well aligned teeth, regular arch forms, no relapse of the posterior crossbite, a good overjet and overbite. She had achieved a good functional occlusion and an aesthetically pleasing smile. When comparing the images of the maxilla before and after treatment, it can be seen how much the structure of palate has changed in dimension and shape. Gingival recessions on teeth 13, 14, 23, 24, 33, 34, 35, 36, 44, 45 were present at the long-term check-up: we cannot say for sure if these recessions have been caused by the expansion, or by something else. However, what we noticed is that 10 years after expansion, she did not have any recessions. We would need more studies to see if undesired effects from RME can appear even after this long. Also, these recessions are both on the upper and on the lower jaw, so since some authors have shown how nonsurgical RME is a clinically successful and safe method even in adults [Chester et al., 2000] it seems more likely to us that these have been caused by wrong brushing habits. Studies show that incisor rotational relapse can be minimized if treatment with RME appliances is performed prior to eruption of the permanent maxillary lateral incisors [Mutinelli et al., 2008] due to the memory of the transseptal fibers [Edwards, 1988]. When the first expansion was carried out, upper deciduous lateral incisors were exfoliating and even after 17 years there was no relapse.

The outcome of this case report shows that a repeated rapid maxillary expansion, anchored onto deciduous teeth, performed in early mixed dentition could be a safe and successful treatment to correct severe bilateral crossbites and to create space for maxillary incisor eruption.

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