

EXSPIDER™: CLINICAL APPLICATION IN GROWING PATIENTS

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INTRODUCTION

During growth the maxilla develops a bone structure which is very sensitive to any functional stimulus. Any uneven pressure that occurs between different muscles can impair development, and this manifests itself clinically in the form of transversal constriction of the maxilla.

This reduces the width of the dental arch, and in some cases this has an equal effect on the anterior and posterior segments bilaterally, whereas in other cases there is a more obvious reduction in the anterior region without the same marked compression in the posterior region.

This condition generally occurs where there is an imbalance in the developing forces. The imbalance is especially evident between the forces of the outer cheek and lip muscles and the tongue musculature. The anterior region of the dental arch is also compromised in those subjects who are oral breathers.

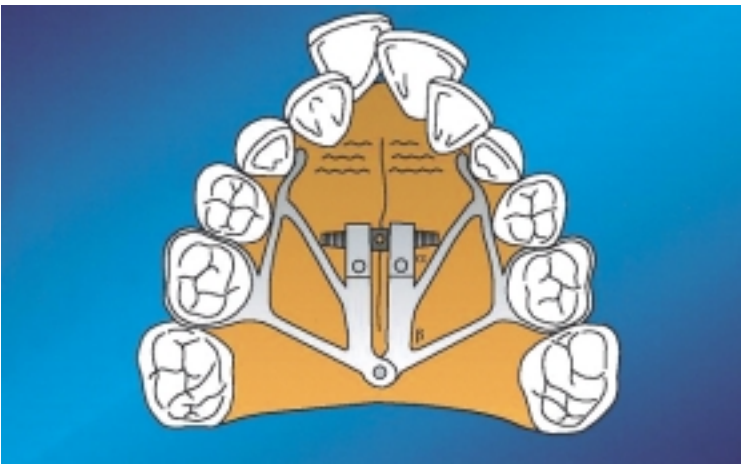


Fig.1- Rapid expansion appliance with Exspider™ screw

In these cases the dental arch displays the typical "V" shape, which is caused by the lack of coordination between intraoral and intranasal airflow pressures.

In addition to patients who are oral breathers, a narrowed maxillary arch is also evident in patients who suffer from cleft lip and palate. This constriction affects both the soft and hard palate and extends into the alveolus on one or both sides of the premaxilla, resulting in an unattached and often mobile premaxilla.

To correct this particular disparity in the width of the dental arch, E.Schellino and R. Modica, in collaboration with Leone, developed in 1996 an orthodontic appliance, known as the "Ragno" screw in Europe and the "Exspider™" in the U.S.A. This screw is used to expand the maxilla by opening the palatal suture in the anterior region only, while still maintaining the width of the dental arch in the posterior region. Published work relating to this appliance has dealt mainly with the treatment of adults or patients with cleft lip and palate.

The purpose of this article is to demonstrate how this orthodontic appliance can be beneficial to growing patients in the mixed dentition, following certain modifications to enable improved clinical application of the Exspider screw.

DESIGN OF THE APPLIANCE

The appliance consists of two sections, which are basically symmetrical with respect to the sagittal plane. Each section has two arms, which form the shape of a fan, and these are welded to the tooth bands. The two halves are connected by an expansion screw which pushes the sections apart at an angle, producing expansion mainly in the anterior region.

The most important component of the appliance is the Exspider screw, a stainless steel screw with modified rapid expansion, which has three hinges: a posterior hinge, which makes the appliance fan out anteriorly, and two anterolateral hinges, which control any torsion that occurs during expansion.

It is important to position the screw so that the anterior hinges are aligned with the center of the palatal cusps of the first premolars or at least between the first and second premolars.

The posterior arms, which project out from the central component, are welded to the bands on the first permanent molars or second deciduous molars. These arms extend anteriorly to the palatal surface of the first premolar or deciduous canine, and they curve back from there towards the midline of the central component of the appliance.

The arms are aligned anteriorly so that acute angles (a and b) are formed between the arms and the lateral margins of the central component. The outcome of this is that the anterior rests, i.e. the contact points of the anterior arms and the palatal surfaces of the first premolars or deciduous canines, are further apart after expansion (Fig. 1 and 2).

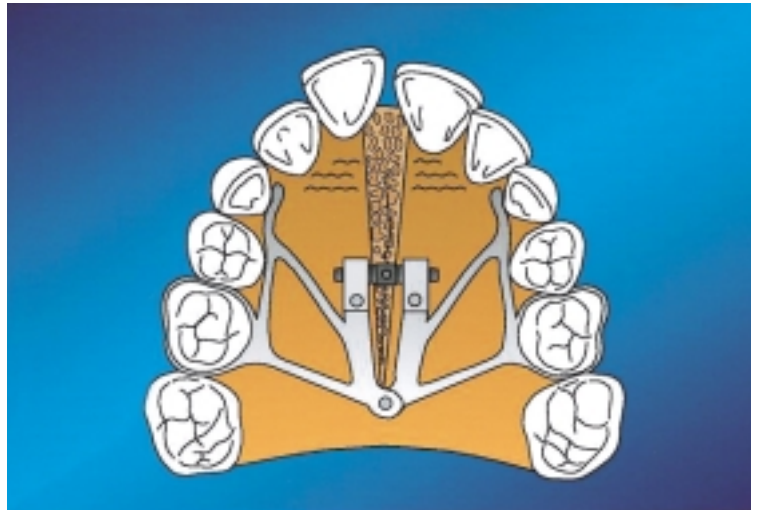


Fig. 2 - Expansion of the upper arch during activation of the Exspider™ screw

It should be noted that further expansion occurs due to distal rotation of the posterior arms which produce a similar movement in the molar region, and this is beneficial in cases in which the molars are rotated due to a transversal anomaly of the upper dental arch.

The length of the arms is also important in achieving the desired biomechanical and skeletal effect: the longer the arms are, the greater the expansion in the anterior region.

ACTIVATION

The activation protocol we use achieves “ultra-rapid expansion”: the screw is activated immediately after the appliance has been fitted by the orthodontist and produces an opening of approx. 1 millimeter (0.8 mm) right away. In the following days, activation is continued by making a quarter turn three times a day (morning, midday and evening).

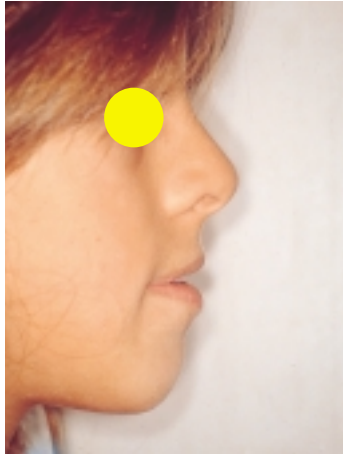


Fig. 3, 4, 5, 6, 7, 8, 9
Frontal view, profile view,
dental arches and patient's
before treatment.

Fig. 4

The activation period lasts between 7 and 9 days, depending on the amount of constriction of the maxilla. An occlusal X-ray is taken during expansion to check how much the palatal suture has opened.

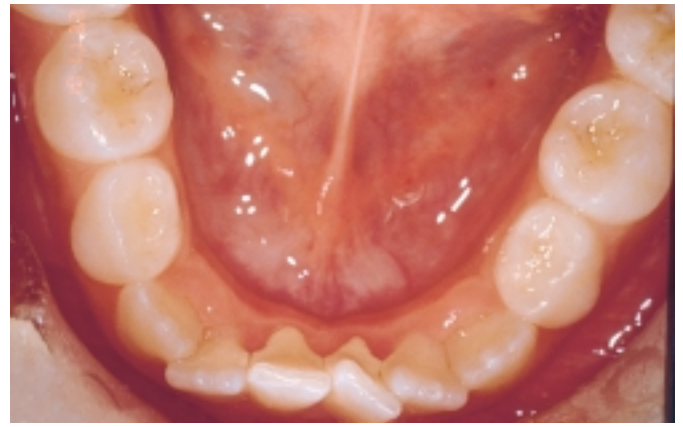


Fig. 6



Fig. 7



Fig. 5

Expansion is considered clinically successful, if overcorrection of 2 – 3 mm is achieved bilaterally. The screw can then be locked in position, but the patient must continue to wear the appliance for another 6 months to allow new bone to form in the area where the expansion occurred.



Fig. 8

CLINICAL CASE HISTORY

The 9 year-old patient V.F. was in the transition from the early to the late dentition. Facial analysis indicated typical signs of oral respiration: a long-shaped face, noticeable rings around the eyes and no lip closure. There were no visible signs of facial asymmetry. Analysis of her profile indicated much greater development of the lower third of the face compared to the central area, and also a flattened maxillary region. The nasal lip angle was open (Fig. 3 and 4).



Fig. 9



Fig.10 Rapid expansion appliance with the Exspider screw; intraoral view.

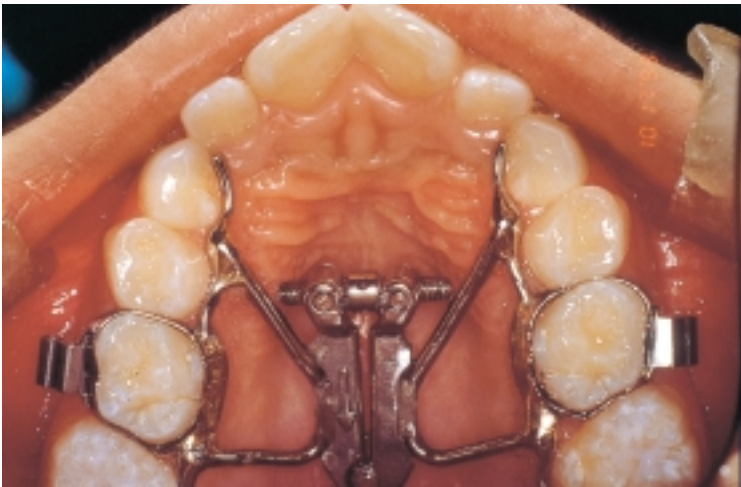


Fig.11 View of the maxilla following activation of the screw.

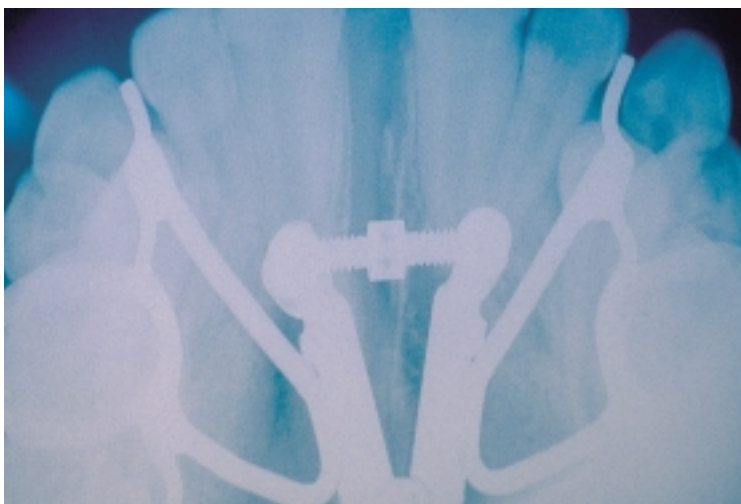


Fig. 12 The opening at the medial palatal suture as seen on the occlusal X-ray

The intraoral photograph shows a bilateral cross-bite, indicating a transversal deficiency in the maxilla, which is also evident from the V-shaped dental arch, i.e. a constriction which is more pronounced in the anterior than in the posterior region. A slight open bite is also evident bilaterally. The lower dental arch is broad, and there is a certain degree of crowding in the anterior region (Fig. 5–9).

Cephalometric analysis revealed mandibular protrusion along with hyperdivergency.



Fig.13 Increase in the size of the diastema between the upper central incisors following activation of the screw.

In this case immediate intervention was required to restore the correct width of the dental arch and, normal sagittal intermaxillary relationships.

Expansion of the maxilla was indicated, especially in the anterior region of the dental arch. An expansion appliance with a Exspider screw was fitted, and this was welded only to the bands on the second deciduous molars in accordance with the above-mentioned modification to the design.



Fig.14 Active protraction of the maxilla using a Delaire face mask.

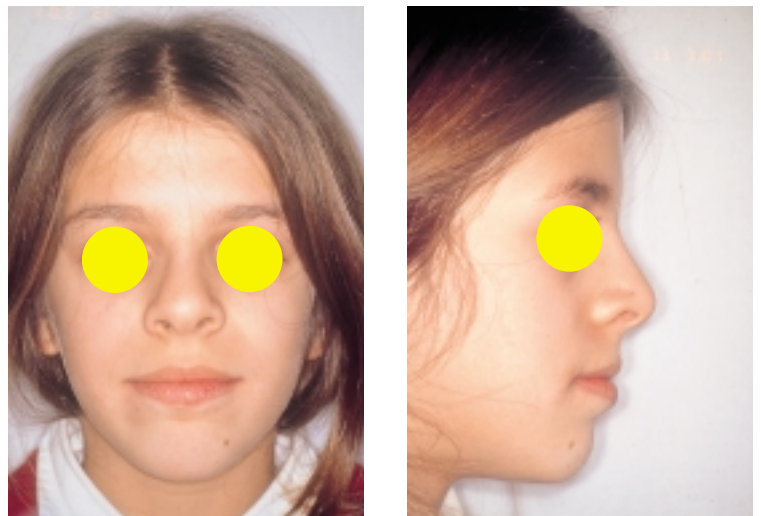


Fig.15, 16, 17, 18, 19, 20, 21 Front view, profile, upper and lower dental arches of the patient following orthodontic treatment.

The appliance was activated according to the treatment plan. This resulted in a split in the medial palatal suture, which was also ascertained by means of an occlusal X-ray (Fig. 10 – 13).

The correction of intercanine and interpremolar diameters can be noticed.

Both diameters showed greater increases than the intermolar diameter.

Following a six-month retention phase, a phase of active maxillary protraction was performed by means of Delaire's mask." (fig. 14)

There is a considerable improvement in the intraoral situation as well as in the facial profile and front view (Fig. 15 – 21). Active retention was performed with a Bionator III appliance, while waiting for replacement of the deciduous teeth.



Fig. 17



Fig. 18



Fig. 19



Fig. 20



Fig. 21

CONCLUSIONS

The greatest advantage of this appliance is that bands do not have to be fitted to the deciduous canines or premolars. As a result, clinical application of the appliance is simpler and more practical for the orthodontist. It also prevents some undesired effects, mainly involving the anchoring teeth, which may cause root resorption, crown tipping or extrusion, as demonstrated in the tests carried out by Langford.

Expanding the dental arch between the canines, while successfully controlling the position of the posterior region, is the main objective of this treatment for pathological conditions characterized by anterior constriction of the maxilla.

SUMMARY

The authors present a report on the clinical application and the results of treatment to expand the maxilla using the Exspider screw. This appliance, appropriately modified and using two bands on the deciduous molars, is recommended for patients in the mixed dentition.

The results following activation indicate good control in the posterior region and expansion of the dental arch at the canines. This is particularly desirable in cases in which parafunctions have produced a change in the anterior region of the upper dental arch.