



TECHNICAL NOTE

Transpalatal distraction as a method of maxillary expansion

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SUMMARY. Conventional devices used for surgically assisted rapid palatal expansion are tooth-borne. Dental fixation entails a number of possible drawbacks such as loss of anchorage, skeletal relapse during and after the expansion period, cortical fenestration and buccal root resorption. A bone-borne titanium device with interchangeable expansion modules, used with a callous distraction policy, is presented.

INTRODUCTION

Maxillary constriction can be corrected with slow orthodontic expansion (SOE), rapid palatal expansion (RPE), surgically assisted rapid palatal expansion (SARPE) or a two-segmented Le Fort I-type osteotomy with expansion (LFI-E).

SOE is indicated for very mild lateral discrepancies. Currently used SOE devices are the Coffin palatal arch, the Arnold expander and the quad-helix appliance. Expansion of the dental arch occurs as a combination of bodily tooth movement and tipping.

RPE is indicated in patients younger than 12 years, who have lateral discrepancies involving several teeth, whether the constriction is skeletal, dental or a combination of both.¹ The devices are all tooth-borne, but one type has palatal flanges. Most commonly used is the 'hygienic appliance' (Hyrax), an all-wire frame soldered to bands that are cemented on the abutment teeth. The expander can be a nonspring-loaded jackscrew, or a telescopic screw-system consisting of three overlapping cylinders (SUPERScrew™).² The fixed split acrylic appliance which is tissue-borne with bands on the first molars and premolars and provided by a jackscrew was introduced by Derichsweiler³ and advocated by Haas⁴ because it would resist the post-expansion forces that tend to collapse the maxilla whilst the teeth remain in their expanded state.⁵ The Howe acrylic-lined bondable expander with a mid-palatal jackscrew⁶ and the Minne expander, which consists of a heavy calibre coil spring with two metal flanges soldered to the bands, are less frequently used.

From 14 years on, RPE is accompanied by corticotomies that release the areas of bony resistance (SARPE) out of fear for alveolar bending, tooth tipping and extrusion,^{7–9} periodontal membrane compression and buccal root resorption,^{10–13} fenestration of the buccal cortex^{4,8,9,13–15} and instability-relapse with the necessity for overcorrection.^{4,5,8,9,13,14,16–20} The same expansion devices as for RPE are used. Still, after surgical release of the areas of maxillary support, undesired movements of the abutment teeth are noticed

during expansion and retention.^{21–23} Prolonged retention and overcorrection is advisable to counteract skeletal relapse.^{22–25}

The Transpalatal Distractor (TPD™ – Surgitech cvoha, L. Bauwenstraat 20, 8200 Brugge, Belgium) avoids all these aforementioned problems, since fixation is sought in palatal bone. The aim of the article is to describe the rationale and use of TPD.™

TECHNIQUE

Under general anaesthesia, the anterior, lateral and median bony supports of the maxilla are transected with a reciprocating saw and an osteotome. The bone surfaces are approached by two horizontal mucosa incisions in the canine fossa region, and a vertical incision in the upper lip frenulum, or by one single median V-shaped incision around the frenulum.

After local infiltration with an anaesthetic solution containing a vasoconstrictor, a T-shaped incision is made in the palatal gingiva, in the area of the future abutment plate. The horizontal segment of the T is approximately 12 mm long, overlying the second premolar root (Fig. 1). The perpendicular segment measures approximately 3 mm, and extends cranially. The two abutment plates have a 30° angled box-like extension with a horizontal slot, in between two holes of 2.4 mm diameter which centres are 8 mm apart (Fig. 2). The titanium abutment plates are placed horizontally as superiorly as possible on the vertical wall of the palatal vault, for patient comfort and for mechanical advantage.^{1,26} Each plate is centred over the second premolar root. Two titanium screws of 5.5 mm in length and 2.3 mm in diameter fix the plate (Fig. 3). A single suture on the posterior part of the incision prevents postoperative bleeding from the palatal artery. The gingiva is adapted with electrocautery around the box extension.

After a latency period of 5–7 days, a titanium grade 2 telescopic distractor module is placed in the slots of the abutment plates and expansion starts at a rate of 0.33 mm daily. The smallest module is 12 mm



Fig. 1 – T-shaped incision markings over the second premolar.

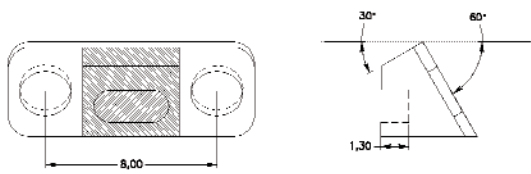


Fig. 2 – Technical drawing of an abutment plate. The centres of the two holes for the osteosynthesis screw are 8 mm apart. The box extension angles 30° with the baseplate, to cope with the slope of the palatal vault.

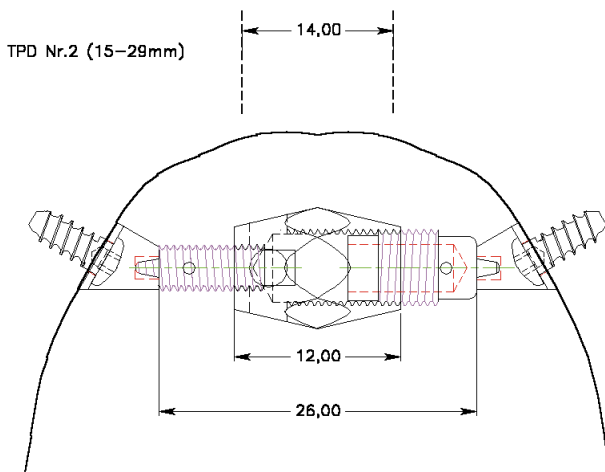


Fig. 3 – Cross-section of distraction expanded palatal vault. The osteosynthesis screws measure 5.5 mm in length. Module 2 has achieved 14 mm of distraction.

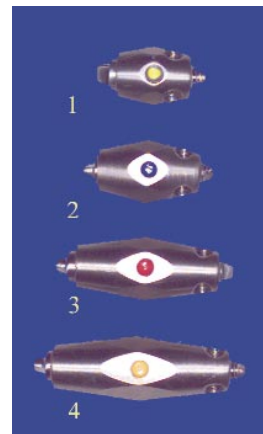


Fig. 4 – The four custom made interchangeable titanium modules. These are made of three overlapping (telescoping) cylinders. Coloured dots facilitate rate and rhythm control.

49 mm and number 4 from 25 to 58 mm. Numbers 2 and 3 are most frequently used (Fig. 4). Over-expansion is not necessary since forces are directly applied to the skeletal base. The distractor is turned into a fixed retainer by inserting a blocking screw. Distraction osteogenesis in the midpalatal suture ensures quicker ossification (Fig. 5). All teeth remain available for fixed appliances. Hence, orthodontic alignment in the anterior and lateral segments can start soon after expansion.

DISCUSSION

In the first part of the nineteenth century, Lefoulon,^{27,28} Schmidt²⁹ and Talma³⁰ reported on maxillary expansion with a palatal or buccal C-shaped spring. Another

long, and can expand to 21 mm. The next interchangeable module measures 15 mm, and can expand to 29 mm. Module number 3 can expand from 21 to

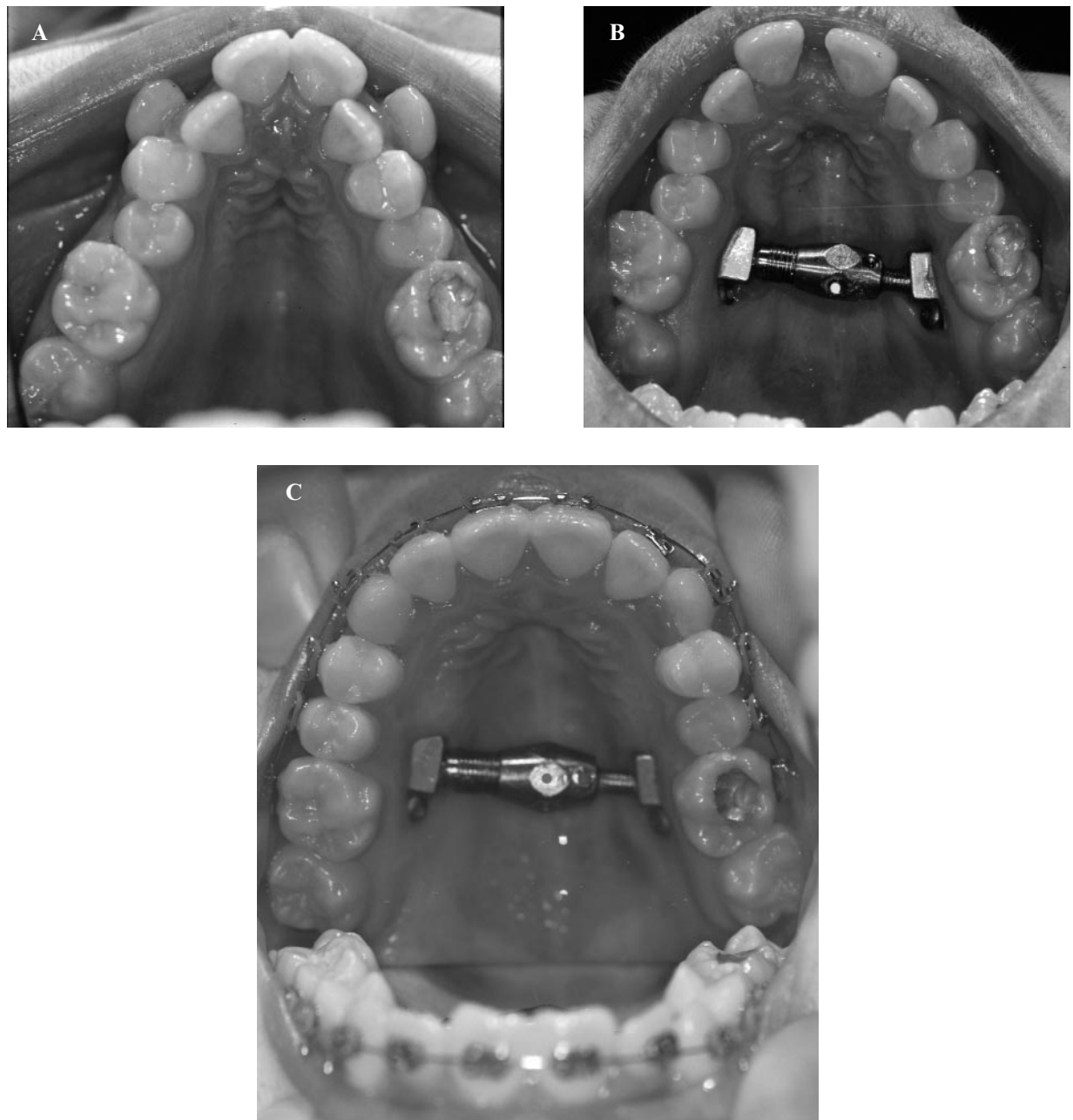


Fig. 5 – Case TC. (A) Palatal view showing maxillary constriction and anterior crowding. (B) Palatal view during distraction (prototype distraction module) (C) Palatal view upon removal of TPD™, 6 months after treatment start. Good alignment except for the right canine tooth. Good skeletal expansion is noted.

method, reserved for less severe cases, consisted of lateral thumb pressure, ‘every morning and even many times daily’, by the parents or the child itself.³⁰

RPE was introduced in the second part of the nineteenth century^{14,31} and was especially ‘en vogue’ in the Germanic countries early in the twentieth century, mainly because of the presumed positive effects on nasal permeability.^{14,26,32–35} Schröder-Benseler presented in 1913 the still-popular all-wire frame with a nonspring-loaded jackscrew, the ‘hygienic appliance’.³³ Haas stressed the importance of ‘applying a more parallel expansion force on the maxillary halves by using a

tissue-borne fixed split acrylic appliance.¹⁶ With an all tooth-borne appliance, the same palatal recontouring cannot be achieved. On the other hand, Alpern experienced palatal soft tissue necrosis due to tissue impingement between the acrylic palatal buttons of the Derichsweiler-Haas appliance.³⁶ The major advantage of TPD is that the forces are acting directly to the bone at the mechanically desired level. Tooth tipping or necrosis of the palatal gingiva is not to be feared for.

Opinions differ concerning the length of the retention period after RPE. Active root resorption slows significantly after about 3 months’ retention^{5,10,11} but

Timms and Moss found signs of root resorption and alveolar bone remodelling as long as 23 months postexpansion.¹³ Most authors agree upon a minimum of 3-month retention^{17,18,37} and upon over-correction.^{16,18,19,37}

Brown was probably the first to describe a technique of SA-RPE with midpalatal splitting in his textbook in 1938.³⁹ There is no agreement on how many areas of resistance are to be transected. The areas of resistance to lateral forces in the midface are the piriform aperture (anterior support), the zygomatic buttress (lateral support), the pterygoid junction (posterior support) and the midpalatal synostosed suture (median support). In early reports, all four supports are transected.^{20,23,40,41} More recently, with emphasis on decreasing morbidity and ambulatory surgery, fewer supports are osteotomized; the anterior, lateral and median,²¹ the lateral and median support,²⁵ the anterior, lateral and posterior,⁴² the anterior and lateral.^{22,43} For bilateral expansion, we routinely transect the median, anterior and lateral support. The median support is split by a median buccal approach. Septal release is only performed in case of unilateral expansion. Bleeding from a small artery within the osseous triangle forming the lateral nasal wall and lateral maxillary walls frequently occurs and must be treated adequately to avoid postoperative bleeding problems. The transection can be performed with a round bur (lateral support), a small Lindeman bur (anterior support), a 1-cm wide osteotome (median, lateral and anterior support) or a reciprocating saw (lateral and anterior support).

Activation rates for SA-RPE are between 0.25 mm and 1 mm daily.^{21,22,41,43} With SA-RPE, latency periods are not the rule; in fact, peroperative expansion is performed till the buccal gingiva around the central incisors blanches, which occurs when the gap reaches 1.5–2 mm in width.²¹ This latency period is important, however, to allow nature to create a callus. Callus distraction will lead to a regenerate that readily ossifies and stabilizes.⁴⁴

In an overview article on orthognathic surgery, Proffit's overall statement was that stability is greatest when the soft tissues are relaxed during surgery and least when they are stretched.⁴⁵ After SA-RPE, the palatal gingiva, the masticatory and labial muscles and the investing fascia will certainly try to recreate the original condition. Only Bell and Epker⁴⁰ and Bays and Greco²¹ find it unnecessary to counteract these forces by prolonged retention. Most leave the expansion device in place as a retainer for 3–6 months.^{1,22–24} In most cases, active alignment can only be initiated after removal of the device, unless it is replaced by a transpalatal arch or a removable retainer.²⁴ TPD can be turned into a retainer that can be left for an indefinite time period, because it is entirely made of titanium. TPD meets the requirements of Zimring and Isaacson⁵ for RPE, in that 'the use of other than absolutely rigid retention appears to be contraindicated'.

A LFI-E is mainly indicated during an orthognathic procedure to correct a posterior crossbite. It is prone to considerable relapse^{46,47} and overcorrection and prolonged retention are necessary.⁴⁷

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