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Review Article

Selected palatal suture expansion techniques in the treatment of transverse maxillary narrowings – Literature review

Maciej Dobrzyński[*,1], *Katarzyna Miśków*, *Krzysztof Dowgierd*

Stomatological Outpatient Clinic in Olsztyn, Poland

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ABSTRACT

Introduction: Palatal suture expansion techniques are used to treat severe maxillary narrowing and lead to its base extending. The palatal suture expansion procedure was for the first time described by Angell in 1860.

Aim: To review the palatal suture expansion methods, particularly surgically-assisted rapid maxillary expansion technique and indications for their choice as well as possible complications. Gum-teeth complications associated with the use of orthodontic-orthopedic devices and lack of their efficacy in adult patients contributed to designs invention directly fixed in the palatal bone.

Discussion: Anatomic structure of palatal suture changes with age. Palatal suture ossification status determines the choice of one of the orthodontic-orthopedic methods of treatment, which include slow maxillary expansion (SME) or rapid maxillary expansion (RME), as well as the surgically-assisted rapid expansion of the maxillae (SARME/SARPE). In orthodontic-orthopedic methods of palatal suture expansion Haas and Hyrax devices are applied. In the method of surgically-assisted rapid palatal expansion (SARPE), a distractor is placed in the maxilla after *Le Fort I* osteotomy performance. Screws are a source of force for expanding devices both orthodontic-orthopedic and palatal distractors which can be activated by patients. It should be noted that surgically-assisted rapid maxillary expansion (SARME) is a relatively new method, and despite it giving great opportunities of stable maxillary expansion in adult patients, it also raises some concerns related to the surgical intervention and necessity for general anesthesia.

Conclusions: SARME expansion technique has particular advantages which include the possibility of application among adult patients, no relapses, as well as the skeletal but not dentoalveolar expanding of maxilla.

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*Correspondence to: Stomatological Outpatient Clinic in Olsztyn, Żołnierska 18, 10-561 Olsztyn, Poland. Tel.: +48 604 795 947.
E-mail address: maciejdobrzynski@op.pl (M. Dobrzyński).
[1]Dentist, during specialization in Orthodontics. Specialization carried out at Specialist Orthodontics Outpatient Clinic, Mickiewicza 33/1, 10-508 Olsztyn, Poland.

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1. Introduction

Palatal suture expansion techniques are used to treat severe maxillary narrowing and lead to its base extending. Maxillary narrowings are characterized by partial bilateral crossbite and high gothic palate.[1,2,3,6] The result of reducing the transverse dimension of maxilla is limitation of space for the teeth which in consequence leads to crowding. Palatal suture ossification status determines the choice of one of the methods of treatment, which include slow maxillary expansion (SME) or rapid maxillary expansion (RME), as well as the surgically-assisted rapid expansion of the maxilla.[3,6]

Anatomic structure of palatal suture changes with age. In the primary or early mixed dentition, two palatine processes of maxilla bones are joined via connective tissue symphysis containing a large number of collagen fibers and undifferentiated mesenchymal cells. During this period, the palatal suture can be relatively easily expanded by applying forces less than 1 kg.[1,2] In the period of late mixed dentition, as a result of symphysis ossification, palatal suture becomes narrow and takes the sinusoidal shape.[1,5] In this case, palatal suture expansion requires applying stronger forces to separate palatine processes of maxilla. In late adolescence, palatal suture can be completely ossified resembling the shape of zip-fastener. During this period, palatal suture expansion often requires the use of high orthodontic forces of 5–10 kg. In such case, there is also a risk of abutment teeth breakage or alveolar bone fracture.[1,2] The pain may accompany this method of treatment and the effects are less stable as maxillary narrowing recurrence might be present in more than 60% of cases.[2]

2. Aim

To review the palatal suture expansion methods, particularly SARME technique and indications for their choice as well as possible complications.

3. Discussion

The choice of one of the maxillary expansion methods: orthopedic-orthodontic ones or surgically-assisted method depends on state of palatal ossification and degree of maxillary narrowing.

4. Orthopedic-orthodontic palatal suture expansion methods

The palatal suture expansion procedure was for the first time described by Angell in 1860 who was a dentist in San Francisco. It was performed in a 14.5-year-old female patient and resulted in an increase in transverse maxillary dimension approximately for 6 mm as well as the appearance of median diastema.[5,14] However, the criticism of such treatment associated with too high forces transmitted by anchor teeth and hampered oral hygiene contributed to the rare application of the above procedure in the U.S.[5] The renaissance of this method in the U.S. took place in the 1960s as a technique of rapid palatal suture expansion. It consisted in daily screw activation (0.5–1.0 mm) placed in a fixed appliance which was mounted on posterior teeth by cemented orthodontic bands. This activation generates a force of 4.5–9.0 kg across the palatal suture. After 2–3 weeks activation period follows 3–4 weeks of retention period, during which the new bone tissue is formed in the space of expanded mid-palatal suture. Evaluation of such treatment results showed that only in the initial phase of therapy, expansion range of the body of maxilla exceeds degree of expansion of the alveolar process and reaches a dimension of 10 mm. However, during the retention period a partial recurrence of maxillary narrowing is observed and alveolar expansion begins to dominate. In the final result of the therapy, only half of the obtained expansion constitutes of bone expansion and the rest constitutes of tooth expansion.[1,2,9,13]

The disadvantage of rapid palatal suture expansion technique presented above, has been eliminated by the introduction of slow palatal suture expansion method. In this method the screw activation is less frequent (1 mm per week) resulting in generation of forces in range of 0.9–2.0 kg. The longer activation time carried over 10 weeks makes the method less traumatic. It has been shown that a 3-month retention period assures similar to RME method expansion of 10 mm. In this case, bone and teeth component of palatal expansion have equal participation.

In both presented methods of palatal suture expansion Haas and Hyrax devices are applied. In the Haas device the screw is placed between two acrylic plates covering the palate, while in the Hyrax (Fig. 1) device the screw is attached to the two metal supports. Both constructions are fixed to the premolars and molars of maxilla by the orthodontic bands.

Among children where the course of the palatal suture is straight, maxilla expansion can be achieved using devices designed to extend the upper dental arch, which include Quadhelix, Nickel-titanium palatal expander, Schwarz plate.[8,9]

The complications observed during the application of orthodontic-orthopedic palatal expansion methods including teeth extrusions, lateral tilting of the teeth and alveolar

Fig. 1 – Correction of the maxillary narrowing in patient after cleft of primary and secondary palate using Hyrax device. From the collection of Center of Craniofacial Defects Treatment and Maxillofacial Surgery in Olsztyn.

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