Hass-Type Expander with Marco Rosa Modification used in Primary and Early Mixed Dentition Advantages, Drawbacks and Encountered Clinical Problems

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1. Introduction

Maxillary constriction, usually manifested with the crowding of teeth or a cross-bite, is one of the most common orthodontic defects in the European population in the deciduous and the early mixed dentition periods [1]. This condition is an indicator for early orthodontic treatment with the use of devices intended for RPE – rapid palatal expansion [2-5]. One of the options is the Hass appliance with Marco Rosa modifications [6]. This device is anchored on rings cemented to the primary second molars, with arms supported on the palatal side of primary canines providing additional reinforcement [Figure 1]. The device has acrylic plates positioned bilaterally to the Hyrax screw, which adhere to the palatal mucosa much like in the standard Haas appliance. This way, the forces generated when the screw is turned are transferred mainly to the palatal processes of the maxilla [6], and to a lesser extent to the alveolar processes and the teeth of the patient. As the screw is turned once a day for 28 to 38 days, maxillary expansion in the range of 5.6 mm to 7.6 mm is obtained, which is usually sufficient to eliminate the maxillary narrowing present [6 -7]. However, the very construction of the device creates potential problems affecting the palatal mucosa, and permanent cementation requires maintenance of adequate oral hygiene to prevent adverse consequences of bacterial plaque accumulation (caries, periodontal disease).

2. Objective

The aim of the study was to evaluate the effectiveness of treatment with the Marco Rosa expander with own modification (the rests on canines are tipped with a metal mesh) [Figure 2] and to determine the frequency of damages to the device and side effects during and after treatment. This way, the suitability of the device in the clinical practice should be assessed.
3. Material and Methods

The material for the study was obtained from the database of patients of the “Ortomikar” Orthodontic-Dental Clinic in total, 33 children were enrolled: 15 girls and 18 boys aged between 5 and 8 years, which in practice means all the patients who had been treated with the Marco Rosa appliance between September 2017 and April 2021. These patients were qualified for treatment on the basis of CS 1-3 skeletal age acc. to Baccetti’s et al. cervical vertebrae analysis [8] as well as the presence or absence of maxillary narrowing determined by: no space for permanent incisors, posterior cross bite or lateral deviation of the mandible. It was a retrospective study based on patients’ records, radiographic documentation, photographs and diagnostic models. The activation of the screw followed the semi-rapid palatal expansion procedure (1 turn daily) according to Haas’ recommendation [3]. Several patients (36%) required more than 28 turns, namely 38 turns. The following data were analyzed: indications for treatment, the presence of a diastema during treatment, the frequency of spontaneous improvement of lower incisors crowding, duration of treatment, the number of mechanical problems related to the appliance (debonding, fracture of one or both rings), the presence of caries, mobility of teeth, periodontal problems, and sores, as potential complications resulting from the use of this type of expander.

4. Results

The patients in the study group represented the following types of malocclusions: maxillary narrowing – 33 patients (100%), insufficient space for maxillary lateral incisors – 19 patients (57.6%), anterior cross bite – 3 patients (9.9%), complete cross bite – 4 patients (12.1%), lateral functional displacement of the mandible – 4 patients (12.1%), mesioclusion-2 patients (6.1%) (Graph 1). Maxillary narrowing, with associated absence of space in the mandible manifested by crowding of the lower incisors, was present in 25 cases (75.7%). The appliances were bonded for the period of 9-12 months, with the period of the screw activation of 28 - 38 days depending on the amount of space needed in the dental arch; the remainder of that period was taken by retention. There was correlation between the need for additional screw turns and the patients’ age, only patients at the age of six needed 28 turns (Graph 2). In 16 patients (48.5%), the appliance was worn for the previously predicted period, but in 17 patients (51.5%) the treatment was completed sooner. All the cases of failure involved mechanical problems with the appliance itself, fracture or damage to the rings [Figure 3]. Eight patients (24.3%) never required re-bonding of the expander. In the remaining 22 patients, in whom the appliance debonded but the ring did not fracture, the device was applied again (the number of repairs did not exceed four) (Graph 3). In 3 (9%) patients, damage to the appliance resulted in discontinuation of treatment. The mean frequency of cases of debonding of the Marco Rosa appliance during therapy was 1.27 times per treatment.

All the patients who underwent treatment achieved maxillary expansion [Figure 4]. Of the total number of 30 patients, who had primary or permanent central incisors present at the onset of the therapy, in 18 (60%) a median diastema appeared as the expansion screw was turned. Of the total number of 25 patients, who had crowding of mandibular incisors at baseline, 12 (48%) manifested spontaneous improvement of this condition [Figure 5]. The adherence of acrylic wings to the palate may, in consequence, result in mucosal sores [9]. The incidence of this complication was rare, and occurred only in 4 patients (12%), as was the occurrence of carious lesions on ring-supporting teeth (3 patients – 9%), or loosening of teeth due to resorption of roots of primary teeth (5 patients – 17%) (Graph 4). Problems related to periodontium (inflammation, swelling, bleeding) were observed in 3 cases (9%); one 8.5-year-old patient reported nose bleeds following the sixth turn of the screw, which resolved when the screw was not turned for two days. In another patient, who was 6.5 years old, transient blanching of the dorsum of the nose appeared after the screw had been turned to its ultimate position.
Graph 1: Distribution of malocclusions

Graph 2: Correlation between the need for additional screw turns and the patients’ age

Figure 3: Fractured ring of the expander
Graph 3: Appliance failure distribution

Figure 4: Maxillary expansion obtained with the Marco Rosa appliance

Figure 5: Spontaneous improvement of crowding of mandibular incisors
**5. Discussion**

The main incentive to use rapid maxillary expanders is narrowing of the upper jaw. The use of Haas appliance with Marco Rosa modification resulted in maxillary expansion in all the patients. Similar outcomes have been reported in many other studies [6, 10 - 12]. The successful outcome can be attributed to the fact that in patients before pubertal growth spur the palatal suture is wide and straight whereas later it develops more curvatures, which results in higher resistance during the palatal expansion procedure [13 - 14]. The argument for not delaying the rapid maxillary expansion procedure is the fact that maxillary narrowing does not undergo spontaneous resolution, and may lead to skeletal defects in the position of the mandible: asymmetries, mesio- or distocclusion, as well as TMJ dysfunctions [5, 15]. In the studied sample, 60% of patients developed a wide median diastema in consequence of the expansion procedure [Figure 6], which is similar to data relating to the Polish population of patients treated after pubertal growth spur [16]. Yet, the mechanism of this process, regarded as the clinical proof of skeletal maxillary expansion [17-19], may vary in the primary dentition. A wide median diastema in the primary dentition did not appear in patients in whom roots of central incisors were so short that they were embedded in the alveolar mucosa only [Figure 7].

The present study also confirms the positive, indirect impact of rapid maxillary expansion on the lower arch, which has been reported in other studies [20-22]. It involves spontaneous improvement of incisal crowding in the mandible, which was observed in 65% of our patients [Figure 5]. Several studies [23-25] report potential complications involving teeth that are used as anchorage for the appliance. These may be due to high-magnitude forces which are generated during RME including pulpal stones, root resorption, thinning of the vestibular lamina of the teeth involved in the process, periodontal problems and increased mobility of teeth. Therefore, several authors argue that the rings should be bonded onto primary second molars and not permanent first molars [6, 10-12]. The average age for the exfoliation of primary teeth in the Polish population is 10-13 years [26], which means that even if treatment with the Marco Rosa appliance involves loss of these teeth, the second permanent premolar will erupt relatively soon. If the first molar becomes damaged, the long-term prognosis for this tooth is much poorer [27]. A similar scenario concerns dental caries. A primary tooth is retained in the mouth for 1-6 years and in this period its pulp is usually at the stage of involution [28]. Therefore, the destruction of hard tissues of a deciduous tooth seems a much less serious problem than carious lesions in permanent teeth when we consider the longevity of 78-83 years for children now aged 6 to 10 years [29].

The appliance-induced sores were usually due to insufficient oral hygiene [Figure 8], and so the relevant patients’ parents were re-educated in how to maintain the appliance. Additionally, the surface under the appliance was irrigated with a 0.12% solution of chlorhexidine delivered under pressure with an irrigator or a syringe without a needle. As hygiene improved, sores abated and the patients never needed to have the therapy discontinued. Other authors have described a similar experience [30]. No other adverse effects were noted, including those reported in the literature as potentially severe RME complications such as fracture of the vestibular lamina of abutment teeth, gum recession, pain and ulceration [31-32]. The patients had been asked to report any unusual events in the period of activation of the appliance and its retention. Only one 8.5-year-old patient reported nose bleeds, and another 6.5-year-old manifested transient blanching of the dorsum of the nose.

There were no reports of pain at the base of the nose or any other kind of pain as the screw was being turned; this observation can be attributed to the young age of the patients who qualified for this type of RME. Mechanical failure of the modified Haas appliance reported by the majority of users constitutes the most serious drawback. The appliance usually malfunctioned in 6-year-old children (Graph 5). On the basis of the clinical observations in the present study it can also be concluded that the problem concerned excitable and agitated patients.
Figure 6: Appearance of median diastema following treatment in the presence of erupted permanent incisors

Figure 7: Absence of a median diastema following treatment due to root resorption of primary incisors
6. Conclusion

All the patients aged 5-8.5 years (CS 1-3 maturation stage) who underwent treatment with the Marco Rosa modified appliance had their maxilla expanded. The appliance turned once a day before falling asleep does not produce any painful sensations in patients in skeletal age before pubertal growth peak. Potential problems of the RME procedure described in the literature occur rarely (sores, caries, periodontitis, increased mobility of the abutment teeth) or sporadically (blanching of the dorsum of the nose, nose bleed).

During the extension process, a wide median diastema will not appear in patients whose roots of deciduous incisors are very short, embedded only in the mucosa and not reaching the alveolar bone. The appliance does not require good co-operation of juvenile patients with respect to wearing. Dietary restrictions are necessary and good oral hygiene has to be maintained. The appliance is subject to frequent damages, most commonly in 6-year-old and excitable patients.

References


