



Long-term stability of rapid maxillary expander: a systematic review

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Abstract

The rapid maxillary expander (RME) is a fixed orthodontic-orthopedic appliance frequently used to widen the maxilla. Aim of this review is to investigate long-term stability of transversal, vertical and anteroposterior changes induced by RME. After a careful analysis of the literature, RME is able to provide long-term changes in transversal width without side effects on the other planes. It's important to start therapy with RME before peak in skeletal growth. There are not long-term important differences in transversal width changes between RME and slow maxillary expander.

Introduction

The rapid maxillary expander (RME) is a fixed orthodontic-orthopedic appliance used to correct posterior crossbite, dental crowding and to facilitate correction of class II and class III malocclusion, with the overall objective to widen the maxilla by separating the midpalatal suture and the circummaxillary sutural system (zygomaticomaxillary, frontonasal and pterygopalatine sutures).¹

This appliance is constituted by a central screw with 4 arms attached to bands (2 or 4) or to a bite-block.

Angell 150 years ago described for first time this appliance and introduced the concept that the maxilla can be expanded by opening the midpalatal suture.² This idea wasn't followed over the years until the 1960s when the landmark work of Haas made RME routine in many orthodontic practices.³

In clinical use RME has following features: speed of action and high load (4,5-9 kg) applied to the posterior dentoalveolar processes of maxilla provoking from a biological point of view an osteogenetic distraction of the median suture of the hard palate then leading at skeletal level to disjunction of this suture and widening of palate.⁴

The activation of the screw initially causes an inclination of the teeth (orthodontic effect) and, after stimulation of the sutures, a change in the extent of the maxillary bone (orthopedic effect).

Skeletal effects consist, on occlusal plane, in the V-opening of the major median suture both in front and back for effect of skeletal constraints (sphenoid bone posteriorly and zygomatic process laterally) opposing resistance to a parallel opening.

Dental effects consist in lateralization of dento-alveolar processes and the creation of an interincisal diastema (it will spontaneously close).

The magnitude of skeletal changes (orthopedic effect) of RME depends on the morphological characteristics of the midline suture of the palate that varies depending on individual skeletal maturation.⁵

RME can be used until mid-adolescence, when periosteal bridges can be formed along the suture making skeletal expansion impossible.^{1,6}

It is mainly used to solve a dimensional discrepancy between the transverse diameters of the two maxillary bones.

However, the rapid expander has shown to be sometimes effective in spontaneous correction of II classes.⁷ It's used also in III class correction in combination with facemask, in the treatment of dental crowding. Its use for other indications can improve nasal respiration.⁸

Regarding disadvantages, significant loss of buccal bone thickness and marginal bone level were observed in anchored teeth, following RME.⁹

A disadvantage of expansion therapy is its instability due to the fact that it increases the pressure of cheeks and lips that can shift palatally the teeth unless it is appropriately counterbalanced.

Available data on long-term stability of results are contradictory; however, if expansion is carried out at an early age, skeletal, dentoalveolar and muscular adaptation may be expected before the permanent teeth eruption.

Aim of this review is to investigate the long-term stability of rapid expansion results and the long-term occurrence of side effects on vertical and anteroposterior planes.

Methods

A systematic review of literature has been carried out

on the principal medical databases: PubMed (Medline) and Scopus. Used keywords were: rapid maxillary expansion, long-term stability. After a careful analysis and eliminating the studies without a proper control group or adequate quality, 7 articles were selected.Â

Review

A study performed by McNamara compared a group of 112 patients treated with RME followed by fixed appliance because of crowding and narrow dental arches with a group of 41 untreated patients.¹⁰⁻¹¹ Patients were followed during treatment and after end of treatment with a follow up time of about 9 years, in some cases also 10 years.

Treatment by RME followed by fixed appliances produced significantly favorable short- and long-term changes in almost all the maxillary and mandibular arch measurements.¹¹ In comparison with controls, a net gain of six mm was achieved in the maxillary arch perimeter, whereas a net gain of 4.5 mm was found for the mandibular arch perimeter of treated subjects in the long term.¹¹ The duration of retention with a fixed lower appliance in the posttreatment period did not appear to affect the long-term outcomes of the treatment protocol significantly.¹¹

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Baccetti compared a group of 42 patients treated with RME (divided in two subgroups, early-treated patients and late-treated patients, according to skeletal maturity, as evaluated by means of CVM method) with a control group of 20 subjects, in order to evaluate the short-term and long-term treatment effects of rapid maxillary expansion.¹²⁻¹³

In the long-term (about 9 years of follow up), maxillary skeletal width, maxillary intermolar width, lateronasal width, and lateroorbitale width were significantly greater in the early-treated group. The late-treated group exhibited significant increases in lateronasal width and in maxillary and mandibular intermolar widths. Authors concluded that RME treatment before the peak in skeletal growth velocity is able to induce more pronounced transverse craniofacial changes at the skeletal level.¹²

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A study carried out by Chang, in order to analyze anteroposterior and vertical long-term changes after RME use, compared a group of 25 patients treated with RME followed by standard edge-wise therapy with a group of 25 patients treated only with edgewise therapy and a group of 23 untreated patients¹⁴. All

patients were followed for over 6 years.

Authors concluded that RME therapy has little long-term (more than 6 years after treatment) effect on either the vertical dimensions or the anteroposterior dimensions of the face. This study does not support the claim that bite opening (i.e., increase in lower anterior facial height or opening of the mandibular plane angle or both) occurs in patients with Class I and Class II malocclusions treated with RME.

Similar results were found in the retrospective study carried out by Garib that compared a group of 25 patients treated with RME and edgewise therapy, a group of 25 patients treated with edgewise only and an untreated control group of 26 patients, in order to evaluate the long-term effects of RME in the sagittal and vertical facial planes.¹⁵

Authors, after a mean follow up of 5 years, concluded that unfavorable cephalometric changes resulting immediately after RME are temporary, and therefore concerns about using RME in patients with vertical growth patterns or an extremely convex facial profile are not substantiated.

A recent study investigated long-term interdental width changes in 90 patients: 30 treated with RME followed by edgewise, 30 treated with slow maxillary expander (SME) followed by edgewise and 30 treated with only edgewise.¹⁶ A significant long-term change in interdental width was observed in both RME and SME group compared to control group and long-term stability was present and similar for RME and SME, except for 3-3 intercanine width that was significantly reduced in RME group.

Conclusions

Long-term stability of rapid maxillary expander is present and transversal changes induced by the appliance are preserved over the time. To have good long-term results, it's important to start RME treatment before the peak in skeletal growth velocity because at this stage we can expect more pronounced transverse craniofacial changes at the skeletal level. There are not long-term side effects on vertical and anteroposterior planes with the use of RME. At long-term follow up, there are not important differences between RME and slow maxillary expander.

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