Orthodontist approach to palatal expansion: analysis of indications and clinical choices

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Abstract

The aim of this study is to analyze the clinical conditions that lead orthodontists to use Rapid Maxillary Expansion (RME), by evaluating whether, to date, maxillary contraction remains an essential clinical requirement or if there are other indications. Additionally, it assesses the effects—desirable or not—observed by clinicians following RME treatment. Materials and methods: This research involved developing a questionnaire that collected all possible effects and indications of RME therapy to evaluate, through several questions, how orthodontists currently use RME. The questionnaire was distributed via Google Forms (Google LLC, Mountain View, CA, USA) to national and international orthodontists and dentists. Statistical analysis included descriptive statistics for the initial questions about the characteristics of the respondents and their clinical preferences. Questions regarding the indications for performing RME and the effects or side effects of the technique were analyzed using means and standard deviations. Results: After discarding incomplete responses, the final data from 127 completed questionnaires were processed. Conclusions: There are additional indications beyond the conventional ones (maxillary contraction, unilateral and bilateral posterior crossbite) that clinicians consider when performing RME, indicating an evolution in the clinical use of the technique from its inception to the present. Furthermore, adopting modified techniques—such as skeletal anchorage or digitally designed devices—is becoming more common among orthodontists, sometimes allowing for the resolution of certain limitations or the control of side effects. This suggests that RME is evolving into a technique with potential impacts in orthodontics that extend well beyond its initial application.

Keywords: Rapid maxillary expansion, Rapid palatal expansion, Clinical choices of rapid maxillary expansion, RME effects and adverse events, RME indications

Introduction

Transverse maxillary contraction is one of the most common orthodontic anomalies,

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often associated with unilateral or bilateral crossbite in the maxillary arch. The prevalence of crossbite in the general population has been reported to range from 6% to 30%, depending on different studies (1). The etiology of maxillary contraction can be due to both genetic and environmental factors. While some cases may self-correct after removing underlying causes—such as harmful oral habits—the chances of spontaneous resolution remain low, estimated between 0% and 9%.

Rapid Maxillary Expansion (RME) is a commonly used interceptive treatment to address maxillary transverse discrepancies, especially in unilateral or bilateral crossbite cases. However, its applications extend beyond correcting crossbite. RME can improve the alignment of the first permanent molars and may help in mandibular repositioning to correct mild skeletal discrepancies. In patients with skeletal Class II, RME may assist in anterior repositioning of the mandible, while in skeletal Class III cases, it can facilitate posterior mandibular repositioning. Additionally, RME is indicated for cases that require extra space for the eruption of upper permanent lateral incisors and to reduce the risk of upper permanent canine impaction.

The timing of the intervention is crucial for the success of RME. The optimal period for maxillary expansion is before the pubertal growth spurt, typically during the mixed dentition phase, when skeletal structures are more receptive to orthopedic forces. Early treatment promotes a more effective skeletal response, reducing the need for more invasive procedures during adolescence or adulthood. Delayed intervention, especially after skeletal maturity, may require alternative methods like surgically assisted maxillary expansion to achieve similar results. Therefore, proper assessment of skeletal development and early diagnosis are vital for maximizing treatment outcomes.

Beyond its orthopedic and dental effects, maxillary expansion can greatly influence nasal and oral breathing. Patients with transverse maxillary deficiency often have a narrow nasal cavity, which can increase airway resistance and result in chronic mouth breathing. Mouth breathing is connected to changes in craniofacial development, postural adjustments, and sleep-disordered breathing conditions such as obstructive sleep apnea. RME has been shown to increase nasal airway volume by widening the nasal passages, thereby improving airflow and encouraging a switch from oral to nasal breathing. This can enhance respiratory function, reduce nighttime breathing problems, and support healthy craniofacial growth. These points highlight the importance of a multidisciplinary approach in managing maxillary constriction, combining orthodontic treatment with respiratory and otolaryngological evaluations when needed. This questionnaire-based research examines the orthodontic indications for palatal expansion and discusses the clinical decision-making process for selecting the best treatment based on each patient's unique characteristics.

Materials and methods

This study focused on creating a questionnaire to gather detailed information on the indications, effects, and current clinical applications of Rapid Maxillary Expansion (RME) therapy. The aim was to assess orthodontists' preferences and practices regarding RME through a structured series of questions. To ensure worldwide accessibility, the questionnaire was validated and then translated into English. Participants gave informed consent to process sensitive data before completing the survey. A total of 129 orthodontists participated in the study. The questionnaire was distributed via Google Forms (Google LLC, Mountain View, CA, USA) both nationally and internationally. It included sections on the orthodontist's background, demographics, clinical experience, clinical preferences related to RME, indications for RME, and its effects and potential side effects. Two responses from initial 129 were excluded due to incomplete or inconsistent data, leaving 127 valid responses.

Statistical Analysis

Descriptive statistical analysis was conducted to examine the characteristics of orthodontists and their clinical preferences regarding RME. For questions related to the technique's indications, effects, and side effects, data were analyzed using mean values and standard deviations to summarize response patterns. This method provided an objective way to assess the consensus among orthodontists on the clinical use and outcomes of RME therapy.

Results

Final data from 127 completed questionnaires, after excluding any discarded ones, were processed. The questionnaires were filled out by 127 subjects, with 116 being specialists or exclusivists in orthodontics, and only 11 general dentists practicing orthodontics. 40.6% of participants had over 20 years of experience in orthodontics, 20.3% had 10-20 years, 19.5% had between 0 and 5 years, and the remaining 19.5% had 5-10 years of experience.

37.5% of participants reported using RME treatment in less than 20% of growing patients. 28.9% said they used it in 20-50% of cases involving growing patients. 21.1% indicated they used it in 50-80% of growing patients. Finally, 11.7% reported using it in more than 80% of cases involving growing patients.

The responses also provided extra data on the clinical preferences for using the technique among the orthodontists who filled out the questionnaire.

The Hyrax was the most commonly used RME device, with 71.9% of our participants using it, while the Haas was used by 13.3% of the surveyed physicians. Lower percentages were recorded for Bonded McNamara and other devices (Figure 1).

58.9% used RME in the permanent dentition, while 41.1% used it in deciduous dentition when possible (Figure 2). 39.4% reported performing RME treatment with two-tooth anchorage, 30.7% used 4 anchor teeth; 24.4% performed it with 2 anchor teeth in prepubertal patients and with 4 anchor teeth in pubertal patients (Figure 3).

55% of the respondents use light-curing vitreous ionomer cement as the luting material for the RME

Figure 1. Type of device used in RME treatment.

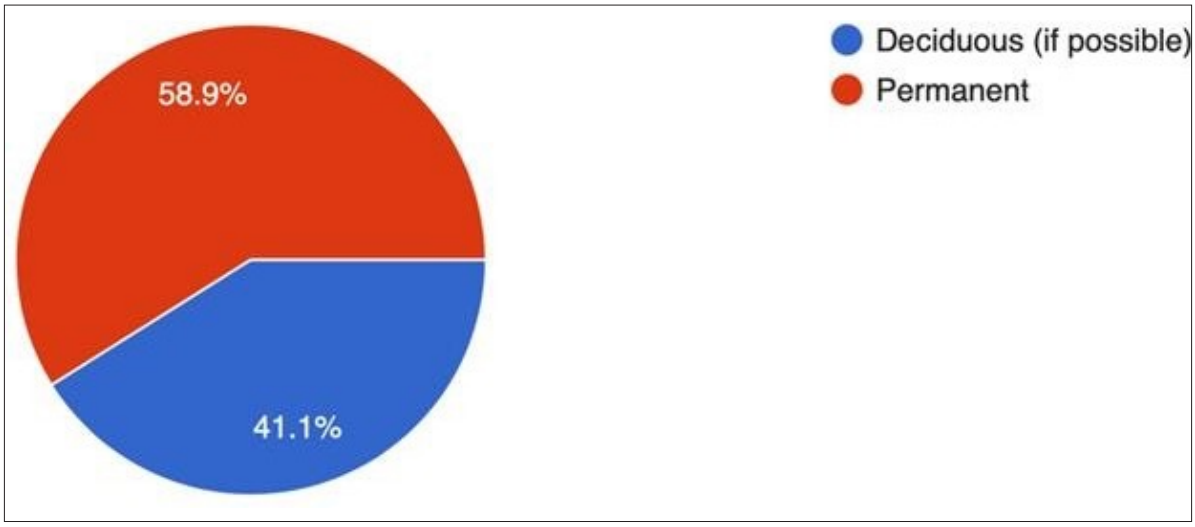

Figure 2. Anchor elements in RME treatment.

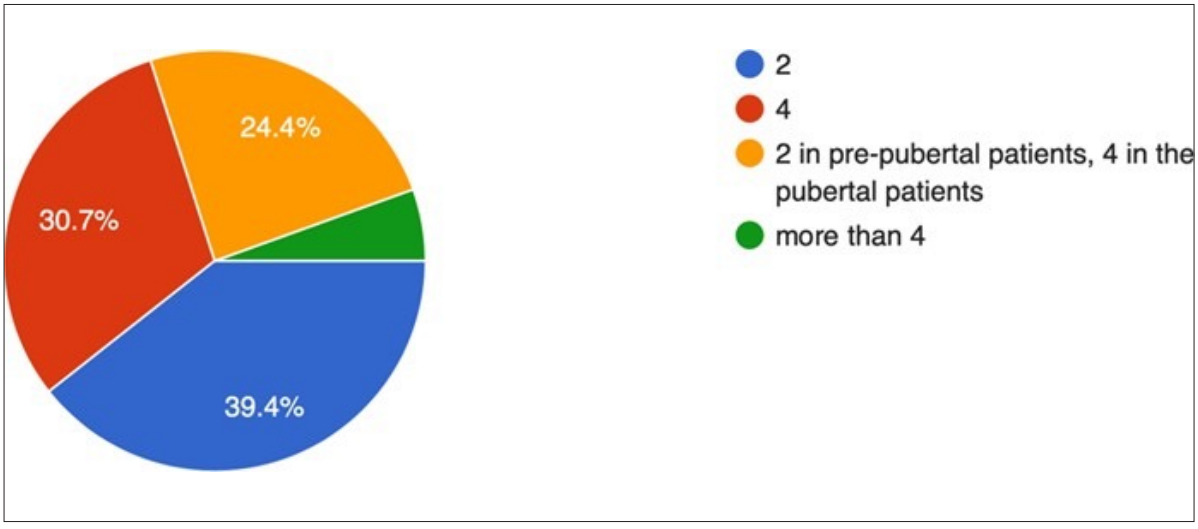

Figure 3. Number of anchor elements in the RME.

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device, and 37.2% use self-curing glass ionomer cement. 65.4% do not use the McNamara expansion device in hyperdivergent subjects, while 34.6% do. 36.4% reported that they do not use skeletal anchorage with mini-screws but would like to start; 31.8% do not use it and are not interested in doing so; 12.4% use it in skeletal or mixed anchorage; 10.1% use it in total skeletal anchorage; 9.3% use it in mixed skeletal anchorages (Figure 4).

68.2% reported using an activation protocol once daily; 54.3% reported using a protocol of two daily activations; 3.1% reported following a protocol of three daily activations; 6.2% follow another activation protocol (Figure 5).

Discussion

RME Indications

Rapid Maxillary Expansion (RME) is recommended in various clinical situations, primarily to correct transverse maxillary deficiency and its associated functional and skeletal problems. One common reason for RME is treating unilateral or bilateral posterior crossbite, which helps resolve the functional deviation of the mandible. In these cases, maxillary constriction causes premature occlusal contacts, forcing the mandible to deviate upon closure, and RME can address this (3). Another indication for RME is a "V"-shaped arch, where maxillary narrowing is unlikely to resolve on its own. Selective anterior expansion is necessary, especially in patients with cleft palate. In such cases, the anterior maxillary segment often collapses while the posterior segment remains in a normal relationship, requiring targeted expansion (4). Similarly, maxillary contraction related to palatal tilting of upper molars is another reason to use RME. Laterally flared posterior teeth sometimes hide a transverse maxillary deficiency, appearing as normal posterior occlusion. However, closer examination often reveals a narrow maxilla, usually diagnosed when the intermolar width is less than 31 mm, compared to the typical range of 36 to 39 mm. In these instances, RME therapy is essential (5).

Severe crowding in the upper arch is another clinical indication for RME. In individuals of European descent, crowding is often linked to a deficiency in arch perimeter rather than overly large teeth. Transverse or sagittal maxillary deficiencies are frequently primary factors in dental crowding, making maxillary expansion a crucial part of treatment (6). Additionally, RME helps reduce the risk of maxillary canine impaction. When the permanent canine is displaced but still capable of

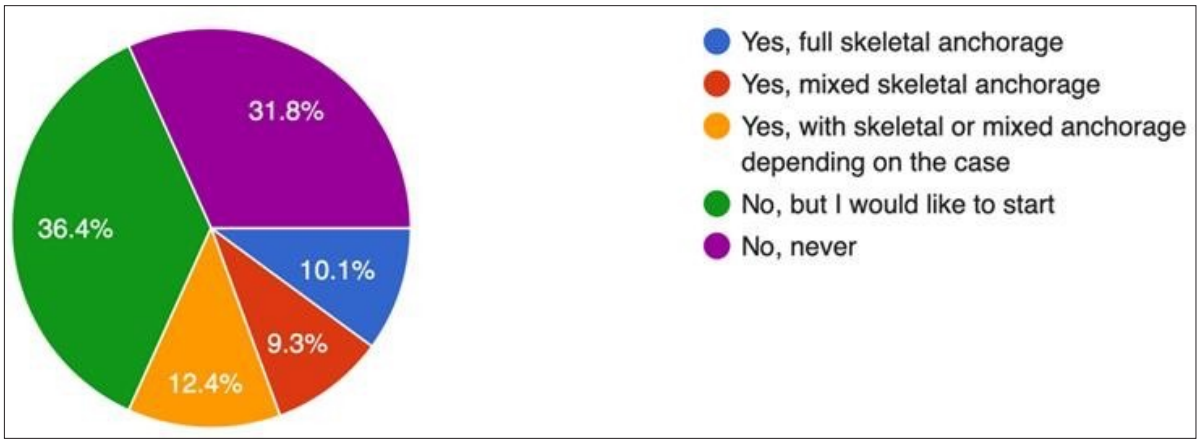

Figure 4. Use of skeletal anchorage with mini-screw among participants

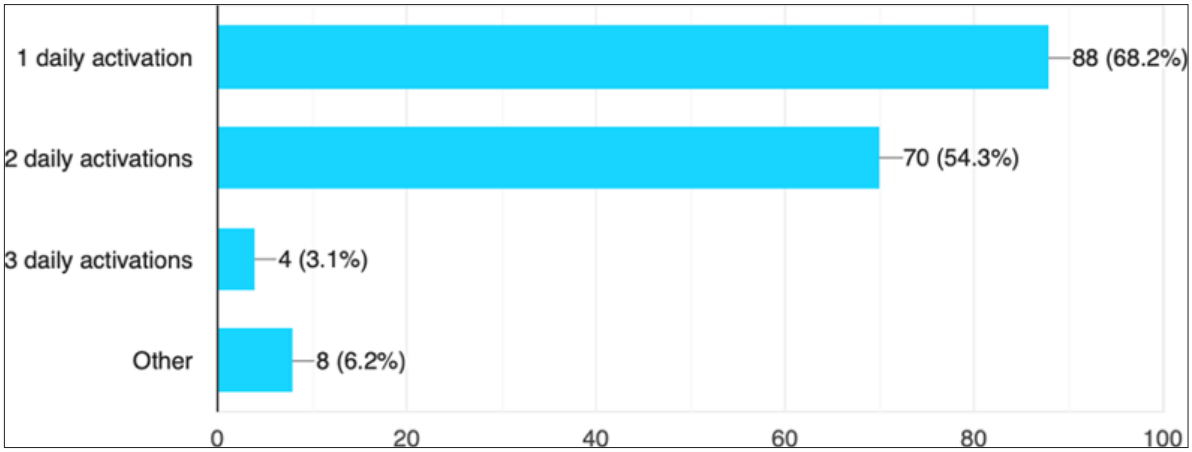

Figure 5. Rationale behind the choice of activation protocol in RME treatment.

erupting, transverse expansion of the maxillary arch can create the necessary space. The expansion continues until the palatal cusps of the maxillary posterior teeth contact the buccal cusps of the mandibular posterior teeth, optimizing eruption pathways (7,8). Moreover, RME is increasingly recognized for its role in improving respiratory function—especially in cases of oral breathing and Obstructive Sleep Apnea Syndrome (OSAS). Many OSAS patients have maxillary constriction; in young individuals, RME can have a positive orthopedic effect. By inducing skeletal changes and improving airway function, RME supports the interdisciplinary management of OSAS. Patients with a high palatal vault, often associated with OSAS, also benefit from RME (9,10). Lastly, RME is indicated in cases of dental protrusion. When the maxillary arch is narrowed, worsening anterior crowding, incisor proclination, and increased overbite, maxillary expansion can help reshape the arch, reduce dental protrusion, and improve occlusal stability. These findings support the use of RME to comprehensively manage sagittal and transverse arch development (11).

RME effects and adverse events

RME therapy has various effects on both dental and skeletal structures. One of the most immediate results is the formation of an inter-incisal diastema, caused by the lateral movement of the dentoalveolar processes. However, this diastema often closes spontaneously after treatment (12). Additionally, RME has been shown to naturally help correct Class II malocclusions and is effective in treating Class III cases when combined with a face mask. The therapy also helps resolve dental crowding and has been linked to increased size of the nasal cavity and airway openness, which improves breathing (13,14).

The expansion achieved through RME has positive effects on smile aesthetics. Studies show a significant increase in transverse smile width, with greater maxillary central and lateral incisor exposure. Additionally, the treatment helps maintain smile symmetry while preserving the natural curve of the maxillary incisal edges relative to the lower lip contour (15). However, some adverse effects have been reported, including increased vestibular angulation due to the expansion force acting on the palatal aspect of dental crowns, which can cause unwanted buccal tipping (16,18). In Class III patients, RME has been linked to decreased upper incisor inclination. While maxillary incisors tend to be proclined and extruded initially, mandibular incisors experience slight retroclination. The initial phase of treatment keeps molars in place because of occlusal force on the expander, while in the second phase, maxillary molars are extruded to establish proper occlusion (19). Differences in treatment effects are observed depending on the activation protocol used. Both slow and rapid activation rates effectively increase intra-arch widths, although a rate of 0.8 mm/day produces the most notable results (20). Mandibular intermolars and intercanines also show increased distances shortly after RME, with statistically significant changes at the time of expander removal or one year post-treatment. However, long-term evaluations suggest a slight reduction in these widths over time (21). Pain levels experienced during RME vary depending on the activation protocol, with lower expansion rates associated with less discomfort. The most painful period generally occurs between the fifth and tenth activation phases, and pain perception is influenced by the patient's skeletal maturity (22,23). The treatment also encourages spontaneous upper arch alignment when anchored to deciduous teeth, facilitating increased transverse width in the intermolar and intercanine regions. This change is maintained throughout the entire stage of permanent dentition. Early expansion, especially before the eruption of maxillary lateral incisors, allows for a rapid increase in anterior arch length, creating space and reducing crowding (24). Additionally, RME increases nasal cavity volume, further supporting its role in improving respiratory function (25).

One of RME's key benefits is its role in spontaneously correcting anterior crossbite. The therapy influences mandibular rotation, enhances vertical ratios, and facilitates the forward movement of the maxillary complex, which helps fix anterior crossbite (26,28). Additionally, RME has been linked to spontaneous lower arch alignment. Studies show that mandibular arch width increases because of the orthopedic effects of early RME treatment, with stability lasting into adulthood (29).

However, RME is not without risks, such as root resorption. Research indicates that tooth-loaded RME therapy carries a higher risk of root surface changes compared to other expansion techniques. Most root resorption occurs on the buccal surface of the roots and appears as small, irregular gaps (30,33). Another concern is the potential for relapse after RME treatment. Transverse relapse can result from inadequate retention time and may be minimized by extending retention for at least three months in adult patients. Overexpanding by 2-3 mm is often recommended to prevent relapse, and retention duration should be customized for each case (34,35). In some cases, the maxillary and mandibular arch perimeters initially increase but tend to revert to near pre-treatment levels over time. While RME remains relatively stable, the mandibular intercanine width has been shown to return to baseline values after treatment (36,37).

Clinical choices

The questionnaire results reveal clear trends and differences in how orthodontists use Rapid Maxillary Expansion (RME). A strong preference for the Hyrax expander was observed, with 71.9% of respondents choosing it as their main RME device, compared to only 13.3% who used the Haas expander. This preference might be because of the Hyrax expander's benefits, such as easier hygiene maintenance due to its all-metal design and controlled, predictable expansion ability. The lower use of the Haas expander may be related to the presence of acrylic parts, which can cause more plaque buildup and discomfort for patients.

A main concern raised in the responses is the choice of anchorage teeth. Deciduous teeth should be used for anchorage because they lower the risk of negative effects on permanent teeth, such as root resorption

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or excessive tipping. However, 58.9% of respondents reported mainly using RME in the permanent dentition, showing a preference for molar anchorage over primary teeth. This practice might be because many clinicians begin expansion treatments later than ideal, after deciduous molars have exfoliated. Still, earlier intervention using deciduous molars for anchorage could enhance skeletal outcomes and reduce dental side effects.

Another aspect requiring further consideration is the number of anchorage teeth used during RME. While literature supports using two-tooth anchorage as the most biomechanically efficient approach, the questionnaire results show considerable variation in clinical practice. Only 39.4% of respondents reported using two-tooth anchorage. In comparison, 30.7% preferred four-tooth anchorage, and 24.4% adjusted their approach based on the patient's developmental stage—using two anchor teeth in prepubertal patients and four in pubertal patients. Although it may offer increased stability, choosing four-tooth anchorage might also cause unwanted dental effects such as excessive buccal tipping. These findings highlight a gap between ideal biomechanical recommendations and actual clinical practice, emphasizing the need for greater awareness and adherence to evidence-based protocols in RME therapy.

Conclusions

This study provides valuable insights into current clinical practices for Rapid Maxillary Expansion (RME) among orthodontists. The questionnaire responses confirm that RME remains a widely used method for correcting transverse maxillary deficiencies and related malocclusions, significantly impacting dental and skeletal structures. The Hyrax expander was identified as the preferred device, likely due to its ease of maintenance and predictable expansion. However, differences in anchorage choices indicate a gap between evidence-based guidelines and actual clinical practice. While deciduous teeth are often selected as the preferred anchorage to reduce unwanted dental effects, most respondents reported using permanent molars, which may increase the risk of root resorption and excessive tipping. Furthermore, the preferred number of anchorage teeth varied considerably, despite research supporting the use of two teeth as the most biomechanically efficient option.

The study also highlights the variety of activation protocols, anchorage methods, and expansion strategies, pointing to the need for more standardization in RME treatment. Additionally, the positive effects of RME on airway function, spontaneous dental alignment, and occlusal relationships emphasize its significance in interdisciplinary treatment planning. Due to potential adverse effects like relapse and root resorption, clinicians should carefully assess each case and optimize retention protocols. Future research should develop clinical guidelines to enhance treatment outcomes and ensure long-term stability in RME therapy.

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