

# Assessing the Efficacy and Stability of Rapid Maxillary Expansion and the Delaire Appliance in Skeletal Class III Malocclusion: A Narrative Review

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**Abstract Background:** A Class III skeletal malocclusion is a very complex condition in orthodontics practice, and its solution is often carried out orthopedically. The most used orthopedic devices include rapid maxillary expansion (RME) and the Delaire Appliances to treat not only maxillary deficiency but also to correct the position of the upper jaw. Even if these interventions become sustainable in the short term, their long-term stability remains questionable. **Aim:** reveal a pretty complicated relationship between orthopaedic and orthodontic surgeries and their influences on the volume of the upper respiratory tract and craniofacial correction. **Methods:** We searched multiple online databases including; Web of Science, Scopus, Google Scholar, PubMed, and Cochrane Library. We used the following search strategy; "Rapid maxillary expansion" OR RME AND ("sleep apnea" OR "sleep-disordered breathing" OR "sleep-related breathing disorders" OR "sleep apnea-hypopnea syndrome" OR SAHS) AND (children OR pediatric) AND ("orthodontic treatment" OR "orthopaedic treatment" OR "maxillary expansion") AND (oximetry OR polysomnography). **Results:** RME and the Delaire appliance were seen to be promising in the short term with an outcome of correction of maxillary transverse deficiency and skeletal relationships. Nevertheless, the issue of the long-term stability was spotted, including with regard to growth. But nevertheless both interventions exhibited some really valuable additions in general treatment of skeletal class III malocclusion. **Scientific Novelty:** This literature review synthesizes and summarizes the current knowledge on the effectiveness and durability of RME and the Delaire splint concerning skeletal class III malocclusion, presenting perspectives on their short-term impact and long-term performance. With its emphasis on poorly understood issues and new research, it greatly assists in updating our knowledge about orthopedic treatments. **Conclusion:** In a relatively short period of time, the rapid maxillary expansion method as well as the Delaire appliance can produce positive outcomes in terms of correcting the retroposition in cranial base class III malocclusion. Although, long lasting stability issues remain a worry and make the case for continued research and clinical monitoring for achieving better treatment outcomes and evidence-based practices in orthodontics.

**Key Words** rapid maxillary expansion, delaire appliance, skeletal class III malocclusion, upper jaw retroposition, Orthopedic interventions

## 1. Introduction

Breathing freely has a vital role in maintaining overall health and well-being. A fully developed upper respiratory tract is the passage of air from the nose to the lungs and is responsible for optimal oxygen intake and proper facial growth [1]. Unfortunately, the problem of the uppermost jaw retrognathia which makes it situated more apart from the ideal position is one of the most frequent structural hindering this process. As well as impeding breathing, this disease may also cause facial deformities and aesthetic problems, which could be a source

of worries about appearance [2], [3].

Orthopaedic and Orthodontic surgeries have a vital role in the treatment of craniofacial anomalies, they not only address the aesthetics concerns but also treat issues related to breathing and overall health [4]. These interventions have been in place for a long time and they are effective in changing the facial skeletons and teeth structure so that they can improve the lives of those affected by different craniofacial conditions [5]. Rapid Maxillary Expansion (RME) techniques as well as Delaire face covering have been proven to be effective in

promoting upper jaw expansion. The goal of this treatment method is not just the expansion of the maxilla but also applying orthopaedic force which stimulates anterior midface growth improving sagittal disharmonies and face balance [6].

Most utilized as the frontline remedies in the orthodontic arsenal for the treatment of maxillary cross bite, the RME devices, also known as palatal expanders, have become a mainstay in the treatment of transverse maxillary deficiencies. These types of devices customly exert a controlled force laterally on the maxillary bones the result of which is the suspension of the midpalatal suture and the widening of the maxilla. Essentially, the fixed RME devices, while increasing the upper arch thickness, provide adequate space for overcrowded teeth, a posterior crossbite correction, and consequently, an improved dental occlusion [7], [8].

Among other things, using Delaire masks is an important step in the very process of choosing orthodontic methods, especially in cases of Class III malocclusions with mandibular prognathism and maxillary retrusion. Unlike those of traditional orthodontics [9], the Delaire face mask produces one-way orthopaedic traction of the maxilla toward the front which subsequently makes midface forward movement and leads to improved aesthetics [10]. This orthopaedic approach is not only aimed at correcting skeletal anomalies but also at achieving an esthetic smile with facial esthetics.

Therefore, the question "should treatment for upper jaw retrognathia be chosen?" should not be considered as a universal answer for everyone. Exploring how effective they are involving a deeper exploration. This review will critically analyze studies related to the applicability of RME with Delaire face masks [11]. A particular measurement will be explored on linear cephalograms known as Transnasopharyngeal height (TRH). The role of the TRH is similar to the ruler, measuring out the extent of the upper airway. Through the investigation of ways in which these treatments alter TRH and studying their potential to enhance respiratory functions, we can generate crucial information [12].

In this narrative review, our main issue is to reveal a pretty complicated relationship between orthopaedic and orthodontic surgeries and their influences on the volume of the upper respiratory tract and craniofacial correction. Firstly, we are ready to study the interplay between fixed RME appliances and a Delaire face mask and their effectiveness in the treatment of the group of craniofacial malformations ranging from disorder of the upper jaw position retrognathism to Class III malocclusions and crossbite. The review, we intend to conduct, is guided by a coherent critical analysis of the past literature to explore the impacts of the combined treatment approach.

#### **A. Research Focus**

This narrative review centers on exploring the effectiveness and stability of RME and the Delaire appliance in addressing retroposition of the upper jaw, particularly in the context of skeletal class III malocclusion.

#### **B. Research Problem**

This review article focuses on the problems of the long-term stability of RME and Delaire appliance, often used for the correction of retroposition of the upper jaw, mostly in class III skeletal malocclusions.

#### **C. Research Question**

The central research question guiding this review is: Is RME as well as the Delaire appliance proven to be effective in the recovery of upper jaw retrusion in patients with skeletal class III malocclusion long term?

#### **D. Research Aim**

This review aims to discuss the effectiveness and stability of RME and the Delaire appliance in fixing the retroposition of the upper jaw, which mainly focuses on the short-term efficacy and long-term stability in patients with class III skeletal malocclusion.

## **2. Literature Review**

### **A. Craniofacial Anomalies and Orthodontic Treatment**

Craniofacial malformations range from a series of different conditions due to the shape and alignment of the face and bones. Apart from the most frequent dysmorphisms are the displacements of the upper jaw, Class III dental and alveolus malocclusion, and the bite in non-uniformity [13]. The opposite procedure of upper jaw positioning backwards, which is called maxillary retrusion, is one of the most typical kinds of facial deformity. In this case, the upper jaw is placed behind the lower one leading to the concave facial structure and the inadequate upper lip appearance. Class III malocclusions is a condition involving a difference between the uppers and lower jaws with the lower jaw jutting further out while the upper one remains behind, giving the bite a protruding appearance. The shift of upper and lower jaw to front or back teeth can be due to maxillary retrusion mandibular protrusion or both. Crossbite is a case of misalignment on a horizontal plane between the upper and lower teeth when connected with the lower teeth being placed behind the upper teeth when the jaws are closed [14].

These facial and cranial anomalies not only contribute to malocclusion but also have grave impact on breathing and overall facial harmony which are critical for beauty. Maxillary retrusion and the Class III malocclusions can cause the upper airway to be narrowed while at the same time an individual develops breathing problems with the nose resulting in the development of obstructive sleep apnea and other respiratory disorders [15]. For instance, the abnormal facial features evoked by these defects may also create esthetic issues and psychological distress, resulting in low self-esteem and a deterioration of the quality of life of the affected person. Besides this, crossbite can distort the jaws and thus the entire facial features leading to more and more esthetics and functional issues.

Orthodontic treatment methods till recently were only concerned with straightening crooked teeth and correction of

occlusion through braces, aligners, and other appliances. The mentioned strategies are capable of reaching the treatment goal of mild to moderate malocclusions. However, they might not be able to modify the underlying skeletal discrepancies related to maxillary retrusion and Class III malocclusions [16]. In light of the lack of effectiveness of the usual orthodontic therapies, there has been an increase in the merge of the orthopaedic interventions that change the underlying skeletal system to result in a more integrated craniofacial correction.

The emergence of orthopaedic treatments represents a paradigm shift in orthodontic practice. The fixed RME and the Delaire face mask, which are interventions in the field of orthopaedics, target the underlying structures of the skeleton in an attempt to produce positive growth patterns and aesthetically pleasing appearances of the face. Adjustable RME equipment applies stable lateral forces to the maxilla causing the middle palatal suture to open and the width of the maxillary arch to increase. This movement widens the lower jaw and makes room for the teeth to fit in properly and at the same time, increases the upper airway volume, thus enhancing respiratory function. The Delaire mask provides uniaxial orthopaedic force to the maxilla that is capable of correcting the forward midface movement and Class III malocclusions [17].

### **B. Rapid Maxillary Expansion (RME) Devices**

1) Description of RME devices and their mechanism of action in widening the maxilla

Fixed RME devices are orthodontic appliances which are made up of a series of metal bands serving the upper jaw (maxilla) by applying even pressures on the dental arch from the sides. The device is constructed of a screw instead, it is just placed in the palate region with bands or attachments bonded to the posterior teeth. In this process, the screw and the osteotomy are gradually pulled apart, building tension at the mid-palatal suture and finally separating the maxillary bones [18].

RME devices operate through the manipulation of mid-palatal suture, a fibrous joint between the two halves of the maxilla. The midpalate suture during childhood and adolescence stays open and susceptible to orthopaedic forces, and it allows controlled expansion of the maxillary dental arch. Active rotation of the RME device is accompanied by the lateral forces that are transmitted to the surrounding bone and, as a result, the maxillary halves start to separate, and the dental arch widening occurs [19].

2) Review of studies demonstrating the efficacy of fixed RME devices in correcting transverse maxillary deficiencies  
Numerous clinical studies have demonstrated the efficacy of fixed RME devices in correcting transverse maxillary deficiencies and expanding the upper dental arch. These studies have consistently shown significant increases in maxillary width following treatment with RME devices, as measured

by dental casts, radiographs, and three-dimensional imaging modalities [20].

Lee et al [21]. have proposed a non-surgical approach to Rapid Maxillary Expansion (RME) using mini-implants, known as miniscrew-assisted rapid palatal expansion (MARPE), as an alternative for patients with advanced skeletal maturation. Unlike traditional techniques that apply forces directly to the teeth or periodontium, MARPE applies forces to mini-screws positioned near the midpalatal suture. This approach eliminates the need for surgical osteotomies, reducing invasiveness and associated risks.

MARPE offers several advantages over traditional RME methods. Firstly, it provides a skeletal effect with minimal dentoalveolar effects, making it suitable for patients with matured skeletal structures. Additionally, MARPE poses no surgical risks, as it does not involve invasive procedures. The results of MARPE treatment are reasonably stable, and the technique is more financially accessible compared to surgical alternatives like surgically assisted RME (SARME) [22], [23].

3) Discussion on the benefits of maxillary expansion in improving respiratory function and alleviating symptoms of obstructive sleep apnea

Maxillary expansion not only corrects dental and skeletal discrepancies but also has significant implications for respiratory function and airway patency. By widening the maxilla, RME devices create additional space within the upper airway, reducing nasal resistance and improving airflow during breathing. This can be particularly beneficial for individuals with narrow nasal passages or obstructive breathing disorders, such as obstructive sleep apnea (OSA) [24].

A previous systematic review and meta-regression considering the influence of RME on childhood sleep apnea-hypopnea [25]. They analyzed the effects of oximetry variables before treatment and after the treatment with RME. The findings presented a strong effect on the oximetric parameters such as the decline in the apnea-hypopnea index (AHI), augmentation in oxygen saturation (SO<sub>2</sub>), improvement in sleep efficiency (SE) and increase in rapid eye movement (REM) phase. The results indicate that RME may be an efficient form of treatment for mild and moderate obstructive sleep apnea in children with maxillary hypoplasia, possibly complementing the adenotonsillectomy in severe situations of sleep apnea syndrome.

Moreover, lateral maxillary expansion has been observed to improve nasal breathing while inhibiting mouth breathing; these actions are imperative in plastic surgery because they impact airway patency, sleep quality, and daytime function. RME devices stand out from other treatment protocols for obstructive sleep apnea because they are non-surgical and non-invasive treatment options that address fundamental anatomical obstructions that contribute to apnea [26].

### **C. Delaire Face Mask: Uniaxial Orthopedic Force Application**

Aspect	Summary
Craniofacial Anomalies	Common anomalies include retroposition of the upper jaw, Class III skeletal malocclusions, and crossbites.
Impact on Breathing	Anomalies can lead to breathing difficulties, including obstructive sleep apnea syndrome (OSAS).
Orthodontic Treatments	Traditional treatments address malocclusions, with emerging focus on orthopedic interventions like RME and the Delaire appliance.
Role of Rapid Maxillary Expansion (RME)	RME widens the maxilla, improving respiratory function and correcting transverse maxillary deficiencies.
Role of the Delaire Appliance	The Delaire appliance aids in forward maxillary protraction, correcting sagittal discrepancies and promoting facial growth.

Table 1: Summarised information about the craniofacial anomalies, their effect and their management

1) Introduction to the Delaire face mask and its unique design for forward maxillary protraction

The Delaire face mask is an orthodontic procedure that is used to treat Class III malocclusions, an issue where the lower jaw protrudes in front of the upper jaw. This is the discrepancy between the upper and lower jaws. In contrast to standard orthodontic appliances, the Delaire face mask is designed to neutralize multi-axial orthopedic forces on the maxilla thus resulting to forward movement of the midface and correction of sagittal errors.

Generally, the human face mask Delaire 's design consists of the facial carrier, which is connected to intraoral devices, and these devices, like palatal spreaders and miniplates, are built to be secured with the maxilla. This force, acting in the anterior direction, elicits forward growth of the midface, and at the same time aids with orthodontic treatment of Class III malocclusions [27].

2) Overview of the biomechanics involved in applying orthopaedic force to correct sagittal discrepancies

The Delaire face mask employs biomechanical forces by the application of controlled orthopaedic forces to the maxilla, thus initiating bone remodelling in that area to stimulate midface forward growth. The traction effect is achieved on the maxilla by the pressure of the Delaire face mask which forces the anteriorly-directed movement of the maxilla. As a result, the discrepancies are corrected, and the facial profile is improved.

The force that is applied by the Delaire facial splint is directed to sutures and bones of the maxilla encouraging bone deposition and remodelling that occurs in response to mechanical stimuli. This kind of teeth movement slowly moves the maxilla towards a vertical axis where it meets the mandible and eventually results in the proper alignment of teeth [28].

3) Review of clinical studies evaluating the effectiveness of the Delaire face mask in correcting Class III malocclusions and promoting forward facial growth

Numerous clinical studies have demonstrated the effectiveness of the Delaire face mask in correcting Class III malocclusions and promoting forward facial growth. These studies

have reported significant improvements in skeletal relationships, dental occlusion, and facial aesthetics following treatment with the Delaire face mask [29].

### 3. Methods

#### A. General Background

Orthopaedic and Orthodontic surgeries have a vital role in the treatment of craniofacial anomalies, they not only address the aesthetics concerns but also treat issues related to breathing and overall health. RM techniques as well as Delaire face covering have been proven to be effective in promoting upper jaw expansion. The goal of this treatment method is not just the expansion of the maxilla but also applying orthopaedic force which stimulates anterior midface growth improving sagittal disharmonies and face balance.

Most utilized as the frontline remedies in the orthodontic arsenal for the treatment of maxillary crossbite, the RME devices, also known as palatal expanders, have become a mainstay in the treatment of transverse maxillary deficiencies. These types of devices customly exert a controlled force laterally on the maxillary bones the result of which is the suspension of the midpalatal suture and the widening of the maxilla [30].

#### B. Inclusion Criteria

- Research methodology includes RCTs, observational studies, meta-analyses, cohort studies, and case-control studies.
- Selected recent articles (i.e. 2019), with a cut-off date, to refresh the knowledge.
- Studies that highlighted the role of the use of orthopaedic traction in the correction of retroposition of the upper jaw

#### C. Exclusion criteria

- Non-peer review articles such as study proposals, opinions, and letters to the editor.
- Articles not related to our topic.

#### D. Data Collection

We searched multiple online databases including; Web of Science, Scopus, Google Scholar, PubMed, and Cochrane Library.

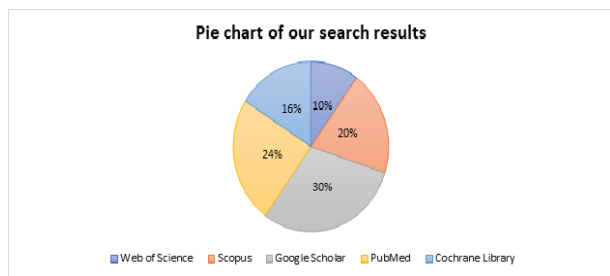


Figure 1: Summary of our included studies

We used the following search strategy; "Rapid maxillary expansion" OR RME AND ("sleep apnea" OR "sleep-disordered breathing" OR "sleep-related breathing disorders" OR "sleep apnea-hypopnea syndrome" OR SAHS) AND (children OR pediatric) AND ("orthodontic treatment" OR "orthopaedic treatment" OR "maxillary expansion") AND (oximetry OR polysomnography)

#### E. Data collection

The included studies were reviewed following three stages. The first involved using EndNote Software to import the findings from electronic databases into a Microsoft Excel sheet. During the second phase, the titles and abstracts of the articles entered into the Excel sheet were screened. The next stage was assessing the included citations from Stage 2's full text. In addition, we cross-checked the studies' references for any missed ones.

#### F. Statistical analysis

We conducted a qualitative study of the previously published studies. We could not do a quantitative analysis because our study is a narrative review. The outcomes that will be measured in the quantitative analysis must be specified, and more than two studies reporting data on these outcomes must be located and compared to conclude. We attempted a quantitative analysis in our research, but we could not identify specific results relevant to our subject or papers that presented similar data. To get strong evidence and current results and conclusions, we conducted a qualitative analysis of papers relevant to our topic, presented their findings, and compared them.

### 4. Results

A systematic search employing a specific search strategy yielded 500 articles initially. Subsequent screening based on titles and abstracts narrowed down the selection to 100 articles for full-text evaluation. Upon thorough assessment, 30 articles were deemed relevant and subsequently utilized to inform and construct this review. Refer to Figure 1 for a graphical representation. One of our important studies was published in 2023 [31] and investigated the efficacy of orthodontic treatment using RME together with the Delaire mask in children with OSAS and class III malocclusion. The goal was to evaluate variations in cephalometric mea-

surements of upper airway dimension and clinical symptoms of OSAS before and post-treatment. Fourteen paediatric patients, aged 6 to 10 years old, with mixed dentition were selected for the study. All patients were treated using the RME and the Delaire masks. Pre- and post-treatment cephalometric radiographs have been examined and compared.

Through the study, they observed a significant increase in upper airway linear measurements, nasopharyngeal, and oropharyngeal dimensions post-treatment ( $p \geq 0.05$ ). This has been accompanied by an increase in airway patency and eye conditions related to obesity hypoventilation syndrome. These results may indicate that RME along with the Delaire appliance can be an effective modality for pediatric patients with Class III malocclusion and OSAS. The implication of this study is that clinicians should consider this treatment protocol for pediatric patients with class III malocclusion and OSAS, while also emphasizing the importance of multidisciplinary collaboration, comprehensive assessment, patient education, and long-term follow-up for optimal outcomes.

Another study was a meta-analysis [32] that studied the therapeutic implications of RME in positive sleep apnea-hypopnea syndrome (SAHS) among pediatric patients, examining its performance on different oximetric parameters. The criteria for inclusion focused on pediatric individuals undergoing RME treatment for SAHS with pre-treatment and post-treatment oximetric data available. Among the ten articles which I considered to qualify for the qualitative synthesis nine intended to contribute to the meta-analysis. They revealed a major advancement in the oximetry parameters after RME treatment. In particular, there was a remarkable reduction in mean AHI values by 5.79 events/hour, an important increase in mean oxygen saturation by 2.54%, a notable decrease in AI by 2.17 events/hour, a considerable elevation in REM phase by 1.20%, and a slight rise in SE by 0.961%.

Focusing on the class III malocclusion one of our studies [33] evaluated the short-term treatment effects of two types of facemasks on skeletal Class III patients. A total of 40 patients with Class III malocclusion who had a mean age of 7.7 years were included in this retrospective study. The patients had received treatment either by the protraction facemasks with forehead straps (PFFS) or by the Petit facemask (PTF). Initial lateral cephalograms were examined before treatment (T1) and after (T2), with an average of 9-month intervals. The outcomes demonstrated that both the PFFS and PTF groups showed a similar sagittal and vertical dentoskeletal pattern at T1. T1 to T2 period both groups were found to have significant forward movement of the maxilla, posterior movement and clockwise rotation of the mandible (all  $p < 0.001$ ).

To study the post-treatment stability after the face mask therapy in skeletal class III malocclusion. We included another systematic review published in 2023 and focused on this concern. They reported that in the short-term follow-up after implementing the face mask (FM) intervention, the results were found to be stable. In the long run, the maxillary FM facet was found to stay stable [34]. However,

the mandible accommodated this patient by growing in a horizontal and unpleasant fashion until the just started the adolescent growth spurt. The crucial determinant that determines the long-term results of FM treatment is the magnitude and the line of mandibular growth during the pubertal development spurt. It is a necessity to pay attention to restricting unfavourable mandibular growth and duration of retention in order to post-FM therapy effect.

#### **A. Teleröntgenogram (TRG) analysis in lateral projection radiographs**

TRG, providing a panoramic view of the skull in lateral projection, offers comprehensive insights into craniofacial structures and their relationships. TRG analysis involves assessing various cephalometric measurements. TRG in lateral projection in sagittal direction make it possible to assess jaw location in the space and teeth displacement in anterior-posterior dimension. For an orthodontist TRG image in lateral projection is a must for diagnostics and treatment planning. Hence, the image is interpreted and calculated by means of the bone points and on the soft tissues' lines are made between them, forming angles; after that the mathematical calculations are made. It allows the orthodontologist to make a correct diagnosis and determine conditions for orthodontological treatment: kind of growth, tooth joint plane (occlusion plane), teeth inclination and the best location and spatial position of the lower jaw towards the upper one [35].

Several studies have proven the RME and the Delaire Appliance to be effective in increasing the upper respiratory tract volume, as measured through TRG analysis. The increase of the maxillary arch due to the use of these mechanical devices widens the nasal cavity and therefore improves the airflow, so that the symptoms of obstructive sleep apnea and other respiratory disorders in children and adolescents are reduced [35].

#### **B. Clinical Implications**

TRG analysis is a precious instrument for orthodontists in the evaluation of the efficiency of the mechanical devices for the upper respiratory tract expansion. Through the evaluation of TRG images before and after the treatment with RME or the Delaire Appliance, the clinicians are able to measure the changes in the upper airway dimensions and thus, monitor the results of the treatment. The usage of these devices at the early stage may be able to stop the progression of respiratory conditions and thus, to improve the overall respiratory health of the pediatric patients [35].

#### **C. Future Directions**

Nevertheless, more research is necessary to clarify the long-term effects of RME and the Delaire Appliance on the upper respiratory tract volume and respiratory function in children and adolescents. Besides, the comparative studies of the efficacy of the mechanical devices and their effects on the TRG parameters can be the source of the information about

the best methods of treatment to reduce the upper airway dimensions.

### **5. Discussion**

Our study summarized the evidence related to success in orthopaedic and orthodontic therapies which particularly addresses craniofacial anomalies like retroposition of the upper jaw, class III skeletal malocclusions and crossbite. Besides the above, the combination of RME equipment together with the Delaire mask was acknowledged as a good therapy to change the abnormalities and facilitate respiratory functions. By utilising fixed RME apparatuses, doctors are able to maintain controlled and predictable expansion of the maxilla, which results in quite a big enhancement of the transverse maxillary deficiency and nasal patency. Furthermore, it was noticed that the Delaire face mask innovation has biomechanical features that resolve the sagittal discrepancies and facilitate comfortable protrusion of jaw.

It has been repeatedly confirmed by clinical studies that the combination of this method ensures the treatment of Class III malocclusions and the esthetics of the face as well [36]. Besides, the review assessed the effects of orthopaedic interventions on the upper airway dimensions and OSAS in pediatric patients. The results indicate that RME treatment eliminates symptoms such as AHI and SO<sub>2</sub>, pointing to the general improvement of respiratory functions and the decrease of the severity of OSAS.

A study by Remy et al [37] assessed the effectiveness of a maxillary expansion devices in the treatment of OSAS in Class II children and also in improving their respiratory status during sleep. The children were studied before and after the treatment for a total of 103 but the long-term effects were evaluated by sleep questionnaires administered to the parents. With treatment over nine months, a significant improvement in sleep breathing quality was demonstrated by systematic descent in the Apnea/Hypopnea Index to not more than 5.

However, a follow-up study after many years demonstrated that more than half of patients had no audible and clear breathing at that time. It was pointed out that a combination of maxillary expansion with mandibular advancement resulted in a three-dimensional increase of the oral space, which seemed to be an important contributor to substantial improvement of the OSAS symptoms and it could have a long-term impact on the sleep breathing quality as well.

Another study evaluated [36] cephalometric alterations in upper airway dimensions and facial morphology of pediatric patients with sleep-disordered breathing (SDB) treated with rapid RME and compared them with a control group treated with RME for malocclusion. Retrospectively measured, pre- and post-treatment cephalometric variables were measured in 20 control patients (mean age  $7.61 \pm 0.6$ ) and 20 SDB pediatric patients (mean age  $8.4 \pm 0.5$ ). Skeletal airway dimensions and mandibular position were altered to a great extent in both studies and class II skeletal correction was seen in SDB children. RME was associated with the increased dimensions of structures in the upper airways in SDB as well

as control subjects, implying a tendency to establish a class 2 relationship.

A previous review [38] addressed the ongoing debate surrounding the effectiveness of skeletal maxillary expansion in improving upper airway dimensions, particularly in cases of constricted maxilla. Whenever a constricted maxilla is involved the general dentists, ENTs and Paediatricians should consider if ME is actually an option to improve the current condition. While the limited/poor quality of systematic reviews does not allow us to recommend ME solely for upright airway enhancement, the orthodontic indication should support ME.

A recent systematic review in 2023 [12] focused on the stability of orthopaedic correction that is achieved after face-mask therapy in patients with skeletal class III malocclusion. A thorough search across different databases ended up with 14 studies that were eligible. The review concluded that while the maxillo-mandibular differential was likely to regress to its class III position post-process, the maxillary modifications achieved were spotted to vary, with slight increases in SNA angles and greater changes in SNB angles. Instead of the lower anterior facial height, the maxillary and mandibular incisors exhibited proclination, and the decreases in overjet and overbite were involved. Yet, the soft tissues were not affected. Initially, the FM treatment was rather stable, particularly given the maxilla. However long-term evaluation revealed mandibular horizontal and unfavorable growth into adolescence.

## 6. Limitation

The major drawback of our study is that it is an overview in the form of a narrative review covering majority of observational studies. The data from the summarized trials is apportioned into paragraphs and compared to each other without being pooled together. Therefore, true objectivity and subjects combined as one are impossible. A narrative review is the most recent publication that presents a complete roundup of the published evidence. Such a case can be also used for a complete examination of evidence. Since it fully disregards the hypothesis with which it is in disagreement, it does not guarantee that what is now believed to be true is true.

## 7. Conclusion

The article emphasizes the contribution of RME and the Delaire device towards the treatment of retrognathia, which is associated with skeletal class III malocclusion. Orthodontic interventions offer a good opportunity in the short term by giving airway patency, wide maxilla, and favorable skeletal and dental changes. Although long-term stability is worth consideration, future investigations and clinical monitoring are imperative. Notwithstanding that, RME and the Delaire appliance forms an important part of upper jaw repositioning management, which offers possible benefits for class III patients with skeletal. Ongoing investigation and longitudinal

studies will continue to be of great help in tuning the treatment methods for better results in the patients.

## 8. Future Direction

The future directions of the orthodontic interventions for craniofacial anomalies involving repositioning of upper jaw include improving imaging technologies, personalized treatment approach, interdisciplinary work, and long-term follow-up studies. Integration of imaging techniques of CBCT caliber and 3D imaging is anticipated to improve planning and evaluation of treatment. According to personalized orthodontics that is targeted to specific patient characteristics, as well as to the development of protocols by specialists, will be a critical point. Furthermore, long-term follow-up studies produce the necessary knowledge regarding the efficiency and effectiveness of the interventions in the long run that helps to improve patient outcomes and quality of life.

## Ethical Statement

Not applicable.

## Funding

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## Data Availability

Data are available upon contacting any of the authors.

## Conflict of interest

The authors declare no conflict of interests. All authors read and approved final version of the paper.

## Authors Contribution

All authors contributed equally in this paper.

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