



## Optimization of facial aesthetics through orthognathic treatment: a systematic review

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### Abstract

**Introduction:** In the aesthetics scenario, facial optimization is considered an essential outcome of orthognathic treatment (OT) due to its potential advantages in reducing the duration and cost of treatment, providing early aesthetic improvement, and increasing patient satisfaction. **Objective:** It presents a systematic review study listing the main optimizations of facial aesthetics through orthognathic surgery, to highlight the importance of this treatment for improving patients' comfort and quality of life. **Methods:** The PRISMA Platform systematic review rules were followed. The search was carried out from January to March 2024 in the Scopus, PubMed, Science Direct, Scielo, and Google Scholar databases. The quality of the studies was based on the GRADE instrument and the risk of bias was analyzed according to the Cochrane instrument. **Results and Conclusion:** A total of 179 articles were found, 45 articles were evaluated in full and 39 were included and developed in the present systematic review study. Considering the Cochrane tool for risk of bias, the overall assessment resulted in 15 studies with a high risk of bias and 31 studies that did not meet GRADE and AMSTAR-2. Most studies did not show homogeneity in their results, with  $X^2=69.5\%>50\%$ . It was concluded space maintenance is one of the most important activities in the prevention of malocclusion. The maintenance of the lost space is of paramount importance to ensure normal eruption and development of the dentition. Aesthetic/functional rehabilitation is

necessary until the eruption of permanent successor teeth occurs. A practical option to obtain this rehabilitation is through the installation of aesthetic or functional space maintainers. There are several requirements, such as maintaining the desired interproximal space, not interfering with the occlusion of the opposing teeth nor with the eruption of the permanent tooth, allowing sufficient mesiodistal space for the permanent tooth alignment to erupt, not interfering in phonetics and chewing and present a simple framework and be easily sanitized. Thus, the neuromuscular stability of the stomatognathic system may be impaired by the presence of deleterious habits.

**Keywords:** Malocclusions. Space maintainers. Aesthetics. Orthodontic treatment.

### Introduction

In the aesthetics scenario, facial optimization is considered an essential result of orthognathic treatment (OT). The surgical first approach (SFA) has emerged as a promising alternative to the conventional orthodontic approach (OFA) due to its potential advantages in reducing treatment duration and cost, providing early aesthetic improvement, and increasing patient satisfaction [1].

In this context, OT makes it possible to restore the functional and aesthetic patterns of the face, and non-surgical or minimally invasive procedures have optimized the results of ortho-surgical facial treatments

[1,2]. In this sense, aesthetic/functional rehabilitation is necessary until the eruption of permanent successor teeth occurs. A practical option to obtain this rehabilitation is through the installation of aesthetic or functional space maintainers [3-6].

Concerning craniofacial growth and development, it is known that throughout life there are variations in its structure, due to the demand and projected requests, such as, for example, oral habits. Habits are patterns of muscle contraction that serve as a stimulus to the normal growth of the craniofacial complex [7-11]. Thus, the face requires besides genetic stimuli, external stimuli for its development, offered naturally by the functions of respiration, suction, chewing, and deglutition. More and more Brazilian adolescents suffer from the lack of or lack of dental spaces, a study confirms that the high rate of dental crowding is an aggravating problem in aesthetics and should have greater attention in public health, these problems can interfere with social life and the self-esteem of adolescents [12-15].

Dental crowding is the type of malocclusion that occurs most frequently among the Brazilian population and leads to the development of caries and gingival diseases, damaging oral health and disfavoring them aesthetically [16,17]. Temporomandibular TMDs may also have their development related to malocclusions, making them an aggravating cofactor of this disease [18].

Orthodontics is the specialty that prevents, intercepts, and treats crowding, diastema, and malocclusion. Orthodontic treatment is essential to reduce the impact of poor quality of life where the treatment period may generate dissatisfaction with the appearance, but the result of the post-treatment brings satisfaction and returns to the well-being of the patient [19]. Contention plates are used after orthodontic correction to control dental movements, it was designed to keep the teeth in the position obtained after orthodontic treatment [20]. There are several containment models used by professionals in orthodontics. Among these varied orthodontic containment models, the most requested for patients are the Hawley and Begg plates for the upper arch the lingual fixed bars, and the Hawley plate for the lower ones [21].

With the advancement of age the stomatognathic apparatus changes, causing the teeth, gums, and bone tissues to change their structures, the professionals must be attentive to these changes and able to take measures of prevention and the promotion of the health of their patients, orthodontics these anatomical and physiological changes may influence the treatment outcome [22]. Space maintainers are important when there is early loss of deciduous teeth due to caries

disease and trauma. The early loss of the second deciduous upper or lower molars after the eruption of the first permanent molars entails closure of space, especially when the permanent successor slows to erupt [23].

Even if the permanent molars are in occlusion, this fact will not prevent the inclination of the permanent ones, however, the loss of space will be less severe than that observed during the active movements of the eruption [24]. Moreover, the installation of a maintainer is necessary to avoid harmful repercussions to the normal development of the occlusion that can lead to future problems of malocclusion such as arch shortening, a mesial inclination of the first permanent molar, and impaction of the second premolar that even succeeding in breaking out, if directed by lingual or palatal accompanied by gyro-versions, supra-eruption of the antagonist teeth and impairment of future periodontal support [25].

Partial or total loss of the dental structure causes a reduction of the available space in the arch, causing a structural and functional imbalance. Each tooth must remain harmoniously in its correct position, aligned with proximal contacts, in semi-elliptic curves for the maxilla, and parabolic for the mandible, receiving the action of external and internal muscular forces [26]. In cases where one of these forces is altered or removed, changes such as dental migration and loss of space, leading to an occlusal disharmony with deleterious consequences to the stomatognathic system of the child, may lead to a discrepancy between the present space and the space required for the eruption and accommodation of all permanent teeth [27].

By the age of six years, the first permanent molars should erupt, with the lower ones before the upper ones preferentially. These teeth, after erupting, seek occlusion with the antagonists guided by the distal face of the second deciduous molars. Thus, early loss of primary molars will impair the occlusion of the first permanent molars. The variations in the time of exfoliation of deciduous teeth depend on several parameters, including genetic and environmental parameters. It is considered a prematurely lost tooth when it occurs at least six months before the loss of the homologous tooth, or when the deciduous tooth does not exfoliate before the half to three-quarters of the root of the successor's tooth is formed [28].

Given this, the present systematic review study listed the main optimizations of facial aesthetics through orthognathic treatment, to highlight the importance of this treatment for improving patients' comfort and quality of life.

## Methods

### Study Design

The present study followed the international systematic review model, following the rules of PRISMA (preferred reporting items for systematic reviews and meta-analysis). Available at: <http://www.prisma-statement.org/?AspxAutoDetectCookieSupport=1>. Accessed on: 03/22/2024. The methodological quality standards of AMSTAR-2 (Assessing the methodological quality of systematic reviews) were also followed. Available at: <https://amstar.ca/>. Accessed on: 03/22/2024.

### Data Sources and Research Strategy

The literary search process was carried out from January to March 2024 and was developed based on Scopus, PubMed, Web of Science, Lilacs, Ebsco, Scielo, and Google Scholar, covering scientific articles from various to the present. The descriptors (MeSH Terms) were used: "*Malocclusions. Space maintainers. Aesthetics. Orthodontic treatment*" and using the Boolean "and" between the MeSH terms and "or" between historical discoveries.

### Study Quality and Risk of Bias

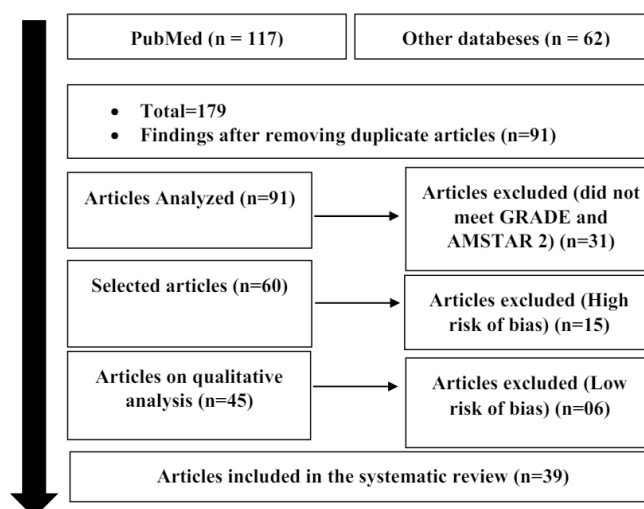
Quality was classified as high, moderate, low, or very low in terms of risk of bias, clarity of comparisons, precision, and consistency of analyses. The most evident emphasis was on systematic review articles or meta-analyses of randomized clinical trials, followed by randomized clinical trials. The low quality of evidence was attributed to case reports, editorials, and brief communications, according to the GRADE instrument. The risk of bias was analyzed according to the Cochrane instrument by analyzing the Funnel Plot graph (Sample size versus Effect size), using the Cohen test (d).

## Results and Discussion

### Summary of Findings

A total of 179 articles were found that were subjected to eligibility analysis, with 39 final studies being selected to compose the results of this systematic review. The studies listed were of medium to high quality (Figure 1), considering the level of scientific evidence of studies such as meta-analysis, consensus, randomized clinical, prospective, and observational. The biases did not compromise the scientific basis of the studies. According to the GRADE instrument, most studies showed homogeneity in their results, with  $X^2=69.5\% > 50\%$ . Considering the Cochrane tool for risk of bias, the overall assessment resulted in 15 studies with a high risk of bias and 31 studies that did not meet GRADE and AMSTAR-2.

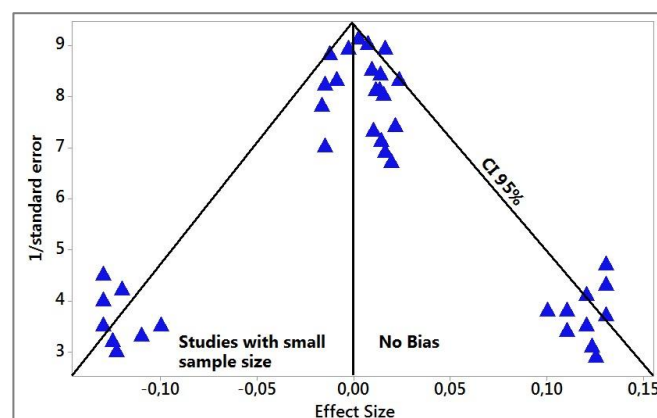
Figure 1. The article selection process by the level of methodological and publication quality.



Source: Own authorship.

Figure 2 presents the results of the risk of bias of the studies using the Funnel Plot, showing the calculation of the Effect Size (Magnitude of the difference) using the Cohen Test (d). Precision (sample size) was determined indirectly by the inverse of the standard error (1/Standard Error). This graph had a symmetrical behavior, not suggesting a significant risk of bias, both between studies with a small sample size (lower precision) that are shown at the bottom of the graph and in studies with a large sample size that are presented at the top.

Figure 2. The symmetric funnel plot suggests no risk of bias among the small sample size studies that are shown at the bottom of the graph. High confidence and high recommendation studies are shown above the graph (n= 39 studies).



Source: Own authorship.

### Major Findings

After selecting the literary findings, a retrospective study of 54 patients compared the costs and benefits of surgical first (SF) and orthodontic first (OF) approaches

in patients with skeletal class III malocclusion. The duration of the SF was shorter than that of the OF, due to the reduced orthodontic time. Operating time was longer with SF than with OF. There was no significant difference in hospital stay, hospitalization, or orthodontic costs. Study results revealed that total treatment time was significantly shorter with SF than with OF, although the two approaches did not differ significantly in terms of the total cost [29].

A high percentage of malocclusions are caused by these early losses, he proposed, in 1907, a space maintainer that would remain unchanged, even if for a prolonged length of stay in the oral cavity [11-14]. In the literature, there have been initiatives towards the use of maintainers since 1924. From 1930, the authors recommend and talk about the necessity of using such devices [15-17]. Space maintenance is one of the most important activities in the prevention of malocclusion [18,19]. The purpose of deciduous dentition is to maintain the perimeter of the bow for successors to erupt normally, hence great importance should be given to tooth loss at this stage. However, attention should be paid to the loss of young permanent teeth [20].

In this context, a study showed that of 119,000 school-aged children examined, a 51% malocclusion index was found, and in 80% of those, a preventive orthodontic treatment orientation would be required [12]. In Brauer's study of the incidence of malocclusions, with 41 patients examined, 42 premature extractions of primary first molars and 71 premature extractions of primary second molars were found [13].

Also, handling the premature loss of deciduous teeth requires care, especially when done by a clinical dentist. The consequences of inadequate procedures have serious repercussions on normal dental development [21]. The loss can compromise the eruption of permanent teeth and decrease the perimeter of the arch. The maintenance of the lost space is of paramount importance to ensure normal eruption and development of the dentition [22-25].

Most of the posterior ones are lost by caries, rarely by trauma [26-28]. To maintain the spaces of dental losses, the use of space-saving devices is indicated, as there is no loss of space, since the permanent tooth may take months to erupt [29-32]. In another study on the incidence of malocclusions, with 41 patients examined, 42 premature extractions of primary first molars and 71 premature extractions of primary second molars were found. Aesthetic/functional rehabilitation is necessary until the eruption of permanent successor teeth occurs. A practical option to obtain this rehabilitation is through the installation of aesthetic or functional space maintainers [33-35].

Thus, space maintainers are orthodontic devices

that replace one or more deciduous teeth and are used to preserve the space destined for the permanent tooth successor, preventing it from suffering deviations during its eruption [36]. These devices, regardless of the design chosen, should be as realistic as possible. However, there are several requirements, such as: maintaining the desired interproximal space, not interfering with the occlusion of the opposing teeth nor with the eruption of the permanent tooth, allowing sufficient mesiodistal space for the permanent tooth alignment to erupt, not interfering in phonetics and chewing and present a simple framework and be easily hygienized [37].

Moreover, space maintainers are important when there is early loss of deciduous teeth due to caries disease and trauma. The early loss of the second deciduous upper or lower molars after the eruption of the first permanent molars entails closure of space, especially when the permanent successor slows to erupt [38]. The facial typology seeks to redefine the relationships between deleterious habits and malocclusions, through the valuation of individual morphological characteristics, which will lead to craniofacial growth and development to assume certain facial types, different in their structural and functional aspects [39].

Thus, the neuromuscular stability of the stomatognathic system may be impaired by the presence of deleterious habits [1-3]. In addition to the habits of digital sucking, prolonged use of the pacifier, tongue sucking, or lips triggering facial changes and/or functional adaptations, there are habits, mainly related to masticatory muscles, such as bruxism, dental tightening, onicofagia, cheek bite or lips. These habits result in an abnormal request of the masseter, temporal, and pterygoid muscles, both medial and lateral. Such muscles, in a state of hyperfunction, may present painful symptomatology and decreased coordination [4-6].

## Conclusion

It was concluded space maintenance is one of the most important activities in the prevention of malocclusion. The maintenance of the lost space is of paramount importance to ensure normal eruption and development of the dentition. Aesthetic/functional rehabilitation is necessary until the eruption of permanent successor teeth occurs. A practical option to obtain this rehabilitation is through the installation of aesthetic or functional space maintainers. There are several requirements, such as: maintaining the desired interproximal space, not interfering with the occlusion of the opposing teeth nor with the eruption of the permanent tooth, allowing sufficient mesiodistal space



for the permanent tooth alignment to erupt, not inferring in phonetics and chewing and present a simple framework and be easily hygienized. Thus, the neuromuscular stability of the stomatognathic system may be impaired by the presence of deleterious habits.

### CRedit

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No additional data are available.

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The authors declare no conflict of interest.

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It was performed.

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