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Highlights of orthognathic surgery in class II patients: a systematic review

Guilherme Ferreira[1,2*], Isaac Roschel Buongiovanni Estêvão[1,2], João Vitor Leandro Lombardi[1,2], Andreia Borges Scriboni[1,2]

[1] UNORTE - University Center of Northern São Paulo, Dentistry Department, São José do Rio Preto, São Paulo, Brazil.
[2] UNIPOS - Post Graduate and Continuing Education, Dentistry Department, São José do Rio Preto, São Paulo, Brazil.

*Corresponding author: Guilherme Ferreira.
Unorte/Unipos - Postgraduate and continuing education,
Sao Jose do Rio Preto, Sao Paulo, Brazil.
E-mail: guilherme.ferreira.611@hotmail.com

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Abstract

Introduction: Orthognathic surgery is indicated to modify the position of the maxillomandibular structure, which may cause changes in the sagittal position of the mandibular condyle in individuals with retrognathism and mandibular prognathism. In the context of orthognathic surgery, anterior open bite (AOB) is an easily recognized malocclusion and presents only aesthetic and functional problems. **Objective:** Iven this, the present study developed a systematic review to present the main considerations of orthognathic surgery in class II patients. **Methods:** The PRISMA Platform systematic review rules were followed. The search was carried out from October to December 2023 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 88 articles were found, 40 articles were evaluated in full and 20 were included and developed in the present systematic review study. Considering the Cochrane tool for risk of bias, the overall assessment resulted in 21 studies with a high risk of bias and 21 studies that did not meet GRADE and AMSTAR-2. Most studies did not show homogeneity in their results, with X^2=57.5%>50%. The etiology of anterior open bite is multifactorial and may be caused by environmental and hereditary factors. Class II patients may have significantly greater amounts of lateral and inferior translation than class III patients. Two-jaw surgery for open bite correction led to different directions and amounts of condylar rotational displacement in patients with skeletal class II malocclusion. Treatment can be carried out through preventive, interceptive, corrective, or even surgical treatments. The differentiated bonding of brackets to the anterior teeth is also a very useful resource for the treatment of anterior open bite.

Keywords: Orthognathic surgery. Class II malocclusion. Open bite. Maxillary protrusion.

Introduction

Orthognathic surgery is indicated to modify the position of the maxillomandibular structure, which may cause changes in the sagittal position of the mandibular condyle in individuals with retrognathism and mandibular prognathism. In the context of orthognathic surgery, anterior open bite (AOB) is an easily recognized malocclusion and presents only aesthetic and functional problems [1,2]. Its etiology is multifactorial, including heredity, oral habits, unfavorable growth patterns, and enlarged lymphatic tissue along with mouth breathing and oral functional matrices. It can occur in Class I, Class II, or Class III malocclusions [3,4].

Non-nutritive sucking habits can cause anterior open bite, however, not all patients develop malocclusion [5,6]. Therefore, a harmful habit may cause malocclusion, as long as there is a direct interrelationship of three factors: duration, frequency, and intensity [6]. There are studies related to the prevalence of anterior open bite, for example, Castro et al. [7], observed that a total of 24.44% of the patients in their sample had an anterior open bite.

Other authors found a prevalence of anterior open bite in the early mixed dentition of 17.0% [8]. Tibolla et al. [9], found a prevalence of 24.4% in mixed dentition. In the study by Lentini-Oliveira et al. [10], the prevalence ranged from 17.0% to 18.0% of children with mixed dentition, but when associated with sucking habits, it increased to 36.3%. However, in the sample by Shalish et al. [11], 6.7% had an anterior open bite, in the mixed dentition phase.

Characteristics of individuals with anterior open bite include excessive gonial, mandibular, and occlusal plane angles, small mandibular body and ramus, increased lower anterior facial height, decreased upper anterior facial height, retrusive mandible, Class II tendency, divergent cephalometric planes, lingual position and inadequate lip sealing [12,13]. Therefore, several treatments have been proposed to correct malocclusion, but the interventions are not supported by strong scientific evidence. Furthermore, some studies have reported high recurrence rates [14-16].

In mixed and permanent dentition, it can be stated that the AOB tends to self-correct [17]. This fact occurs due to the individual's development and growth, leading to a physiological decrease in adenoids [12]. This fact, concomitantly with the abandonment of harmful habits so present in early childhood, will lead to self-correction of the malocclusion. AOB can be treated in primary and mixed dentition, but it is also possible to perform treatment in adult patients, but with greater difficulty, especially in maintaining stability [10].

In this context, open bite treatment involves preventive treatments, eliminating harmful habits, and correcting the posture of soft tissues through the use of palatal bars or orthopedic devices, including corrective mechanics, extractions, elastics, alignment, and leveling, headgear, and orthognathic surgeries [1,2]. The literature is controversial regarding definitions, etiology, and forms of treatment [4-7]. The lack of consensus on etiological factors was probably what led to the diversification of AOM treatment plans, explaining the high number of relapses due to instability. In this sense, if the etiology is of skeletal origin, the greater the difficulty in correction and the greater the difficulty in maintaining stability. This stability would be achieved if the professional knew which etiological factor was leading to the development of AOB [8].

The positioning of the tongue is generally overlooked by dentists, however, it is an important factor to be considered, as tongue posture is one of the most important factors that allow the development of AOB [1]. To achieve stability, there must be good occlusion after carrying out the open bite correction treatment, so the orthodontist must aim for excellent occlusion, with simultaneous contacts bilaterally, in total harmony with the centric relationship, with the presence of disocclusion of the posterior teeth during excursive movements of the mandible [2,3].

Given this, the present study developed a systematic review to present the main considerations of orthognathic surgery in class II patients.

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: 08/14/2023. The methodological quality standards of AMSTAR-2 (Assessing the methodological quality of systematic reviews) were also followed. Available at: https://amstar.ca/. Accessed on: 08/14/2023.

Data Sources and Research Strategy

The literary search process was carried out from October to December 2023 and was developed based on Scopus, PubMed, Lilacs, Ebsco, Scielo, and Google Scholar, covering scientific articles from various eras to the present. The descriptors (MeSH Terms) were used: *"Orthognathic surgery. Class II malocclusion. Open bite. Maxillary protrusion"*, 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).

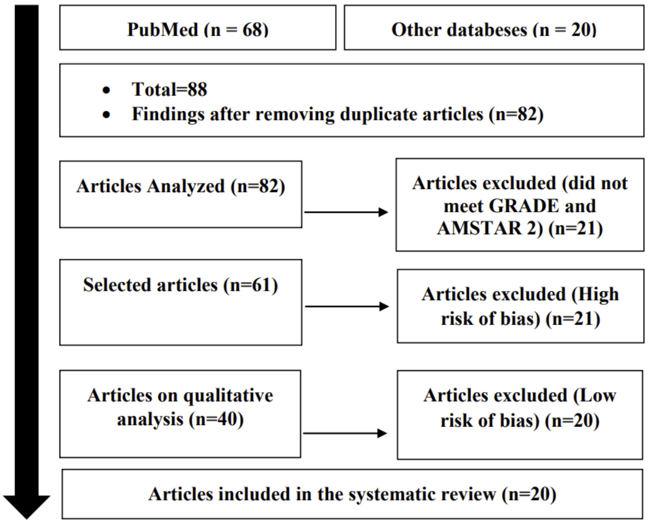
Results and Discussion

Summary of Findings

A total of 88 articles were found that were subjected to eligibility analysis, with 20 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=57.5%>50%. Considering the Cochrane tool for risk of bias, the overall assessment resulted in 21 studies with a high risk of bias and 21 studies that did not meet GRADE and AMSTAR-2.

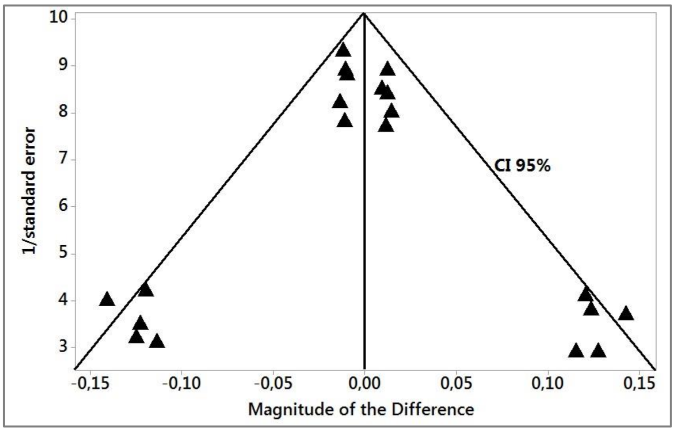
Figure 1. Article selection - exclusion process.



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=20 studies).



Source: Own authorship.

Based on the main literary findings, harmful habits are the main etiological factors of AOB, and the etiology is multifactorial, but may also be related to the lack of growth of the alveolar bone in the anterior region of the mandible or three other factors such as excessive posterior alveolar growth, shortening of the mandibular ramus, as well as an increase in the mandibular angle [3].

Regarding treatment, there is still no consensus on the ideal treatment and there is a wide range of options for performing AOB closure. However, the use of glued lingual spurs on the palatal surface of the upper and lower incisors can be highlighted, to remove the habit of digital sucking and prevent tongue interference in the act of phonation and swallowing and installation of the Hyrax expander [8].

Thus, treatment can be carried out through preventive, interceptive, corrective, or even surgical treatments. The differentiated bonding of brackets to the anterior teeth is also a very valuable resource for the treatment of AOB. With the advent of mini-implants, it is easier to carry out treatments, especially in more severe cases, as they behave like skeletal anchorage [9-12].

The orthodontist must analyze which extracted teeth will bring the best benefit to the case, as extractions are allowed on all teeth, especially premolars, first molars, and even second molars [12]. AOB closure occurs through intrusion of molars or extrusion of anterior teeth, but intrusive movement behaves more stably. The etiology of anterior open bite is multifactorial and may be caused by environmental and hereditary factors [13].

In this context, an observational and cross-sectional study compared linear and angular measurements of the skull base between individuals with skeletal open bite and different sagittal skeletal relationships, with 101 lateral radiographs of young patients with skeletal open bite. Skull base angles were significantly smaller (approximately 3° to 5°) in the Class III skeletal open bite group (BaSN = 127.97° ± 5.86°, ArSN = 120.19° ± 6.12°) when compared with the other groups. BaSN Angle, Class I versus Class III (p <0.001) and Class II versus Class III (p <0.001). ArSN Angle, Class I versus Class III (p = 0.005) and Class II versus Class III (p = 0.026). Multiple linear regressions showed that gender had a significant influence on both skull base dimensions, with men having higher values than women [18].

Furthermore, a retrospective observational study compared 57 patient records on the results of treatment for anterior occlusion and vertical skeletal stability after maxillary or mandibular surgery to correct Class II malocclusion, with a mild to moderate open bite. After surgery, 87% of Le Fort I patients and 63% of patients with bilateral sagittal split osteotomy had a positive overbite and, at the 6-month follow-up, the percentages were 90% and 74%, respectively. Three years after surgery, 74% of patients with Le Fort I and 42% of patients with bilateral sagittal split osteotomy had a positive overbite. Anterior facial height decreased in the Le Fort I subsample and increased in the bilateral sagittal split osteotomy subsample, and the mandibular plane angle decreased in both. The Le Fort I subsample generally remained stable, while clinically significant relapse of the mandibular plane angle (≥2°) occurred in 80% of the bilateral sagittal split osteotomy subsample [19].

Finally, a study quantified three-dimensional condylar displacements resulting from bi-maxillary surgery to correct open bites in patients with class II and class III skeletal malocclusion. Pre-surgical (T1) and post-surgical (T2) cone beam computed tomography scans were performed on 16 patients with skeletal class II (mean age 22.3 ± 9.47 years) and 14 patients with skeletal class III (age average of 25.6 ± 6.27 years). Class II patients showed significantly greater amounts of lateral ($p = 0.002$) and inferior ($p = 0.038$) translation than class III patients. The magnitudes of condylar translational displacements were small for both groups. Patients in skeletal class III had a predominantly medial and superior condylar translation. Patients in skeletal class II had greater counterclockwise condylar pitch than patients in class III. Two-jaw surgery for open bite correction led to different directions and amounts of condylar rotational displacement in patients with skeletal Class II malocclusion compared to Class III malocclusion, with greater rotational than translational displacements [20].

Conclusion

The etiology of anterior open bite is multifactorial and may be caused by environmental and hereditary factors. Class II patients may have significantly greater amounts of lateral and inferior translation than class III patients. Two-jaw surgery for open bite correction led to different directions and amounts of condylar rotational displacement in patients with skeletal class II malocclusion. Treatment can be carried out through preventive, interceptive, corrective, or even surgical treatments. The differentiated bonding of brackets to the anterior teeth is also a very useful resource for the treatment of anterior open bite.

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Ethical Approval

Not applicable.

Informed consent

Not applicable.

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Data sharing statement

No additional data are available.

Conflict of interest

The authors declare no conflict of interest.

Similarity check

It was applied by Ithenticate@.

Peer Review Process

It was performed.

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