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Major clinical approaches to osteotomy of the middle third face: a concise systematic review

Eduardo Costa Figueiredo Passos[1,2*], Fabio Alarcon Idalgo[1,2], Silvio Antonio dos Santos Pereira[1,2], Alexandre Gomes Nunes[1,2], Elias Naim Kassis[1,2], Alvaro José Cicareli[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: Eduardo Costa Figueiredo Passos.
Unorte/Unipos – Graduate and Postgraduate education,
Dentistry department, São José do Rio Preto, São Paulo, Brazil.
Email: eduardo.cfp@hotmail.com

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Abstract

Introduction: Orthognathic surgery is a standardized procedure used to improve the patient's facial appearance and to correct maxillary and mandibular deformities resulting from malocclusion, disease, or trauma. Non-ossification between the maxillary bones after osteotomies is an important complication that may occur after performing this surgical procedure. **Objective:** It was to evaluate and quantify the three-dimensional space between the mandibular bone segments after advances in bilateral sagittal osteotomies of the mandible, involving the middle third of the face, with a consequent indication of bone grafting to achieve better surgical results, in terms of bone healing, stability, complications and prevention of aesthetic defects. **Methods:** The systematic review rules of the PRISMA Platform were followed. The search was carried out from February to April 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 accordingly, according to the Cochrane instrument. **Results and Conclusion:** A total of 104 articles were found, 28 articles were evaluated and 22 were included and developed in this systematic review study. Considering the Cochrane tool for risk of bias, the overall assessment resulted in 46 studies with a high risk of bias and 20 studies that did not meet GRADE. Bilateral sagittal osteotomy involving the middle third of the face is the most used technique in mandibular orthognathic surgery, allowing mandibular movements in the sagittal, vertical, and transverse directions, with good results and few complications. Also, in orthognathic surgeries, bone grafting can accelerate bone formation.

Keywords: Bucco-maxillo surgery. Orthognathic surgery. Sagittal osteotomy. The middle third of the face. Bone formation.

Introduction

Orthognathic surgery is a standardized procedure used to improve the patient's facial appearance and to correct maxillary and mandibular deformities resulting from malocclusions, disease, or trauma [1-3]. A satisfactory result in orthognathic surgery depends on the surgical technique and the accuracy of the orthodontic-surgical treatment plan [4]. Bilateral sagittal osteotomy of the mandibular ramus is a technique widely used in orthognathic surgery for the correction of mandibular deformities [2].

Mandibular advancement is a procedure with a high risk of skeletal recurrence, due to the difference between the proximal and distal bone segments [5]. Non-ossification between the maxillary bones after osteotomies is an important complication that may occur after performing this surgical procedure [6].

Several studies report that areas of little or no bone contact in both the maxilla and the mandible have a greater chance of instability. Furthermore, bone recovery would be inadequate if there is a defect greater than 3 mm between segments along the line of

osteosynthesis [7]. However, studies that correlate the use of biomaterials in osteotomy areas in orthognathic surgery to contribute to bone union and stability of osteotomies are scarce [8].

Lee et al. (2014) [9] used a bone substitute between bone gaps and observed faster bone formation. They then suggested that in patients who need broader movements with discontinuity between the stumps, it is important to use bone grafts to increase stability and reduce postoperative complications, but warn that more studies are needed with tomographic evaluation and in longer periods. than 6 months for more solid conclusions.

Also, Trevisiol et al. (2012) [10] using xenogeneic bone graft in mandibular advancements greater than 8mm performed clinical, radiographic, and histological evaluations, and concluded that the material is an effective tool in bone stability and mandibular aesthetics and that it does not cause an increase in post-operative complications. operative. Using the same material, now in the maxilla in advances of up to 5mm, they also observed promising results in a bone union in Le Fort I osteotomies, with the authors stressing the need for studies with greater advancements in the maxilla and other areas, such as the chin in genioplasty [11].

Therefore, the present study aimed to evaluate and quantify the three-dimensional space between the mandibular bone segments after advances in bilateral sagittal osteotomies of the mandible, involving the middle third of the face, with a consequent indication of bone grafting to achieve better surgical results, in terms of bone healing, stability, complications and prevention of aesthetic defects.

Methods

Study Design and Data Sources

This was followed by a systematic literature review model, according to the PRISMA rules. The literary search process was carried out from February to April 2023 and was developed based on Scopus, PubMed, Science Direct, Scielo, and Google Scholar, using the descriptors (MeSH Terms): *Bucco-maxillo surgery. Orthognathic surgery. Sagittal osteotomy. The middle third of the face. Bone formation,* and using the Booleans "and" between the descriptors (MeSH Terms) and "or" between the historical findings.

Study Quality and Risk of Bias

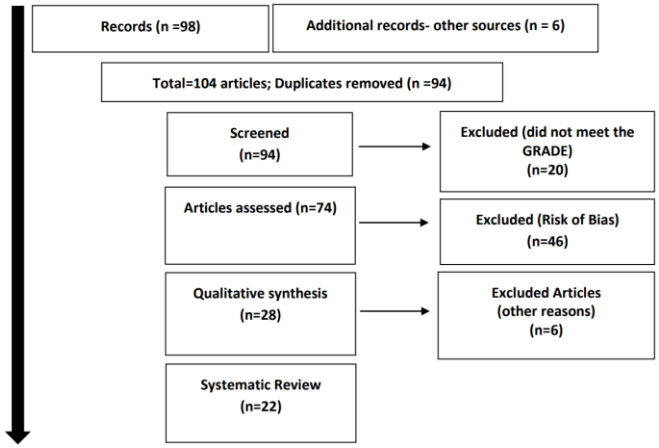
The quality of the studies was based on the GRADE instrument, with randomized controlled clinical studies, prospective controlled clinical studies, and studies of systematic review and meta-analysis listed as the studies with the greatest scientific evidence. The risk of bias was analyzed according to the Cochrane instrument.

Results and Development

Summary

A total of 104 articles were found. Initially, duplication of articles was excluded. After this process, the abstracts were evaluated and a new exclusion was performed, removing the articles that did not include the theme of this article, resulting in 74 articles. A total of 28 articles were evaluated and 22 were included and developed in this systematic review study (Figure 1). Considering the Cochrane tool for risk of bias, the overall assessment resulted in 46 studies with a high risk of bias and 20 studies that did not meet GRADE.

Figure 1. Selection of studies.



Source: Own authorship.

Major Clinical Findings

It is known that the bilateral sagittal osteotomy (BSO) is the most used technique in mandibular orthognathic surgery, allowing mandibular movements in the sagittal, vertical, and transverse directions. Several studies show good results with few complications [12-15].

In this procedure, the mandibular body is separated from the proximal fragment and moved to the planned position, creating a space between the segments. The size of this space is proportional to the mandibular advancement and/or rotation movements required by the patient's maxillomandibular discrepancy. This usually occurs without complications, but in some cases, there is a persistent defect at the osteotomy site at the lower border [16].

Although not widely described, this complication can be a visible and/or palpable defect along the lower border of the mandible, commonly leading to patient complaints [1]. Therefore, the prevention of mandibular inferior border defects is an important issue in the planning of an BSO [2].

One study compared different BSO techniques to prevent the incidence of lower mandibular border defects. The authors performed a retrospective multicenter cohort study comparing 3 BSO techniques for advancements greater than 5 mm: traditional ungrafted BSO (group A), traditional grafted BSO (group B), and modified BSO (group C). The space created by mandibular advancement was measured. The presence or absence of a defect was determined 1 year after surgery by clinical and radiographic evaluation. Bone defect outcome was associated with potential risk predictors (age, gender, BSO side, and magnitude of mandibular advancement) A total of 1002 operative sites in 501 patients were included in the study. The mean age of 26.8 ± 11 years, gender (310 women, 191 men), and right mandibular advancement of 9.3 mm and left 10 mm were similar between groups ($p>0.05$). The proportions of postsurgical inferior border defects were 54.5% in Group A, 1.3% in Group B, and 10.6% in Group C. Traditional grafting techniques and modified BSO were significantly more effective in preventing the incidence of lower mandibular border defects compared to the traditional ungrafted BSO technique ($p<0.05$). Therefore, this study showed that the traditional ungrafted BSO technique produces a large proportion of lower mandibular border defects [17].

Furthermore, Agbaje et al. [18] studied 400 postoperative sites in 200 patients and reported postoperative defects in more than one-third of sites with traditional BSO. The reported risk factors were total inclusion of the inferior border in one or another BSO fragment, the mandibular advancement scale, and the patient's age. The results of this study showed that in cases where the advancement is greater than 10 mm and/or the patient is older than 30 years, the risk of mandibular defect increases significantly. Thus, the results of the present study are in agreement with these findings, given that the mandibular advancements were above 10 mm and the mean age was 38.13±10.64 years, strongly pointing to the placement of a bone graft to avoid defects and complications.

In this sense, a study with a total of 48 patients examined the effects of demineralized bone matrix (DBM) grafts on bone remodeling during sagittal ramus osteotomy by measuring three-dimensional (3D) reconstructed images. In the control group, no graft was performed. In the DBM group, the grafts were placed between the proximal and distal segments. Both groups showed a significant increase in volume. However, over the same period, the volume increase rates of the 2 groups showed significant differences. In the control group, a significant increase in volume was seen up to T2, after which an insignificant increase was seen. In the DBM group, a significant increase in volume continued until T3. Therefore, in orthognathic surgeries, grafting with DBM accelerates bone formation [19].

In addition, a retrospective cohort study with 84 patients (168 osteotomies) and a mean age of 27.4 years determined whether bone grafting into the bone defect in BSO surgery would reduce the defect at 1 year postoperatively compared to none. bone graft, considering 10 mm or more of advancement. Of the 84 patients, 40 underwent bilateral bone grafting. The monocortical block of the iliac crest bone was used as a bone homograft. The final residual defect was measured at 1 year postoperatively on CBCT scans. The BSO and the group without BSO had a mean final defect of 0.7 mm (range 0 to 4.5 mm) and 3.0 mm (range 0 to 5.5 mm), respectively. Complete absence of the defect was achieved in 72% of BSO osteotomies and 9% of osteotomies without BSO [20].

Still, another retrospective study with forty patients investigated the graft in the osteotomy gap during BSO, using a xenograft and fibrin glue. Hard tissue defects at the lower border of the mandible were evaluated by cone beam computed tomography performed 1 week and 1 year after surgery. The study group of 20 patients underwent bone grafting during BSO (mean age 26.1 years; mean horizontal displacement 8.5 mm) and the control group of 20 patients did not (mean age 30.2 years; mean horizontal displacement of 7.6 mm). The graft had a negligible effect on large displacements (9.015.0 mm), which may have been due to inadequate graft quantity and/or positioning, or poor dimensional stability [21].

Finally, one study determined how the condylar position is affected by bone grafting in the intersegmental space created by the sagittal ramus osteotomy. The position of the condyle after osteotomy of the sagittal ramus was compared, without the bone graft (control group, n=30) and with the bone graft (n=30) using computed tomography with a thickness of 2 mm. Condylar displacement to the amount of mandibular setback was significant, especially when it was greater than 10 mm of setback. Therefore, using a bone graft in the intersegmental gap of a sagittal ramus osteotomy is considered an effective clinical method to ensure the desirable intersegmental position as it helps to maintain the space easily [22].

Conclusion

Bilateral sagittal osteotomy involving the middle third of the face is the most used technique in mandibular orthognathic surgery, allowing mandibular movements in the sagittal, vertical, and transverse directions, with good results and few complications.

Also, in orthognathic surgeries, bone grafting can accelerate bone formation.

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Conflict of interest
The authors declare no conflict of interest.

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It was applied by Ithenticate®.

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