



Importance of hospital dentistry for patients undergoing vertical mandibular osteotomy: a systematic review

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Abstract

Introduction: Deformities can be defined as changes in the development of facial bones, especially of the maxilla and mandible, and may cause changes in other structures, organs, and systems, such as the airways. Given this, the dental surgeon assumes a leadership role in the hospital care of these cases. **Objective:** It was to conduct a systematic review on the importance of hospital dentistry for patients undergoing vertical mandibular osteotomy. **Methods:** The systematic review rules of the PRISMA Platform were followed. The search was conducted from May to July 2026 across the Web of Science, Scopus, Embase, PubMed, ScienceDirect, SciELO, and Google Scholar databases. The quality of the studies was assessed using the GRADE instrument, and the risk of bias was evaluated according to the Cochrane instrument. **Results and Conclusion:** According to the GRADE instrument, most studies presented homogeneity in their results, with $X^2=71.6\%>50\%$. A total of 119 articles were found and submitted for eligibility analysis, with 30 final studies selected to compose the results of this systematic review. Considering the Cochrane tool for risk of bias, the overall assessment resulted in 31 studies with a high risk of bias and 25 studies that did not meet GRADE and AMSTAR-2 standards. The articles consulted in the scientific literature analyzed teleradiographs taken before and after vertical jaw osteotomy in 2,342 patients. It was evaluated quantitatively lateral cephalometric radiographs of patients of both genders, who needed to undergo vertical osteotomy of the mandibular branch to correct dento-skeletal deformity of the Class III type, whose

purpose was to mandibular retreat. There were mandibular retreatments with a decrease in mandibular length with a change in the amount of indentation in millimeters with an amplitude of 2 mm to 22 mm and linear (25.7%) or rotational movement. The cases submitted to Mandibular Intraoral Vertical Osteotomy showed a reduction of the Gonial Angle in some cases. After evaluating, radiographically, the pharyngeal airspace, facial height, mandibular length, and gonial angle, it was analyzed that there were mandibular retreatments with decreased mandibular length with change in the amount of indentation and linear or rotational movement.

Keywords: Hospital dentistry. Vertical Mandibular Osteotomy. Mandibular length. Face height.

Introduction

Deformities are changes in the development of facial bones, especially the maxilla and mandible, and may affect other structures, organs, and systems, such as the airways [1-3]. Given this, the dental surgeon assumes a leadership role in the hospital care of these cases. Since the nineteenth century, several osteotomies in the mandible have been described [3]. Hullihen described the first osteotomy, which involved a cut in the body of the mandible to close an open bite resulting from cicatricial retraction of a neck burn [3].

Another proposed technique was a resection of the condyle [3,4]. Later Kosticka (1928) diffused the Osteotomy of the osteotomy of the Condyle realized blindly with a Mountain of Gigli and, in 1940, Smith and Johnson described to it with extraoral access [3]. In

1967, Castro proposed a condyle osteotomy without bone resection to increase the area of bone contact and he called it "Modified osteoplasty of the mandibular ramus" [3].

Moreover, another technique proposed was the Horizontal Osteotomy of the Branch. This was performed both by extraoral and blind access with the use of a Serra de Gigli [4-6]. Ernst in 1927 proposed intraoral access. Other authors have also contributed to the evolution of the technique [7-9].

The Oblique Branch Osteotomy was proposed by Schaefer (1941), and Robinson modified it in 1970 [10,11]. In 1954, the Vertical Osteotomies of the Branch were proposed by Dingman and Letterman, performing a vertical osteotomy of the posterior branch to the mandibular foramen with decortication of the bone, causing greater bone contact [12]. This technique was improved by Converse in 1964. Trauner and Obwegeser in 1955 described an inverted L-osteotomy [13]. Cryer (1913) proposed Mandibular Angle Osteotomy without much acceptance [14].

It is believed that mandibular body osteotomy was first published by Blair (1897) and Dingman in 1944, who performed it in two stages. In 1957 Converse and Shapiro proposed the realization of this technique in a surgical time and by intra-oral access [15]. However, the Sagittal Osteotomy of the Branch, would have been published, initially, by Perthes in 1922 that made it by extraoral access [16]. It was widely accepted when Obwegeser, from 1957, published articles proposing its achievement by intra-oral access with a greater area of bone contact, allowing a faster and safer consolidation. Dal Pont in 1961 proposed some modest modifications making the technique versatile and safe in relation to complications [17].

It is a fact that the stability of any osteotomy of the mandibular branch is affected by the amount of retrusion, the fixation method, and the growth [6,18-25]. Vertical Osteotomy has some advantages over Sagittal Osteotomy, being: low incidence of injury or damage to the inferior alveolar nerve, technical simplicity, reduced surgical time, the possibility of repositioning the condyle and the proximal segment postoperatively, and significant improvement of the symptoms of Temporomandibular Joint Dysfunction [1,2,26-35].

Given this, this study aimed to conduct a systematic review on the importance of hospital dentistry for patients undergoing vertical mandibular osteotomy

Methods

Study Design

This study followed the international systematic review model, following the PRISMA (preferred reporting

items for systematic reviews and meta-analysis) rules. Available at: <http://www.prisma-statement.org/?AspxAutoDetectCookieSupport=1>.

Accessed at: 05/18/2026. The AMSTAR 2 (Assessing the methodological quality of systematic reviews) methodological quality standards were also followed. Available at: <https://amstar.ca/>. Accessed at: 05/18/2026.

Search Strategy and Search Sources

The literature search process was carried out from May to July 2026 and developed based on Web of Science, Embase, Scopus, PubMed, Lilacs, Ebsco, Scielo, and Google Scholar, covering scientific articles from various periods to the present day. The following descriptors were used in health sciences (DeCS/MeSH terms): "Hospital dentistry. *Vertical Mandibular Osteotomy. Mandibular length. Face height*", and the Boolean "and" was used between the MeSH terms and "or" between the historical findings.

Study Quality and Risk of Bias

Quality was classified as high, moderate, low, or very low regarding the 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. 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 Cohen's test (d).

Results and Discussion

Summary of Findings

A total of 119 articles were found and submitted to eligibility analysis, with 30 final studies selected to compose the results of this systematic review. The listed studies 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. Biases did not compromise the scientific basis of the studies. According to the GRADE instrument, most studies presented homogeneity in their results, with $X^2=71.6\%>50\%$. Considering the Cochrane tool for risk of bias, the overall assessment resulted in 31 studies with a high risk of bias and 25 studies that did not meet GRADE and AMSTAR-2.

The cephalograms made before and after the Vertical Jaw Osteotomy of 2,342 patients (45% females and 55% males) were analyzed. It was evaluated quantitatively lateral cephalometric radiographs of patients of both genders, who needed to undergo vertical

osteotomy of the mandibular branch to correct to-skeletal deformity of the Class III type, whose purpose was to mandibular retreat. For the aforementioned evaluation, radiographs were used referring to two periods: 1. preoperative (performed prior to the surgical procedure); 2. Postoperative (six months after surgery). Next, the cephalometric points of interest and the linear and angular measurements that were obtained from these points were described.

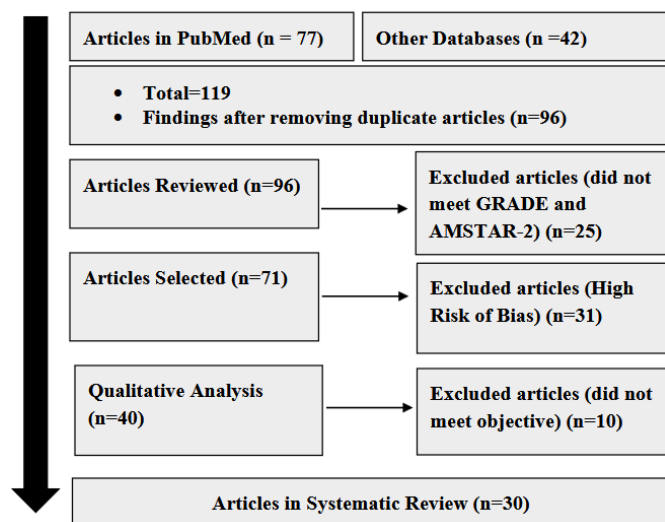


Figure 1. Flowchart showing the article selection process. Source: Own Authorship.

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 Cohen's Test (d). Precision (sample size) was determined indirectly by the inverse of the standard error ($1/\text{Standard Error}$). This graph did not have a symmetrical behavior, suggesting a significant risk of bias, both among studies with small sample sizes (lower precision) that are shown at the base of the graph and in studies with large sample sizes that are presented at the top.

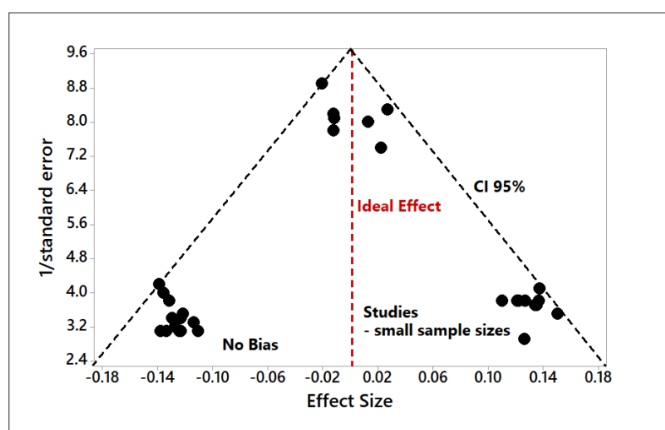


Figure 2. The non-symmetrical funnel plot suggests risk of bias among the studies with small sample sizes that are shown at the bottom of the graph. High confidence and high

recommendation studies are shown above the graph (n=30 studies). Source: Own Authorship.

Major Findings

In this context, Koichiro Ueki, in 2005, concluded that an antero-inferior displacement of the condyle with medial rotation occurs in the vertical, and Martin Ritzau (1989) reported that the fixation of the posterior fragment does not influence the condylar position [17,18]. In his article, Ritzau reports anterior and inferior displacement of the condyle that in a period of one year almost completely returned the preoperative position.

Other advantages of Vertical Osteotomy are that it does not require rigid internal fixation; it allows the alteration of the gonial angle, an increase in the thickness of the masseter muscle, and an increase in the electromyographic activity of the masseter and temporalis muscles [1-3], and there is still a shorter recovery time and a rapid improvement of bite force when compared to Sagittal Osteotomy. However, the disadvantages are intermaxillary block, and there are reports of avascular necrosis of the condyle [36-40].

Regarding Temporomandibular Joint Dysfunction, an experiment was performed in dogs, proving, histologically, that the Vertical Osteotomy promotes a return of the bone and cartilaginous structures to a condition of normality through a lower and anterior displacement of the condyle, which leads to an increased joint space [1,20-24].

According to Hwang Soonshin (2010) [25], Vertical Osteotomy causes a posterior inferior displacement of the hyoid bone immediately after surgery. Over time, it returns, almost entirely, to its original position. But the same does not happen with the tongue that invades the posterior airspace and does not return to its original position.

Ju Hung Pan (2013) [41] presented a technical evolution of sagittal osteotomy over time, aiming to improve bone contact and allowing greater stability, faster recovery, reduction of condylar torque, and minimizing the need for the use of Fixation Intermaxillary. These are the advantages of this technique. Also, in the sagittal, in the immediate postoperative period, there is an increase in the angle of the long condylar axis, which decreases with time, and lateral rotation of the condyle [2]. Other authors observed that patients submitted to BSSO had a greater recidivation of the Sella-Nasio-Ponto B angle with greater anterior movement of Pogonion and ment than those submitted to IVRO [3].

Yoshioka et al. (2008) [6] showed that, in the immediate postoperative period, patients submitted to IVRO had a modification of Pogonion and of Point B

more inferiorly and later than patients submitted to BSSO, but after one year, there was no difference in skeletal stability between techniques. There is a strong relationship between the hourly displacement of the branch during surgery and the anterior displacement of Pogonium during the post-surgical phase. In IVRO, Kitahara et al. (2009) [5] observed that there is an hourly rotation of the proximal segment, in the sagittal plane. Pan et al (2010) [41] report that after IVRO there is an increase in intergonial width.

Current techniques, sagittal and vertical, improve occlusion, function, and aesthetics due to the change in the position of the mandible, hyoid bone, and tongue (Hwang Soonshin-2010), which may cause posterior airspace narrowing (PAS) and, therefore, give rise to Obstructive Sleep Apnea Syndrome (OSAS) [2,25-29]. Class III patients have increased SBP preoperatively when compared to control patients, and show important changes immediately after surgery [5].

Riley et al. (1983) [40] published an article in which he defined PAS is the measurement between the base of the tongue and the posterior wall of the pharynx. This measure is obtained by drawing a line connecting point B to point GO, extending to the posterior wall of the pharynx, whose value ranges around 11.0 mm. He used polysomnography and cephalometry data for the analysis of patients with OSAS.

OSAS is a sleep disorder caused by the narrowing and obstruction of the pharyngeal space during sleep and occurs in the oropharynx or velopharynx, having been associated with snoring and apnea, having as symptoms daytime sleepiness, snoring, airway obstruction, and hypoxia during sleep [2]. Furthermore, there are genetic and environmental factors that influence OSAS, such as obesity, short or retruded jaw, macroglossia or long uvula, airway shape, age, and ethnic factors [1]. OSAS is considered one of the risk factors for arterial hypertension, myocardial ischemia, cerebrovascular disease, and traffic accidents [1,2,5].

The study of the change in SBP is done by means of radiographic images (cephalometric analysis [26,27], cephalometric analysis and computed tomography [28,29] or only computed tomography [30,31]. Some studies also use cone beam imaging to analyze the airway through programs such as Osirix and ICAT Vision and to assess changes in pharyngeal airspace, provided the exams are performed on the same equipment. [32] Some authors report that mandibular retreat has decreased airspace [33] Others report that advancement leads to increased airspace and others report no change [34].

To prevent the development of OSAS after mandibular retreatment, it is important to evaluate the

risks and plan the surgery, because in the study the effects on craniofacial and pharyngeal morphology are investigated [35]. Class III malocclusion leads to mandibular protrusion, causing distortion and prominence in the lower third of the face, poor masticatory function, and psychological problems [36]. The gonial angle is formed by a line that tangential the posterior border of the mandibular branch and another line running along the lower border of the mandibular body [33].

Thus, both the Vertical Osteotomy and the Sagittal Osteotomy promote a change in the Gonial Angle, but there is no predominance of one technique over the other. Many studies have shown that mandibular osteotomy produces changes in the skeleton and soft tissues, including pharyngeal airspace (PAS) [9,10]. Yoshioka et al. (2007) [6] conclude in their study that there are changes over time in the distal and proximal segments between the vertical osteotomy and the sagittal osteotomy.

In this context, Abdelrahman et al. (12 men and 18 women with a mean age of 24.4 years) divided into three groups, Group A: 17 patients submitted to only sagittal osteotomy (9 men and 8 women), Group B: 7 patients undergoing bimaxillary advancement (4 Le Fort I and Sagittal cases and 3 Le Fort I and Vertical cases) and Group C: 6 patients submitted to vertical osteotomy (1 man and 5 women). He reports that the groups submitted only to IVRO and BSSO for retreatment had a narrowing of the SBP and the same did not occur in the bimaxillary advancement. Their analyzes were performed using lateral radiographs [21].

The lateral standard cephalometric radiographs have the advantage of ease of reproduction, simplicity, low cost and the possibility of comparison with other studies and we can still measure the movement of the soft tissue point of the posterior wall of the pharynx [17-22]. The SBP should be included in the predictive to avoid the occurrence of OSAS after the mandibular retreat [4]. Thus, Muto et al. (2008) [4] report that if the regression mathematical equation is applied, which is: 66-104) where the PAS-TP distance was calculated as, in which preoperative PAS-TP, postoperative C3Me, operative C3-Me correctly, the AP dimension of the postoperative SBP will decrease. If it does not diminish it is because a change of the position of the head occurred, after performing the surgery, changing the length of C3 to Me.

There is controversy in the literature if there is a change in SBP after surgery for mandibular recoil: some studies show a decrease in anterior-posterior SBP and others show that there is no change when comparing preoperative and postoperative cephalograms [9-15,19]. The position of the head influences the A-P

dimension of the PAS, a change of 10 degrees changes the A-P dimension of the PAS around 4.0 mm [16]. Some surgeons, in several studies, report no change in SBP [9,11-15]. However, some studies report that SBP decreases in the immediate postoperative period, but over time this decrease does not persist [24,25].

If the preoperative and postoperative cephalometric radiographs are performed with the same head position and there is a 10 mm mandibular recoil, the anteroposterior dimension of the SBP will decrease by about 4.0 mm [4,18]. Some authors, such as Riley et al, report cases of OSA following vertical osteotomy [40].

In the cases of OSAS, some articles [20,21] report different values of SBP due to the fact that the different position of the head at the time of the preoperative and postoperative radiographs make it difficult to establish minimum values between SBP and OSAS. Therefore, the position of the head should be standardized in order to be the same in the preoperative and postoperative periods [42].

Cephalometry is not the best method to evaluate changes in SBP, since this test is two-dimensional and does not allow a dynamic evaluation of the changes that have occurred, giving preference to Cone Beam Tomography, which is more accurate [39]. During life, the gonial angle changes in height and length, influenced by race and sex [35-38].

Gonial angle changes in the immediate postoperative period, but in the tissue remodeling phase, it approaches values close to the preoperative period. The reason for this is in the shape of the cut that in the vertical osteotomy is perpendicular to the lateral surface of the mandibular branch, while in the sagittal the cut is sagittally oriented [41,42].

Conclusion

It was concluded that the cases submitted to Mandibular Intraoral Vertical Osteotomy showed a reduction of the Gonial Angle in some cases. After evaluating, radiographically, the pharyngeal airspace, facial height, mandibular length, and gonial angle, it was analyzed that there were mandibular retreatments with decreased mandibular length with change in the amount of indentation and linear or rotational movement.

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Not applicable.

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