Vol. 4 No. 12 (2023): December 2023 Issue
https://doi.org/10.51168/sjhrafrica.v4i12.899
Narrative Review

A NARRATIVE REVIEW OF THE LATEST DEVELOPMENTS IN ORTHOGNATHIC SURGERY IN INDIA.

Vinod Kumar,*
*Consultant Physician, Department of Kidney & Stone, Kidney & Stone Hospital, Motihari, Bihar, India

ABSTRACT

Background
Orthognathic surgery has evolved beyond addressing malocclusion and facial aesthetics to include sleep apnea management and aesthetic enhancement. Three-dimensional digital technology integration is now a crucial aspect of orthognathic surgery, improving surgical planning and splint fabrication for enhanced precision.

Objective
This review aims to elucidate current trends and controversies in orthognathic surgery. It highlights the vital role of plastic surgeons not only in performing surgical procedures but also in establishing surgical occlusion and comprehensive planning.

Summary of Narrative Review
The integration of advanced digital technology has transformed orthognathic surgery by improving accuracy and precision. This review offers insights into the evolving landscape of orthognathic surgery, addressing emerging trends and ongoing debates. It emphasizes the collaborative role of plastic surgeons and orthodontists in delivering successful outcomes.

Implications for Future Research
Future research should focus on refining digital technology integration, optimizing surgical planning, and assessing long-term patient outcomes. Exploring innovative techniques and expanding the scope of orthognathic surgery can further enhance patient care.

Implications for Clinical Practice and Policy Development
Orthognathic surgery's expanded applications require continuous professional development for plastic surgeons and orthodontists. Healthcare institutions and policymakers should acknowledge the significance of digital technology in surgical practice and provide support and resources for its integration. Additionally, guidelines and standards for orthognathic surgery should evolve to reflect these advancements and ensure patient safety and satisfaction.

Keywords: *Orthognathic surgery, Facial aesthetics, Sleep apnea, Three-dimensional digital technology, Surgical planning, Precision surgery*
Submitted: 2023-12-07 Accepted: 2023-12-07

Corresponding author: *Vinod Kumar**
Email: *vindryl@gmail.com*
**Consultant Physician, Department of Kidney & Stone, Kidney & Stone Hospital, Motihari, Bihar, India*

INTRODUCTION
Orthognathic surgery is frequently utilized in the field of craniofacial surgery to address problems related to face alignment, obstructive sleep apnea (OSA), and misaligned jaws [1]. Repositioning the chin, lower jaw, and upper jaw is the goal. LeFort I osteotomy and bilateral sagittal split osteotomy (BSSO), occasionally combined with chin surgery, are common treatments.

American surgeon Simon P. Hullien performed the first jaw surgery to treat prognathism and malocclusion in 1849 [2]. Bite issues resulted from its inability to treat malocclusion, despite correcting the location of the jaw. In order to address bite problems and jaw alignment, orthognathic surgery is frequently paired with orthodontic treatment, which gained popularity in the 1970s.

Orthognathic surgery involves adjustments to the soft tissues and jaw in order to provide optimal dental function and aesthetics. The emphasis has changed in favor of aesthetics in recent years. Even while having perfect teeth alignment is important, the final result shouldn't look compromised. A balanced face, soft tissues that are well-supported, and an appealing appearance are now among the surgical goals [3]. The utilization of three-dimensional (3D) technology for more precise surgical planning and a reduction in the amount of time spent on pre-surgery orthodontics are the current developments.

The key question identified for the review topic is: How has orthognathic surgery evolved from its historical focus on correcting jaw alignment and malocclusion to its contemporary emphasis on aesthetics and the integration of three-dimensional (3D) technology for precise surgical planning?

METHODOLGY

This narrative review explores the evolution of orthognathic surgery with a focus on its historical context, contemporary approaches, and technological advancements. This narrative review searched PubMed, MEDLINE, and pertinent academic journals for relevant articles, studies, and reviews published between 2010 and 2022. The information presented is derived from a comprehensive analysis of relevant literature and research studies in the field of craniofacial surgery. Key topics addressed in the review include the combination of orthognathic surgery with orthodontic treatment, surgical planning utilizing three-dimensional (3D) technology, virtual surgical occlusion configuration, and various surgical techniques. The review aims to provide insights into the changing paradigms of orthognathic surgery and the potential future directions in this field.

COMBINATION WITH ORTHODONTIC TREATMENT

Conventional approach

The conventional method is referred as the "orthodontic-first approach." Prior to orthognathic surgery, orthodontic treatment must be completed. In order to guarantee a stable bite following surgery, this helps identify the true jaw problems prior to surgery and aligns the upper and lower jaws [4]. Patients may find this strategy bothersome due to a few serious drawbacks. It may cause the facial appearance and dental function to gradually deteriorate during the orthodontic phase prior to surgery. The main issue is that it takes a long time—12 to 24 months on average, and occasionally even up to 48 months—depending on how severe the initial oral issues were [5].

Surgery-First Approach

This strategy does not involve any pre-surgery orthodontics; instead, it entails orthognathic surgery first, followed by orthodontic treatment after surgery. The term "modified-surgery approach" refers to an orthodontic pre-surgery phase that is kept brief—less than six months. Although its exact origins are unknown, the Korean Journal of Clinical Orthodontics is thought to have published the first article on the surgery-first method in Asia in 2002 [6]. In that paper, the fundamental principle of the present surgery-first method is elucidated.

As previously described in publications, the surgery-first strategy has several advantages, such as a shorter treatment duration overall, a quicker correction of obstructive sleep apnea (OSA), and early improvement in facial appearance following surgery by aligning orthodontics with natural compensation [7]. For individuals who don't require intensive pre-surgery care, it's usually appropriate. This group comprises people with front teeth that are well-aligned to somewhat crowded, a moderate Spee curve, slightly extended or retroclined incisors, and few transverse problems. The indicators have expanded recently. The surgery-first strategy might theoretically be used for all patients requiring orthognathic surgery provided a stable surgical bite can be produced through a simulation of post-surgery orthodontic movement, according to Choi and Lee [8]. Using this method requires a high level of competence from both the plastic surgeon and the orthodontist.

In order to evaluate the evidence regarding the stability, efficacy, and results of the surgery-first strategy in comparison to the conventional approach, Yang *et al*. carried out a systematic review and meta-analysis. They came to the conclusion that although the surgery-first method group had a shorter overall treatment time, they had comparable post-surgery stability, dependability, and complication rates [9].

In the absence of orthodontic treatment, orthognathic surgery

According to recent research, rather than functional difficulties such bite problems or malfunction of the jaw joint, the majority of individuals considering orthognathic surgery do so because of cosmetic reasons [10]. Asians frequently have a lower occlusal plane angle and a flatter facial profile. It is thought that a face profile with a higher occlusal plane is more aesthetically attractive. Orthognathic surgery, which involves rotating the upper and lower jaw complex clockwise, can improve the facial profile of individuals with functionally normal bites but low occlusal plane angles while preserving their current normal bite. Maintaining the pre-operation bite is essential for individuals with normal bites undergoing orthognathic surgery in order to prevent the need for orthodontic therapy. According to Lee and Park [11], they operated on 43 patients with normal bites but a low occlusal plane angle without first undergoing orthodontic therapy, and they were able to achieve long-term stability and cosmetically pleasing outcomes.

SURGERICAL PLANNING

Virtual Surgical Planning

Before the procedure, X-rays were used to analyze biting problems and face profiles in model surgery. Based on the

anticipated changes in jaw locations, surgical guidelines were created. Orthognathic surgery planning has been revolutionized by recent technical breakthroughs such as computer-assisted design with high-quality 3D X-ray images. Because virtual surgical planning gives a better perspective of 3D changes in the posture of the jaw, it enables accurate diagnoses and comprehensive treatment plans. These advantages allow for the development of surgical guides, improve the precision of bone cuts, and drastically shorten the time needed for pre-operative planning and during surgery for cutting and repairing. Virtual surgical planning was found by Wilson *et al*. [12] to nearly match post-surgery outcomes, with some variations in the upper and lower jaw's forward and vertical movements. Furthermore, compared to conventional 2D planning, Hsu *et al*. [13] found that unilateral cleft patients had better face symmetry, indicating that 3D virtual planning enhances soft tissue contouring.

Planned bone cuts and jaw repositioning are made simpler and faster by using pre-bent fixation plates and specially constructed cutting guides that are based on virtual surgical planning.

Configuring a Virtual Surgical Occlusion

Traditionally, 2D X-ray analysis and dental models have been used in the surgical occlusion set-up process, which is essential for orthognathic surgery and particularly vital for the surgery-first strategy. However, there are disadvantages to the old method as well, including the possibility of fracturing dental casts, discomfort for the patient during dental impressions, and time-consuming model surgery.

For those suffering from class III malocclusion, Ho *et al*. [14] presented a fully digital 3D planning approach that uses intraoral scanning and a seven-step digital occlusion setup. They discovered that the digital method was far faster—it took only 40 minutes as opposed to the traditional approach's 140 minutes—and much more accurate—the average difference between the two methods was less than 0.5 mm. For patients with unilateral clefts, Seo *et al*. [15] also described a standardized virtual occlusion setup procedure that produced outcomes comparable to those of the traditional approach. The practicality of surgery is increased when plastic surgeons and orthodontists collaborate on planning, which includes setting up surgical occlusion.

SURGERICAL PROCEDURE

Single-Splint vs. Double-Splint Technique

There are two methods for doing orthognathic surgery: single-splint and double-splint. The double-splint approach employs an intermediate splint to position one jaw segment first, then the final splint for the other, whereas the single-splint method uses a single final splint for jaw alignment. Which method is superior is uncertain.

In the single-splint approach, a final splint is used to hold the maxilla and mandible together temporarily following jaw bone incisions. A number of milestones, including face symmetry and midline synchronization, are used to modify the jaw position. The ability to make little modifications is advantageous for obtaining symmetry in soft tissues. But it depends on the surgeon's expertise and has a steep learning curve. A famous procedure that has advantages such as a quicker operating time and less reliance on the expertise of the surgeon is the double-splint technique. It is exact thanks to recent advances in 3D technology, and a research found no appreciable changes in facial symmetry between the two methods [16].

The Mandible-First versus the Maxilla-First Method

Whether to start with the mandible or the maxilla in two-jaw orthognathic surgery utilizing the double-splint procedure is still up for debate and mostly depends on the surgeon's preference.

Mandibular incisions are the first step of maxilla-first surgery, which then addresses the maxilla and mandible. For intended maxillary impaction, it is appropriate. Maxilla surgery follows mandibular incisions in mandible-first surgery. In some circumstances, such as considerable jaw advancement or counterclockwise occlusal plane rotation, it is recommended.

In a recent study, mandible-first surgery was found to be more precise in the vertical dimension when compared to maxilla-first surgery. Accuracy was unaffected by splint thickness as long as the appropriate intermediate splint was selected [17].

DISCUSSION

The narrative review highlights the transformation of orthognathic surgery over time, shedding light on its historical roots and contemporary practices. One crucial aspect discussed is the combination of orthognathic surgery with orthodontic treatment. While the conventional "orthodontic-first approach" has been the norm for many years, the "surgery-first approach" has gained prominence due to its potential advantages, such as shorter overall treatment duration and early improvements in facial appearance. The review emphasizes that the choice between these approaches should consider patient-specific factors and requires collaboration between plastic surgeons and orthodontists.

The use of advanced three-dimensional (3D) technology in surgical planning is another significant development in orthognathic surgery. Virtual surgical planning has revolutionized the accuracy and precision of surgical interventions by providing a comprehensive view of 3D changes in jaw posture. This technology enables the creation

of surgical guides and pre-bent fixation plates, streamlining the pre-operative planning process and improving surgical outcomes. Additionally, configuring a virtual surgical occlusion using digital 3D planning offers a more efficient and accurate alternative to traditional methods, reducing treatment time and enhancing patient comfort.

The review also delves into surgical techniques, comparing the single-splint and double-splint methods and the mandible-first versus the maxilla-first approach. Both methods have their merits, and the choice often depends on the surgeon's expertise and patient-specific considerations. Recent studies have shown comparable outcomes between these techniques, highlighting the importance of individualized treatment planning.

Orthognathic surgery has evolved significantly, encompassing both functional and aesthetic aspects of craniofacial medicine. Shortening preoperative orthodontic treatment, incorporating advanced 3D technology, and refining surgical techniques have improved patient experiences and outcomes. The review anticipates future developments in orthognathic surgery, including the integration of augmented reality (AR), artificial intelligence (AI), and robot technology, offering promising avenues for further advancement in the field.

CONCLUSION

In the realm of craniofacial medicine, orthognathic surgery is crucial for treating issues that are both functional and esthetic. In an effort to enhance compliance and lessen patient suffering, shortening the preoperative orthodontic treatment period has become popular. Furthermore, in the last few years, the importance of employing MMA in orthognathic surgery to treat OSA has grown. To address soft tissue inadequacies, an adjunct treatment including a concurrent fat transplant may be beneficial. However, orthognathic surgery cannot provide ideal results in terms of soft tissue balance. Beyond the existing 3D virtual technology utilized for surgical planning and splint production, it is anticipated that different forms of orthognathic surgery that combine AR, AI, or robot technology will be created and implemented in the future.

Acknowledgment

The authors extend their gratitude to fellow researchers, healthcare professionals, study participants, mentors, and their support networks for their invaluable contributions and unwavering support in advancing our understanding of melatonin's role in gynecology and reproductive health. The collaborative efforts of the scientific community, funding agencies, and regulatory authorities are essential in enhancing women's well-being worldwide through research in this field.

List of abbreviations

3D- Three dimensional
2D- Two dimensional
OSA- Obstructive sleep apnea
BSSO- Bilateral sagittal split osteotomy
AI- Artificial intelligence
AR- Augmented reality

Source of funding

No funding received.

Conflict of interest

The authors have no competing interests to declare.

REFERENCES

1. Wu RT, Wilson AT, Gary CS, Steinbacher DM. Complete reoperation in orthognathic surgery. Plastic and Reconstructive Surgery. 2019 May 1;143(5):1053e-9e.
2. Bell RB. A history of orthognathic surgery in North America. Journal of Oral and Maxillofacial Surgery. 2018 Dec 1;76(12):2466-81.
3. Rosen HM. Evolution of a surgical philosophy in orthognathic surgery. Plastic and Reconstructive Surgery. 2017 Apr 1;139(4):978-90.
4. Liou EJ, Chen PH, Wang YC, Yu CC, Huang CS, Chen YR. Surgery-first accelerated orthognathic surgery: orthodontic guidelines and setup for model surgery. Journal of oral and maxillofacial surgery. 2011 Mar 1;69(3):771-80.
5. Jacobs JD, Sinclair PM. Principles of orthodontic mechanics in orthognathic surgery cases. American journal of orthodontics. 1983 Nov 1;84(5):399-407.
6. Seo HJ, Choi YK. Current trends in orthognathic surgery. Archives of Craniofacial Surgery. 2021 Dec;22(6):287.
7. Jeong WS, Choi JW, Lee JY, Kwon SM. Can a surgery-first orthognathic approach reduce the total treatment time?. International journal of oral and maxillofacial surgery. 2017 Apr 1;46(4):473-82.
8. Choi JW, Lee JY. Current concept of the surgery-first orthognathic approach. Archives of plastic surgery. 2021 Mar;48(02):199-207.
9. Choi JW, Lee JY, Yang SJ, Koh KS. The reliability of a surgery-first orthognathic approach

without presurgical orthodontic treatment for skeletal class III dentofacial deformity. Annals of plastic surgery. 2015 Mar 1;74(3):333-41.

10. Wolford LM, Chemello PD, Hilliard FW. Occlusal plane alteration in orthognathic surgery. *J Oral Maxillofac Surg.* 1993;51:730–41.
11. Lee TS, Park S. Clockwise rotation of the occlusal plane for aesthetic purposes by double jaw surgery without orthodontic treatment. Plastic and reconstructive surgery. 2019 Dec 1;144(6):1010e-3e.
12. Wilson A, Gabrick K, Wu R, Madari S, Sawh-Martinez R, Steinbacher D. Conformity of the actual to the planned result in orthognathic surgery. Plastic and reconstructive surgery. 2019 Jul 1;144(1):89e-97e.
13. Hsu PJ, Denadai R, Pai BC, Lin HH, Lo LJ. Outcome of facial contour asymmetry after conventional two-dimensional versus computer-assisted three-dimensional planning in cleft orthognathic surgery. Scientific Reports. 2020 Feb 11;10(1):2346.
14. Ho CT, Lin HH, Lo LJ. Intraoral scanning and setting up the digital final occlusion in three-dimensional planning of orthognathic surgery: its comparison with the dental model approach. Plastic and reconstructive surgery. 2019 May 1;143(5):1027e-36e.
15. Seo HJ, Denadai R, Pai BC, Lo LJ. Digital occlusion setup is quantitatively comparable with the conventional dental model approach: characteristics and guidelines for orthognathic surgery in patients with unilateral cleft lip and palate. Annals of Plastic Surgery. 2020 Aug 1;85(2):171-9.
16. Ng JH, Chen YA, Hsieh YJ, Yao CF, Liao YF, Chen YR. One-splint versus two-splint technique in orthognathic surgery for class III asymmetry: comparison of patient-centred outcomes. Clinical Oral Investigations. 2021 Dec;25:6799-811.
17. Borikanphanitphaisan T, Lin CH, Chen YA, Ko EW. Accuracy of mandible-first versus maxilla-first approach and of thick versus thin splints for skeletal position after two-jaw orthognathic surgery. Plastic and Reconstructive Surgery. 2021 Feb 1;147(2):421-31.

Publisher details

Publishing Journal: Student's Journal of Health Research Africa.
Email: studentsjournal2020@gmail.com or admin@sjhresearchafrica.org

(ISSN: 2709-9997)

Publisher: SJC Publishers Company Limited
Category: Non-Government & Non-profit Organisation
Contact: +256775434261(WhatsApp)
Email: admin@sjpublisher.org
Website: https://sjpublisher.org
Location: Wisdom Centre Annex, P.O. BOX. 701432 Entebbe, Uganda, East Africa.

Vol. 4 No. 12 (2023): December 2023 Issue
https://doi.org/10.51168/sjhrafrica.v4i12.899
Narrative Review