

Running title : Pattern of Orthognathic Surgical Planning

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Abstract

Background

Orthognathic surgery plays a significant role in the correction of dentofacial deformities by improving functional occlusion, facial esthetics, and psychosocial well-being. The increasing demand for corrective jaw surgery has resulted in evolving trends in surgical treatment planning. Evaluating institutional patterns of orthognathic surgery may provide valuable insight into demographic distribution and commonly performed procedures.

Aim

To evaluate the demographic distribution and pattern of orthognathic surgical treatment planning among patients undergoing corrective jaw surgery in a tertiary dental care institution.

Materials and Methods

This retrospective institutional study included 369 patient records of individuals planned for orthognathic surgical correction between January 2019 and April 2026. Data were retrieved from institutional digital case records maintained by the Department of Oral and Maxillofacial Surgery. Variables analyzed included age, gender, type of surgical procedure, combination surgeries, and arch involvement. Descriptive statistics and Chi-square tests were performed using SPSS software version 23.0, with $p < 0.05$ considered statistically significant.

Results

The majority of patients belonged to the 18–25 years age group (58.0%), with a slight male predominance (54.7%). Anterior maxillary osteotomy (46.6%) was the most frequently planned procedure, followed by bilateral sagittal split osteotomy (40.1%) and genioplasty (34.1%). Combined upper and lower jaw involvement was observed in 59.9% of cases. Significant associations were observed between age group and surgical treatment patterns ($p < 0.05$).

Conclusion

Orthognathic surgical treatment planning was predominantly observed among young adults, with combined jaw surgeries being the most common treatment modality. The study highlights the increasing preference for comprehensive corrective jaw surgery to achieve functional and esthetic rehabilitation.

Keywords : Orthognathic surgery; Bilateral sagittal split osteotomy; Health; Quality of life; Well-being

Introduction

Dentofacial deformities represent a broad spectrum of skeletal and dental discrepancies affecting the maxillofacial region, often leading to functional impairment as well as significant esthetic concerns. These deformities may involve the maxilla, mandible, chin, or a combination of craniofacial structures, resulting in malocclusion, facial asymmetry, impaired mastication, speech difficulties, temporomandibular joint disturbances, airway compromise, and psychosocial distress (1). The severity of these conditions can considerably influence an individual's quality of life, self-esteem, and social interactions. Management of such deformities frequently requires a comprehensive interdisciplinary approach involving orthodontic treatment combined with orthognathic surgical correction.

Orthognathic surgery refers to surgical procedures performed to reposition the jaws and associated facial skeletal structures into a more harmonious and functional relationship. The term originates from the Greek words "ortho," meaning straight, and "gnathic," meaning jaws. The primary goal of orthognathic surgery is to establish functional occlusion while improving facial balance, esthetics, speech, mastication, and airway function. In contemporary clinical practice, orthognathic surgery has evolved beyond merely correcting occlusal discrepancies and now plays a substantial role in enhancing facial esthetics and psychosocial well-being (2).

Advancements in maxillofacial surgical techniques, rigid internal fixation systems, three-dimensional imaging, virtual surgical planning, and perioperative care have greatly improved the predictability, safety, and overall outcomes of orthognathic procedures. These technological developments have also reduced postoperative morbidity and enhanced patient acceptance toward surgical correction of skeletal malocclusions. As a result, orthognathic surgery has become an increasingly accepted treatment modality among young adults seeking both functional rehabilitation and facial esthetic improvement (3).

Several orthognathic surgical procedures are routinely performed depending on the nature and severity of the skeletal discrepancy. Bilateral sagittal split osteotomy (BSSO) is one of the most commonly performed mandibular procedures and is primarily indicated for mandibular advancement or setback. Le Fort I osteotomy is widely utilized for repositioning the maxilla in cases involving vertical maxillary excess, maxillary deficiency, open bite deformities, or facial asymmetry (4). Anterior maxillary osteotomy (AMO) and posterior maxillary osteotomy (PMO) are often employed for segmental correction of localized maxillary deformities, whereas subapical osteotomy facilitates dentoalveolar repositioning in selected malocclusion cases. Genioplasty is commonly performed either as an adjunctive esthetic procedure or in combination with other orthognathic surgeries to improve chin projection, facial profile, and lower facial harmony. The selection of orthognathic surgical procedures is influenced by multiple factors including patient age, gender, severity of skeletal discrepancy, type of malocclusion, esthetic expectations, facial proportions, and institutional treatment protocols. In patients presenting with complex dentofacial deformities, combined maxillary and mandibular surgeries are frequently indicated to achieve optimal skeletal correction and facial balance (4). Such combination procedures have shown improved functional and esthetic outcomes compared to isolated jaw surgeries in severe skeletal discrepancies.

The epidemiological distribution and treatment planning patterns of orthognathic surgery vary considerably among different populations and geographic regions. Ethnic craniofacial characteristics, cultural perceptions of facial esthetics, socioeconomic factors, and healthcare accessibility may significantly influence the prevalence and type of surgical procedures performed (5). In recent years, there has been a growing demand for orthognathic surgery among younger individuals due to increasing awareness regarding facial esthetics, social confidence, and availability of advanced surgical treatment modalities. Additionally, the influence of digital media and changing esthetic perceptions has contributed to greater patient interest in facial corrective procedures.

Institutional retrospective studies provide valuable clinical insight into the demographic distribution and procedural trends associated with orthognathic surgery. Such analyses are important for understanding the frequency of various surgical procedures, identifying commonly performed combination surgeries, evaluating

treatment planning patterns, and assessing changing trends over time (6). Furthermore, these studies contribute to improved institutional treatment protocols, surgical training, patient counseling, and allocation of healthcare resources within oral and maxillofacial surgical departments.

Although numerous international studies have evaluated the prevalence and outcomes of orthognathic surgery, limited data are available regarding the pattern of orthognathic surgical treatment planning in the Indian population, particularly within institutional settings (7). Evaluating institutional trends can help in understanding regional treatment preferences, demographic characteristics, and evolving surgical practices among patients undergoing orthognathic correction. Therefore, the present retrospective institutional study was undertaken to evaluate the pattern of orthognathic surgical treatment planning among patients treated in a tertiary dental care institution. The study aimed to assess the demographic characteristics of patients undergoing orthognathic surgery and to analyze the frequency and distribution of various orthognathic surgical procedures and combination treatment modalities.

Materials and Methods

Study Design and Study Setting

The present study was designed as a retrospective institutional study conducted in a tertiary dental care institution. The study evaluated the pattern of orthognathic surgical treatment planning among patients who underwent corrective jaw surgery procedures during the study period. Patient records were retrieved from the institutional digital case record management system maintained by the Department of Oral and Maxillofacial Surgery.

Study Period

The records of patients who underwent orthognathic surgical treatment between January 2019 and April 2026 were reviewed for the study. Ethical clearance for the study was obtained from the Institutional Scientific Review Board and Institutional Ethics Committee prior to data collection.

Study Population

A total of 369 patient records diagnosed with dentofacial deformities and planned for orthognathic surgical correction were included in the study. Patients of both genders and varying age groups who had complete treatment planning records were considered eligible for inclusion.

Inclusion Criteria

- Patients who underwent orthognathic surgical treatment planning during the study period
- Patients with complete demographic and surgical planning records
- Patients who underwent procedures including Le Fort I osteotomy, bilateral sagittal split osteotomy (BSSO), anterior maxillary osteotomy (AMO), posterior maxillary osteotomy (PMO), genioplasty, and subapical osteotomy
- Patients with clearly documented surgical plans in institutional records

Exclusion Criteria

- Incomplete or duplicated patient records
- Patients with missing demographic details or unclear surgical planning documentation
- Syndromic patients requiring craniofacial reconstructive procedures unrelated to routine orthognathic correction
- Patients who underwent trauma-related corrective surgeries

Data Collection Procedure

The institutional digital database was systematically screened using procedure-based filters related to orthognathic surgery. Relevant patient records were reviewed and cross-verified by independent investigators to minimize data entry errors and duplication. The collected data were anonymized prior to analysis to maintain patient confidentiality.

The following variables were retrieved from the patient records:

Demographic Variables :

- Age
- Gender

Clinical and Surgical Variables :

- Type of orthognathic surgical procedure planned
- Combination surgical procedures
- Arch involvement
 - Upper arch (UA)
 - Lower arch (LA)
 - Both arches (BA)

Classification of Surgical Procedures :

The orthognathic surgical procedures included in the study were categorized as follows:

- Le Fort I Osteotomy – maxillary repositioning procedure
- Bilateral Sagittal Split Osteotomy (BSSO) – mandibular advancement or setback procedure
- Anterior Maxillary Osteotomy (AMO) – anterior maxillary segmental repositioning
- Posterior Maxillary Osteotomy (PMO) – posterior maxillary correction
- Subapical Osteotomy – dentoalveolar corrective osteotomy
- Genioplasty – corrective chin surgery
- Other Procedures – procedures not falling under the above categories

Combination surgeries involving multiple procedures performed simultaneously were also documented and analyzed.

Outcome Measures :

The primary outcome measure of the study was the frequency distribution of orthognathic surgical procedures planned during the study period. Secondary outcome measures included:

- Age-wise distribution of surgical procedures
- Gender distribution among orthognathic surgery patients
- Frequency of combination surgical procedures
- Arch-wise distribution of surgical treatment planning

Statistical Analysis :

The collected data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) software version 23.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics including frequency distribution, percentages, mean, and standard deviation were calculated for demographic and surgical variables. Inferential statistical analysis was performed using the Chi-square test to assess the association between demographic variables and surgical treatment planning patterns. A p-value of less than 0.05 was considered statistically significant.

Results

A total of 369 patient records planned for orthognathic surgical correction were included in the present retrospective institutional study. The age of the study population ranged from 13 to 63 years, with a mean age of 24.8 ± 6.7 years. The majority of patients belonged to the 18–25 years age group (58.0%), followed by the 26–35 years age group (24.7%). Patients aged ≤ 17 years constituted 11.4% of the study population, while only 6.0% of patients were above 35 years of age. The age-wise distribution of the study population is represented in Graph 2.

Gender distribution analysis demonstrated a slight male predominance, with 202 male patients (54.7%) and 167 female patients (45.3%) undergoing orthognathic surgical treatment planning. The gender distribution among the study participants is illustrated in Graph 1.

Evaluation of orthognathic surgical procedures revealed that anterior maxillary osteotomy (AMO) was the most frequently planned surgical procedure, observed in 172 patients (46.6%). Bilateral sagittal split osteotomy (BSSO) was the second most common procedure and was identified in 148 patients (40.1%). Genioplasty was planned in 126 patients (34.1%), either as an isolated esthetic correction or in combination with other orthognathic procedures. Subapical osteotomy was observed in 98 patients (26.6%), while Le Fort I osteotomy was planned in 89 patients (24.1%). Posterior maxillary osteotomy (PMO) represented

the least frequently performed procedure, accounting for only 1.6% of the total cases. The frequency distribution of orthognathic surgical procedures is shown in Graph 3.

Arch-wise distribution analysis demonstrated that combined upper and lower arch involvement (BA) was the most commonly observed pattern, accounting for 221 patients (59.9%). Isolated lower arch involvement (LA) was observed in 93 patients (25.2%), whereas isolated upper arch involvement (UA) was identified in 55 patients (14.9%). The distribution of arch involvement is illustrated in Graph 4.

Analysis of combination surgical procedures demonstrated that multiple procedure planning was common among patients with severe dentofacial deformities. The most frequently observed combinations included AMO with subapical osteotomy, BSSO with genioplasty, and Le Fort I osteotomy combined with BSSO. Combination procedures involving Le Fort I osteotomy, AMO, and genioplasty were also frequently identified. The distribution of commonly performed combination surgeries is represented in Graph 5.

Statistical analysis revealed a significant association between age group and the type of orthognathic surgical procedures performed ($p < 0.001$). Younger patients predominantly underwent combined jaw surgeries and adjunctive esthetic procedures such as genioplasty. However, no statistically significant association was observed between gender and the distribution of orthognathic surgical procedures ($p > 0.05$).

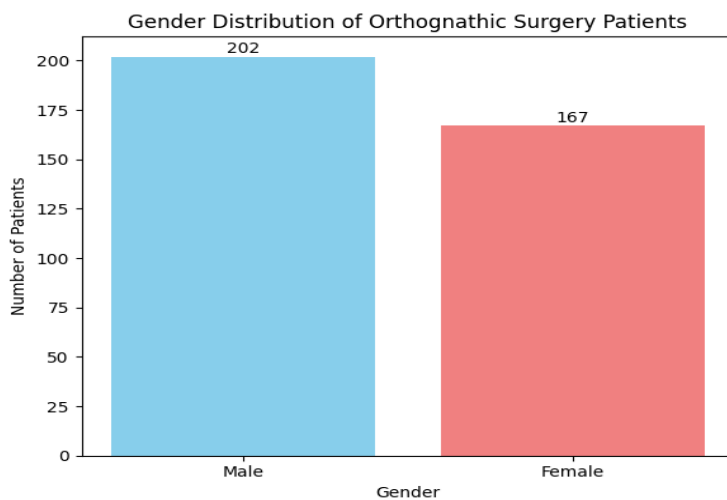
The demographic characteristics, surgical procedure distribution, and arch involvement patterns among the study population are summarized in Table 1.

Table 1. Demographic distribution, frequency of orthognathic surgical procedures, and arch involvement among patients undergoing orthognathic surgery

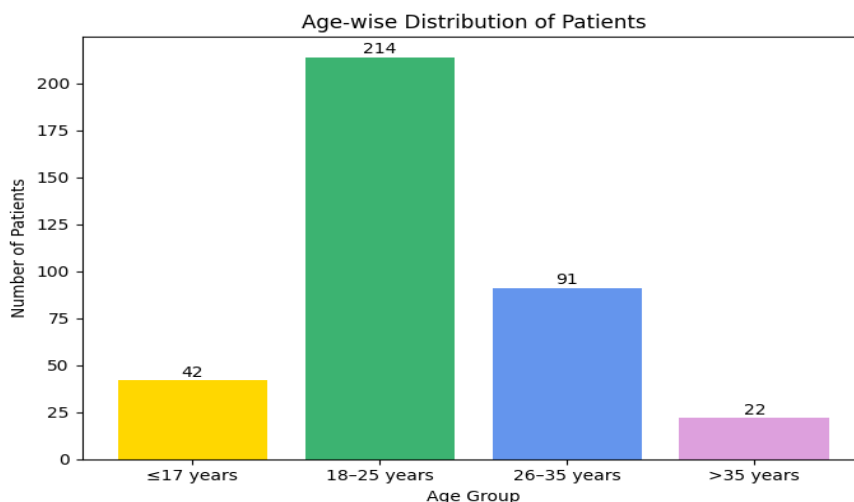
Variable	Category	Frequency (n)	Percentage (%)	p-value
Gender	Male	202	54.7	0.214
	Female	167	45.3	
Age Group	≤17 years	42	11.4	<0.001*
	18–25 years	214	58.0	
	26–35 years	91	24.7	
	>35 years	22	6.0	
Surgical Procedures	AMO	172	46.6	<0.001*
	BSSO	148	40.1	
	Genioplasty	126	34.1	
	Subapical Osteotomy	98	26.6	
	Le Fort I Osteotomy	89	24.1	
	PMO	6	1.6	
Arch Involvement	Both arches (BA)	221	59.9	<0.05*
	Lower arch (LA)	93	25.2	
	Upper arch (UA)	55	14.9	

*Statistically significant ($p < 0.05$)

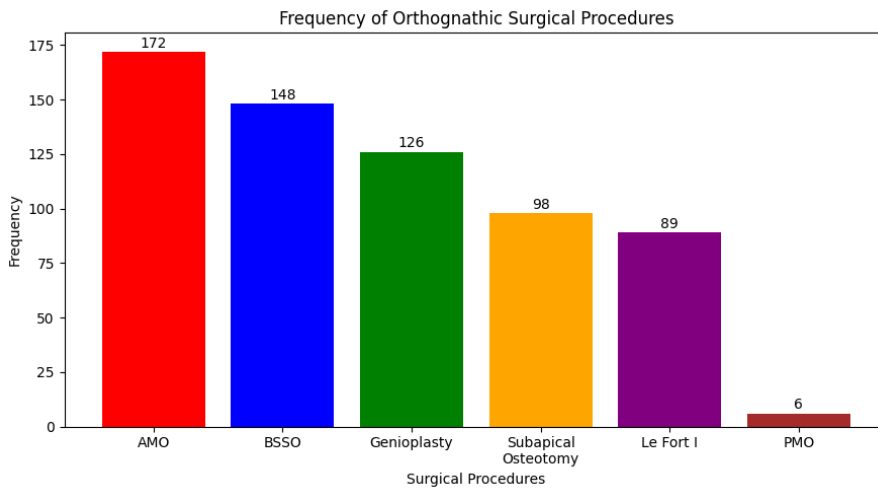
Graph 1 : Bar graph depicting gender distribution among patients undergoing orthognathic surgical treatment planning.



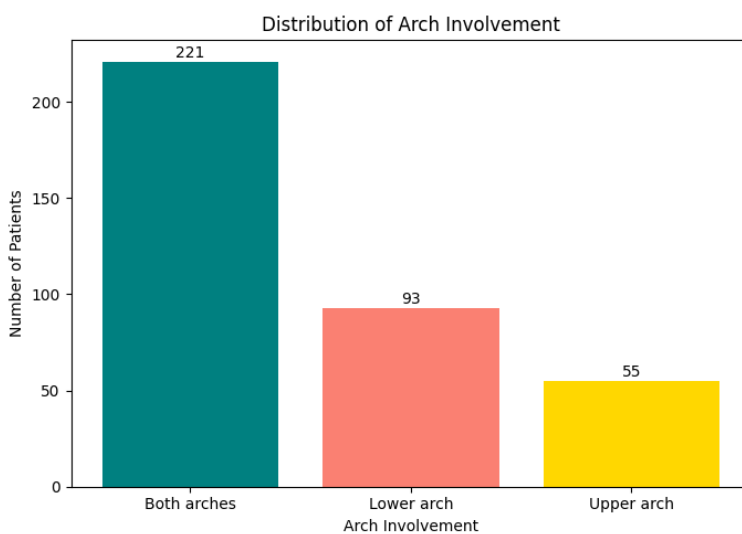
Graph 2 : Bar graph illustrating age-wise distribution of patients undergoing orthognathic surgery.



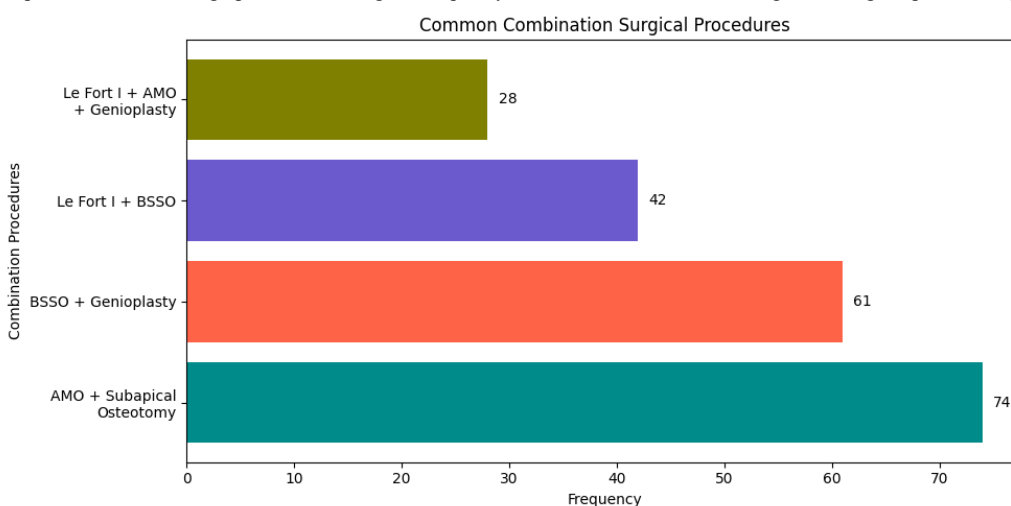
Graph 3. Bar graph representing the frequency distribution of various orthognathic surgical procedures performed among the study population.



Graph 4 : Bar graph showing the distribution of arch involvement among patients undergoing orthognathic surgical procedures.



Graph 5 : Horizontal bar graph demonstrating the frequency of common combination orthognathic surgical procedures performed in the study population.



Discussion

The present retrospective institutional study evaluated the demographic distribution and pattern of orthognathic surgical treatment planning among 369 patients undergoing corrective jaw surgery in a tertiary dental care institution. Orthognathic surgery has evolved considerably over the years, transitioning from a procedure primarily intended for functional rehabilitation to one that also significantly emphasizes facial esthetics and psychosocial well-being (8). The findings of the present study demonstrated a high prevalence of combined surgical procedures among young adults, highlighting the growing demand for comprehensive correction of dentofacial deformities.

The age-wise distribution of the study population revealed that the majority of patients belonged to the 18–25 years age group, accounting for 58% of all cases. This finding is consistent with the conventional timing of orthognathic surgery, which is generally performed after the completion of active craniofacial growth. Younger adults often seek orthognathic correction during late adolescence or early adulthood when skeletal growth stabilizes and esthetic awareness becomes more pronounced (9-11). In addition, increasing social consciousness regarding facial appearance, self-confidence, and improved accessibility to

multidisciplinary orthodontic-surgical care may contribute to the higher prevalence observed in this age group. The relatively lower number of patients above 35 years of age may be attributed to reduced esthetic demand, systemic health considerations, and delayed willingness to undergo major surgical interventions. Gender distribution analysis demonstrated a slight male predominance, with males accounting for 54.7% of the study population. This observation may reflect the greater prevalence of severe skeletal discrepancies among males, particularly mandibular prognathism and facial asymmetry requiring surgical correction (12). However, the difference between male and female distribution was not statistically significant, suggesting that orthognathic surgery is increasingly accepted across both genders. The rising number of female patients undergoing orthognathic treatment could also be associated with heightened esthetic awareness and improved acceptance of facial corrective procedures.

Among the various surgical procedures analyzed, anterior maxillary osteotomy (AMO) emerged as the most commonly planned procedure. This finding may indicate the higher prevalence of maxillary dentoalveolar protrusion and vertical maxillary discrepancies within the studied population. AMO is commonly performed in patients presenting with protrusive maxillary dentition, excessive incisor display, lip incompetence, and convex facial profile (13). The increased frequency of AMO in the present study may also reflect ethnic craniofacial characteristics commonly observed in the South Indian population, where dentoalveolar protrusion is relatively prevalent.

Bilateral sagittal split osteotomy (BSSO) was the second most frequently observed procedure and represented one of the principal mandibular corrective surgeries performed in the institution. BSSO remains a widely accepted procedure for mandibular advancement or setback due to its versatility, favorable postoperative stability, and predictable functional outcomes (14). The high prevalence of BSSO observed in the present study may be associated with the increased occurrence of skeletal Class III malocclusion and mandibular discrepancies requiring surgical repositioning.

Genioplasty was frequently planned either as an isolated esthetic correction or in combination with other orthognathic procedures. This reflects the growing emphasis on lower facial esthetics and profile enhancement in contemporary orthognathic treatment planning. Chin position significantly influences facial harmony, and adjunctive genioplasty is often incorporated to optimize soft tissue balance and improve postoperative esthetic outcomes. The increased use of genioplasty in younger patients further highlights the role of esthetic considerations in modern surgical planning.

The present study also demonstrated that combined upper and lower arch involvement was the most commonly observed treatment pattern. This finding suggests that a substantial proportion of patients presented with complex skeletal discrepancies requiring comprehensive double-jaw correction rather than isolated maxillary or mandibular surgery. Combined surgical approaches provide superior correction of facial asymmetry, occlusal discrepancies, and skeletal imbalance, thereby improving both functional and esthetic outcomes. The increasing frequency of combined jaw surgeries may additionally reflect advancements in surgical expertise, virtual planning technologies, and interdisciplinary treatment coordination.

Combination surgical procedures such as AMO with subapical osteotomy and BSSO with genioplasty were commonly identified in the present study. These procedures are often planned in severe dentofacial deformities where isolated correction may not provide optimal facial balance or occlusal stability (15). The prevalence of such combinations indicates a comprehensive treatment approach tailored toward achieving overall facial harmony rather than correction of a single skeletal component. Statistical analysis revealed a significant association between age and surgical treatment planning patterns, with younger individuals more likely to undergo combined and esthetically driven procedures. This may be attributed to greater esthetic expectations, social awareness, and increased motivation among younger patients seeking facial correction. However, gender did not show a statistically significant influence on treatment planning patterns. Despite the valuable findings obtained, the present study possesses certain limitations. Being a retrospective institutional study, the results are limited to the available clinical records and may not fully represent the general population. Variations in surgeon preference, treatment planning protocols, and case complexity could have influenced the frequency distribution of procedures. Additionally, postoperative outcomes, patient satisfaction, skeletal relapse, and long-term functional stability were not evaluated in the present study. Future multicenter prospective studies incorporating skeletal malocclusion classification, treatment outcomes, and patient-reported esthetic satisfaction would provide more comprehensive insight into orthognathic surgical trends and outcomes.

Overall, the findings of the present study provide valuable information regarding the demographic characteristics and orthognathic surgical planning patterns within a tertiary dental care institution and highlight the increasing demand for comprehensive corrective jaw surgery among young adults.

Conclusion

Within the limitations of the present retrospective institutional study, it can be concluded that orthognathic surgical treatment planning was predominantly observed among young adults, with a slight male predominance. Anterior maxillary osteotomy and bilateral sagittal split osteotomy were the most frequently planned procedures, while combined upper and lower jaw surgeries constituted the majority of treatment plans. The findings indicate an increased preference for comprehensive surgical correction of dentofacial deformities aimed at achieving both functional rehabilitation and improved facial esthetics. The study provides valuable insight into the demographic trends and surgical planning patterns associated with orthognathic surgery in a tertiary dental care institution.

Conflict of interest : nil

Funding : nil

Acknowledgment : The authors would like to express their sincere gratitude to the management of Saveetha Dental College and Hospitals for providing access to the institutional digital records and necessary support to conduct this retrospective study.

References

1. Jandali D, Barrera JE. Recent advances in orthognathic surgery. *Curr Opin Otolaryngol Head Neck Surg.* 2020;28(4):246-50.
2. Alkhayer A, Piffkó J, Lippold C, Segatto E. Accuracy of virtual planning in orthognathic surgery: a systematic review. *Head Face Med.* 2020;16(1):34.
3. Barone S, Rustemeyer J, Sbordone C, D'Agostino A. Surgery-first orthognathic approach vs conventional orthognathic approach: a systematic review of systematic reviews. *J Stomatol Oral Maxillofac Surg.* 2021;122(2):162-72.
4. Weiss RO 2nd, Ong AA, Reddy LV, Bahmanyar S, Vincent AG, Ducic Y. Orthognathic surgery-Le Fort I osteotomy. *Facial Plast Surg.* 2021;37(6):703-8.
5. Bowe CM, Gurney B, Sloane J, Johnson P, Newlands C. Operative time, length of stay and reoperation rates for orthognathic surgery. *Br J Oral Maxillofac Surg.* 2021;59(2):163-7.
6. Cousin AS, Bouletreau P, Gai J, Ibrahim B, Louvrier A, Sigaux N. Severity and long-term complications of surgical site infections after orthognathic surgery: a retrospective study. *Sci Rep.* 2020;10(1):12015.
7. Thiem DGE, Schneider D, Hammel M, et al. Complications or rather side effects? Quantification of patient satisfaction and complications after orthognathic surgery—a retrospective, cross-sectional long-term analysis. *Clin Oral Investig.* 2021;25(5):3315-27.
8. Singh G, Gurung US, Mishra M, Gaur A. A retrospective cohort study of 45 cases treated with surgery first approach in orthognathic surgery and a short review. *Craniofacial Trauma Reconstr.* 2021;14(1):58-65.
9. Varella AM, Bhat SS, Revankar AV, Patil AK. Orthodontic surgical approach of severe skeletal hyperdivergent Class II malocclusion treated by Le Fort I osteotomy, BSSO and genioplasty. *J Contemp Orthod.* 2020;4(3):9-15.
10. Verweij JP, Houppermans PN, Mensink G, van Merkesteyn JPR. Long-term skeletal stability after bilateral sagittal split osteotomy advancement surgery: a systematic review. *Int J Oral Maxillofac Surg.* 2022;51(4):497-506.
11. Steenen SA, Becking AG. Bad splits in bilateral sagittal split osteotomy: systematic review of fracture patterns and associated risk factors. *Int J Oral Maxillofac Surg.* 2021;50(4):481-90.
12. Olate S, Zaror C, Mommaerts MY. A systematic review of soft tissue changes after genioplasty procedures. *J Craniomaxillofac Surg.* 2022;50(5):417-24.
13. Prenetha R, Felicita AS. Original Research Comparison of Maxillary Canine Characteristics between Buccal and Palatal Impactions in South Indian Population-A Preliminary Observational CBCT Study.
14. Felix N, Sreenivasagan S, Subramanian AK. BULLETIN OF STOMATOLOGY AND MAXILLOFACIAL SURGERY. *Bulletin of Stomatology and Maxillofacial Surgery.* 2025;21(9):427-33.
15. Vamsidhar TS, Lakshmanan S, Arularasan G, Pandurangan SM, Krishnan M. Prevalence of Temporomandibular Disorders in Bilateral Sagittal Split Osteotomy Surgery Patients: A Single Institutional Retrospective Study. *Annals of Dental Specialty.* 2025;13(2-2025):78-82.