Original Article

PREVALENCE OF TEMPOROMANDIBULAR DISORDERS IN BILATERAL SAGITTAL SPLIT OSTEOTOMY SURGERY PATIENTS: A SINGLE INSTITUTIONAL RETROSPECTIVE STUDY

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ABSTRACT

Temporomandibular disorders (TMDs) are multifactorial conditions affecting the temporomandibular joint (TMJ), muscles of mastication, and associated structures. Orthognathic surgery, particularly bilateral sagittal split osteotomy (BSSO), plays a dual role in improving skeletal discrepancies and influencing TMD outcomes in both skeletal and functional aspects. This study aimed to evaluate the prevalence of TMD before and after BSSO in patients undergoing orthognathic surgery. A retrospective analysis was performed on 50 patients who received BSSO for mandibular deformities from 2018 to 2023. Preoperative and postoperative TMD symptoms and mouth opening were recorded at three follow-up intervals: 6 months, 12 months. Clinical parameters included joint sounds, pain on TMJ palpation, mandibular range of motion, deviation on opening, and radiological joint changes. Data were analyzed statistically to assess prevalence and associations. Preoperative TMD symptoms were identified in 46% (n=23) patients, most commonly joint clicking and myofascial pain. Postoperatively,78% (18/23) of these patients demonstrated improvement or complete resolution of symptoms, whereas 22% (5/23) patients remained unchanged and 18% (5/27) patients developed new-onset TMD. The most favorable outcomes were noted in patients with mandibular prognathism corrected with BSSO set back and rigid fixation. The risk of persistent or aggravated TMD was associated with preoperative degenerative changes and excessive intraoperative condylar torque. BSSO significantly reduces the prevalence of TMD in patients with skeletal malocclusion, though new-onset symptoms may develop in a subset. Careful case selection, precise surgical execution, and postoperative follow up are critical to minimizing adverse TMJ outcomes.

Key words: Temporomandibular disorder, Orthognathic surgery, Bilateral sagittal split osteotomy, Relapse, mandibular deformity.

Introduction

Temporomandibular disorders (TMD) are multifactorial conditions affecting the temporomandibular joint (TMJ), embracing different manifestations ranging from masticatory muscle pain to joint clicking, crepitus, and functional impairment. Epidemiologically, TMD affects approximately one-third of the global adult population, presenting more in females and young adults aged 20–40 years [1-3]. In patients with malocclusion and different occlusal factors, this prevalence is even higher, reaching up to 43%, particularly among those with Class II malocclusions or dental crossbite tendencies [4, 5]. Orthognathic surgery, notably Bilateral Sagittal Split Osteotomy (BSSO), is performed to correct maxillofacial deformities and malocclusions. Emerging literature indicates that such corrective interventions can have a significant social and psychological as well as biomechanical and clinical impact on TMD symptoms. Finite-element analyses demonstrate that BSSO (or SSRO) can improve TMJ stress distribution, potentially alleviating TMD symptoms in patients with mandibular prognathism. Clinically, retrospective studies have observed reductions in symptoms such as clicking and pain post-surgery, though with occasional increases in crepitus in certain patients [6, 7].

Benefits are particularly pronounced in patients with myogenous TMD components and those with excessive overjet or prior occlusal splint therapy [8]. Conversely, orthognathic surgery may also introduce new risks. Some patients experience symptom exacerbation or new-onset TMD following surgical intervention, likely linked to altered occlusal loads or condylar displacement [9]. In a retrospective review of 145 orthognathic patients, signs and symptoms of TMD decreased significantly post-treatment; yet roughly half of the procedures involved BSSO, which showed a higher overall rate of surgical complications. Despite these insights, the literature lacks a comprehensive understanding of prevalence of TMD specifically before and after BSSO in orthognathic procedures [9-11]. Therefore, the objective of the study is to determine the prevalence of temporomandibular disorders in patients undergoing BSSO, comparing TMD characteristics before and after surgery,

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and assessing the variables that may influence TMD trajectory postoperatively.

Materials and Methods

Study design and setting

This retrospective observational study was carried out at the Department of Oral and Maxillofacial Surgery, Saveetha Dental College and Hospital, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Chennai, India, following ethical approval from the Institutional Ethics Committee in accordance with the Declaration of Helsinki. Medical records from patients who underwent Bilateral Sagittal Split Osteotomy (BSSO) between January 2018 and December 2023 were evaluated [12].

Study population

Consecutive patients aged 18–40 years with skeletal Class II or Class III deformities treated by BSSO and having a minimum follow-up period of 12 months were included, with 32 male and 28 female. 25 patients underwent BSSO setback, 12 patients underwent BSSO advancement, and 13 patients underwent rotational and differential BSSO. Patients were excluded if they had systemic joint disorders (e.g., rheumatoid arthritis), prior TMJ surgery or trauma, or incomplete records. The inclusion and exclusion criteria were carefully established beforehand to minimize selection bias.

Data collection

Data was extracted from medical records and surgical charts using a standardized data-collection form by two independent reviewers to enhance reliability in the study. Extracted variables included:

Demographic data

Patient age and sex were documented. Clinical outcomes were evaluated through assessment of temporomandibular joint (TMJ) function, with pain intensity measured using the Visual Analog Scale (VAS). The presence of joint sounds, including clicking and crepitus, was recorded, and mandibular range of motion was determined by measuring the maximum interincisal distance at mouth opening. Deviation during mandibular opening was measured in millimeters. Radiographic evaluation was performed for all patients using panoramic radiographs, with cone-beam computed tomography (CBCT) data incorporated when available to provide detailed analysis of TMJ morphology. Assessments were recorded for preoperative baseline and at follow-up visits held at approximately 6,8 and 12 months postoperatively.

Procedures

All surgical interventions were performed by the same surgical team using standardized BSSO techniques. Radiographs were acquired and interpreted consistently, and measurement tools (e.g., VAS, ruler calipers) were calibrated per institutional protocols to maintain reproducibility.

Statistical analysis

Continuous variables are summarized as mean ± standard deviation, and categorical variables as frequencies and percentages.

Results and Discussion

The occurrence of temporomandibular disorder (TMD) symptoms was evaluated before surgery and then re assessed at 6 and 12 months after bilateral sagittal split osteotomy (BSSO). Overall, patients experienced a steady improvement in their symptoms over time. Preoperative TMD symptoms were identified in 46% (n=23) patients. TMJ pain showed the most noticeable reduction, dropping from 36% before surgery to just 14% by 12 months. Joint sounds, including clicking and crepitus, also decreased significantly, while functional problems such as restricted mouth opening and deviation on opening became progressively less common. The full distribution of these findings is shown in **Table 1**. Patients showed a clear and steady improvement in mouth opening after bilateral sagittal split osteotomy (BSSO). Before surgery, the average opening was restricted to about 30–31 mm. Just one month after the procedure, patients were already able to open slightly wider, reaching 31–32 mm. By the second month, this improvement became more pronounced, with most patients achieving 34–35 mm. Further follow-ups at 5 and 8 months confirmed continued progress, with mouth opening reaching close to 36 mm. These results highlight that the greatest recovery occurred in the first two months, followed by gradual and sustained improvement, reflecting both functional recovery and long-term stability after surgery, as mentioned in **Figure 1**. In the CBCT evaluation, flattening of the condylar head noticed in eight patients (35%) among the 23 preexisting TMD patients.

Table 1. Prevalence of temporomandibular disorder (TMD) symptoms before surgery and at 6, 12, and following bilateral sagittal split osteotomy (BSSO).

SYMPTOM	PRE OPERATIVE	6 MONTHS	12 MONTHS
TMJ PAIN	18(36%)	12(24%)	7(14%)
CLICKING	15(30%)	10(20%)	6(12%)
CREPITUS	4(8%)	3(6%)	2(4%)
LIMITED OPENING	7(14%)	4(8%)	2(4%)
DEVIATION ON OPENING	9(18%)	6(12%)	3(6%)

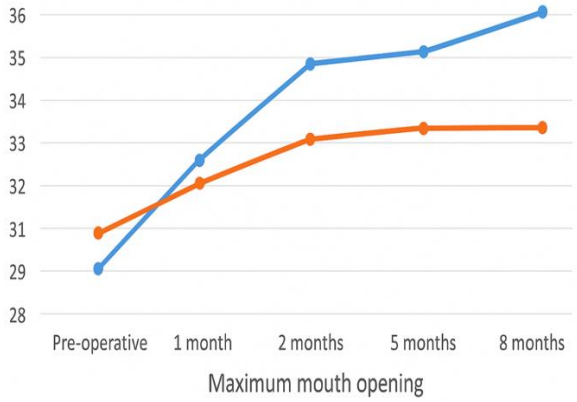

Figure 1. Trend in maximum mouth opening (mm) recorded preoperatively and at 1-, 2-, 5-, and 8-months post-surgery.

Overall outcomes

In the present study, postoperative evaluation demonstrated that 78% (18/23) of patients experienced resolution or improvement of temporomandibular disorder (TMD) symptoms following BSSO. A total of 22% (5/23) of patients showed no appreciable change in their clinical condition, whereas 18% (5/27) developed new-onset TMD symptoms during the follow-up period [3, 5].

The approach utilized to assess TMD symptoms and indicators prior to and during treatment of craniofacial and dental abnormalities differs between research. The existing research clearly demonstrates that TMD is present in patients with maxillomandibular abnormalities who are undergoing bilateral sagittal split osteotomy. Our data show that nearly half of the patients (46%) had preoperative TMD symptoms, most commonly joint clicking and myofascial pain, which is consistent with previous investigations [13, 14]. Following surgery, most patients (78%) reported improvement or remission of symptoms, whereas 18% (5/27) acquired new-onset TMD, which is consistent with the findings [10].

The observed postoperative improvement in TMD symptoms corroborates earlier studies, which have suggested that surgical correction of skeletal deformities and malocclusion can lead to reduced stress and more favorable loading of the temporomandibular joint. Finite-element and clinical studies have demonstrated that mandibular advancement via BSSO reduces joint stress, particularly in cases of mandibular retrognathism [15, 16]. The emergence of new symptoms in a subset of patients has also been widely reported in the literature. These symptoms have been attributed to factors such as condylar torque and suboptimal condylar positioning following the surgery. Our findings support this, with preoperative degenerative joint changes and intraoperative torque associated with poor outcomes [17]. Patients with mandibular prognathism corrected with rigid fixation had the best outcomes, reinforcing prior research indicating that rigid fixation offers better condylar stability than semi-rigid techniques [18], and noted better outcomes in these patient subgroups [19, 20]. The higher prevalence of TMD in females and young adults is in agreement with prior epidemiological data [21, 22]. Our findings add to the emerging understanding that BSSO does not intrinsically worsen TMJ results and, in many circumstances, can improve them when performed correctly and with the right patient selection [23]. Clinically, comprehensive preoperative evaluation, surgical care to reduce condylar torque, and structured long-term monitoring are critical, as reflected in studies by Wolford *et al*., Hatcher *et al*. and Dolwick [24]. Despite the study's positives (uniform surgical team, standardized protocols, and long-term follow-up), limitations exist. The reliance on retrospective data and panoramic radiographs may restrict sensitivity in detecting small osseous changes, as indicated in studies comparing imaging modalities [25-27].

Conclusion

Considering the limitations of this retrospective study, it can be concluded that BSSO led to a noticeable reduction in both the prevalence and severity of TMD symptoms among patients with skeletal malocclusion. These findings align with previous research by Reineke *et al*. and Kerstens *et al*. confirming that BSSO can lead to substantial functional improvement in appropriately selected cases. However, risks remain for those with degenerative joint changes or poor condylar positioning during surgery.

Future scope

BSSO is a functionally safe procedure for correcting mandibular deformities, potentially offering therapeutic benefits for existing TMD by enhancing skeletal alignment, occlusal harmony, and neuromuscular balance. The use of modern techniques—rigid internal fixation, piezoelectric osteotomy tools, and virtual planning—may further improve outcomes and minimize complications. Even though TMD is multifactorial, articular disc play major role hence long follow up studies combined with Magnetic resonance imaging (MRI) to assess the disc position can be considered in the future. Overall, BSSO remains a cornerstone in dentofacial anomaly correction, offering both aesthetic and functional benefits when combined with thorough preoperative assessment and postoperative monitoring.

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Conflict of interest: None

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Ethics statement: The present study was retrospective in nature, data collected from the hospital clinical records after getting clearance (SRB/SDC/OMFS-2403/25/244) from the Institutional Ethical Committee, Saveetha Dental College and Hospital, Chennai. Patient's Data confidentiality and

privacy was maintained in all the phases of study according to Declaration of Helsinki and Institutional guidelines.

References

1. Kapos FP, Exposto FG, Oyarzo JF, Durham J. Temporomandibular disorders: a review of current concepts in aetiology, diagnosis and management. Oral Surg. 2020;13(4):321–34. doi:10.1111/ors.12473
2. Nagdalian A, Askerova A, Blinov A, Shariati MA. Evaluation of the toxicity of copper oxide nanoparticles toward pea seeds. World J Environ Biosci. 2024;13(3):23–30. doi:10.51847/A2gMbUMBUD
3. Mehrzad K, Yazdanpanah F, Arab M, Ghasemi M, Radfar A. Relationship between stress, anxiety, and depression with happiness in students of Bam medical university in 2019. J Adv Pharm Educ Res. 2022;12(2):51–6. doi:10.51847/dJZ1dCmMK6
4. Ângelo DF, Mota B, João RS, Sanz D, Cardoso HJ. Prevalence of clinical signs and symptoms of temporomandibular joint disorders registered in the EUROTMJ Database: a prospective study in a Portuguese centre. J Clin Med. 2023;12(10):3553. doi:10.3390/jcm12103553
5. Huyen NT, Nghi PH, Phuong ĐTL, Trang TTT, Huyen LT. Public debt and prosperity nexus in Asian countries: nonlinearity and threshold analysis. J Organ Behav Res. 2023;8(1):74–91. doi:10.51847/tw5g65dco8
6. Monson LA. Bilateral sagittal split osteotomy. Semin Plast Surg. 2013;27(3):145–8. doi:10.1055/s-0033-1357111
7. Demircan S, Uretürk E, Apaydin A, Şen S. Fixation methods for mandibular advancement and their effects on temporomandibular joint: a finite element analysis study. Biomed Res Int. 2020;2020:2810763. doi:10.1155/2020/2810763
8. Ncube M, Sibanda M, Matenda FR. The influence of AI and the pandemic on BRICS nations: South Africa's economic performance during crisis. Ann Organ Cult Leadersh Extern Engagem J. 2023;4:17–24. doi:10.51847/lrMvYTE3OF
9. Pachnicz D, Ramos A. Mandibular condyle displacements after orthognathic surgery—an overview of quantitative studies. Quant Imaging Med Surg. 2021;11(4):1628–50. doi:10.21037/qims-20-677
10. Agbaje J, Luyten J, Politis C. Pain complaints in patients undergoing orthognathic surgery. Pain Res Manag. 2018;2018:4235025. doi:10.1155/2018/4235025
11. Yang J, Tang Z, Shan Z, Leung YY. Integrating rapid maxillary expansion and Le Fort osteotomy for esthetic rehabilitation: a clinical case report. J Curr Res Oral Surg. 2023;3:22–6. doi:10.51847/E0OEwI52jo
12. Kajanova J, Badrov A. Medical students' perspectives on trust in medical AI: a quantitative comparative study. Asian J Ethics Health Med. 2024;4:44–57. doi:10.51847/36mpdZ9AZ8
13. Kim MJ, Lim CY, Son JL. Examining oral and dental health literacy of mothers and its relationship with children's oral and dental health status. Turk J Dent Hyg. 2024;4:1–7. doi:10.51847/2BHhiOaF1j
14. Hassan F, Hatah E. An analytical exploration of various non-pharmacological approaches utilized in managing diabetes among patients in Malaysia. Int J Soc Psychol Asp Healthc. 2022;2:27–37. doi:10.51847/JmKuHOeBQX
15. Kim YJ, Kim MY, Jha N, Jung MH, Kwon YD, Shin HG, et al. Treatment outcome and long-term stability of orthognathic surgery for facial asymmetry: a systematic review and meta-analysis. Korean J Orthod. 2024;54(2):89–107. doi:10.4041/kjod23.194
16. Wang Y, Daraqel B, Wang Y, Yang D, Dong Y, Hu Y, et al. Biomechanical effects of different mandibular movements and torque compensations during mandibular advancement with clear aligners: a finite element analysis. Front Bioeng Biotechnol. 2024;12:1496517. doi:10.3389/fbioe.2024.1496517
17. Sahu GR, Kaur A, Rattan V, Singh SP, Rai S. Effect of orthognathic surgery on temporomandibular disorders: a prospective study. J Maxillofac Oral Surg. 2022;21(1):277–82. doi:10.1007/s12663-021-01644-8
18. Abdul NS, Minervini G. Prevalence of temporomandibular disorders in orthognathic surgery patients: a systematic review conducted according to PRISMA guidelines and the Cochrane handbook for systematic reviews of interventions. J Oral Rehabil. 2023;50(10):1093–100. doi:10.1111/joor.13827
19. Kretschmer W, Baciuţ G, Baciuţ M, Sader R. Effect of bimaxillary orthognathic surgery on dysfunction of the temporomandibular joint: a retrospective study of 500 consecutive cases. Br J Oral Maxillofac Surg. 2019;57:1–8. doi:10.1016/j.bjoms.2019.06.010
20. Chen CM, Chen PJ, Hsu HJ. Changes in preexisting temporomandibular joint clicking after orthognathic surgery in patients with mandibular prognathism. Bioengineering. 2022;9(12):725. doi:10.3390/bioengineering9120725
21. Machate DJ, Figueiredo PS, Marcelino G, Guimarães RDCA, Hiane PA, Bogo D, et al. Impact of fresh coconut oil on the gastrointestinal microbiome and hematological/biochemical parameters in Wistar rats. Spec J Pharmacogn Phytochem Biotechnol. 2022;2:1–7. doi:10.51847/q69gWhtCds
22. Brekeit KA, AlOmrani AN, Alqwaiz AF, Alsuwayeh AS. Pediatric bullet-related vascular injuries: a case report of two incidents in Saudi Arabia. Interdiscip Res Med Sci Spec. 2022;2(2):23–8. doi:10.51847/0uxSuwERnz
23. Alrizqi AH, Aleissa BM. Prevalence of temporomandibular disorders between 2015–2021: a literature review. Cureus. 2023;15(4):e37028. doi:10.7759/cureus.37028
24. Ouafa B, Ifriqya M, Ikram T. Evaluation of biological activities of Chamaeleo chamaeleon: a reptile used in traditional folk medicine in Algeria. J Biochem

Technol. 2022;13(4):15–9. doi:10.51847/eD9GJaf2j7
25. Sukegawa S, Masui M, Kanno T, Miki M, Nakamoto H, Furuki Y. Evaluation of open reduction and internal fixation of mandibular condyle fracture by intraoperative cone-beam computed tomography in a hybrid operating room. J Craniofac Surg. 2019;31(1):1. doi:10.1097/SCS.0000000000006101
26. Kazemian M, Ghadiri Moghaddam N, Anbiaee N, Kermani H, Samiee Rad S. The clinical and radiographic changes of temporomandibular joint following mandibular set back surgery by bilateral sagittal split osteotomy (BSSO). World J Plast Surg. 2022;11(2):110–6. doi:10.52547/wjps.11.2.110
27. Peltoperä J, Kotaniemi KV, Suojanen J, Stoor P. Bad splits in orthognathic surgery, prevention and management. Curr Probl Surg. 2024;61(11):101587. doi:10.1016/j.cpsurg.2024.101587