CASE REPORT

Skeletal Open Bite Correction through Combined Orthodontic and Orthognathic Surgical Approaches: Review and Report of Two Cases

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ABSTRACT

Skeletal anterior open bite (AOB) is a complex dentofacial deformity characterized by a lack of vertical overlap of the anterior teeth due to skeletal discrepancies, dental/alveolar compensations, or both. Correction often requires a combined orthodontic orthognathic surgical approach to address both dental and skeletal components, improve function, esthetics, and achieve stable long term outcomes. Report of 2 cases is discussed and review discusses the current literature on combined orthodontic and surgical treatment for skeletal open bite, including diagnosis & treatment planning, surgical techniques, factors affecting relapse, and longterm stability. The evidence suggests that while combined treatment can produce significant improvements in overbite, facial esthetics, and occlusion, relapse, especially vertical relapse remains a considerable challenge. Protocol standardization, careful orthodontic preparation (especially arch width/form, curve of Spee, molar intrusion if used, and patient selection are key. Future directions include improved 3D imaging & planning, better understanding of airway & neuromuscular influences, skeletal anchorage adjuncts, and longer followups to better quantify stability and relapse risk.

KEYWORDS: Skeletal open bite, Orthognathic surgery, Combined orthodontic-surgical treatment, Open bite correction, Maxillofacial deformity, Le Fort I osteotomy, Mandibular surgery.

INTRODUCTION

Anterior open bite (AOB) is considered one of the more difficult malocclusions to treat due to its multifactorial etiology, which often combines skeletal, dental/alveolar, and functional (habit, tongue posture, airway) components. In skeletal open bite, features include increased lower anterior facial height, steep mandibular plane angle, short mandibular ramus, maxillary posterior dento-alveolar height increases, and often lip incompetence and excessive gingival display. A key challenge is not only to correct the open bite but also to ensure longterm stability, given the high potential for relapse.

Treatment options vary depending on age (growth potential), severity, and patient expectations. In non-growing patients with significant skeletal discrepancies, orthodontic camouflage may be insufficient; thus, orthognathic surgery combined with orthodontic treatment is often indicated. This combined approach aims to reposition skeletal bases (maxilla, mandible), correct dental compensations, align arches, and improve facial esthetics.

The purpose of this review is to synthesize current evidence around the combined orthodontic orthognathic surgical correction of skeletal open bite: surgical techniques used, orthodontic preparation principles, factors affecting relapse, stability outcomes, and to explore future trends and areas needing research.

Case report 1

B.S. is 30 years Saudi male, who presented to the orthodontic clinic with the chief complaint of “I can’t close my front teeth.”. He has class II malocclusion on a mild class II skeletal base due to retrognathic mandible, complicated by open basal configuration, bilateral posterior cross-bite, and skeletal open bite (8 mm).

Image 1-Pre treatment phase

Treatment plan

Comprehensive, surgical, non-extraction, fixed orthodontic treatment.

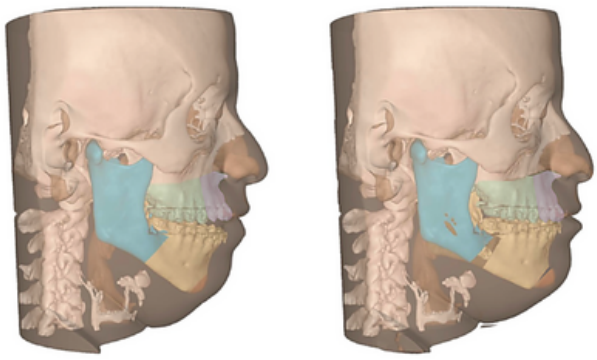
During the pre-surgical phase of dento-alveolar decompensation, oral hygiene was reinforced, initial records were taken, and the treatment plan was thoroughly discussed with the patient, followed by the signing of the informed consent form. The patient was referred for the extraction of all third molars to facilitate surgical planning. Separators were placed between the first and second molars in both arches, after which bands were selected and cemented on these molars using a 0.022” slot MBT prescription (3M). Fixed applia

-nces were bonded from the second premolar to second premolar (5-5) in both the upper and lower arches using a 0.022" straight wire MBT system. Segmental mechanics were implemented in the upper arch in the regions 7-4, 3-3, and 4-7. Leveling, alignment, and de-rotation were carried out progressively using 0.014" NiTi, 0.016" NiTi, and 0.016×0.022" NiTi wires. Treatment progressed until the placement of the surgical wire (0.019×0.025" stainless steel), at which point impressions were taken to prepare for the mock surgery. Finally, surgical hooks were placed in anticipation of the upcoming orthognathic procedure.

PRE-SURGICAL STUDY MODELS PHOTOGRAPHS

Surgical phase

The surgical plan included maxillary advancement through a 3-piece Le Fort I osteotomy, incorporating expansion and differential impaction to achieve optimal occlusal and aesthetic outcomes. Mandibular advancement was performed using a bilateral sagittal split osteotomy (BSSO), along with midline correction to ensure proper facial symmetry. Additionally, an advancement genioplasty was carried out to enhance chin projection and overall facial balance.



Initial Final

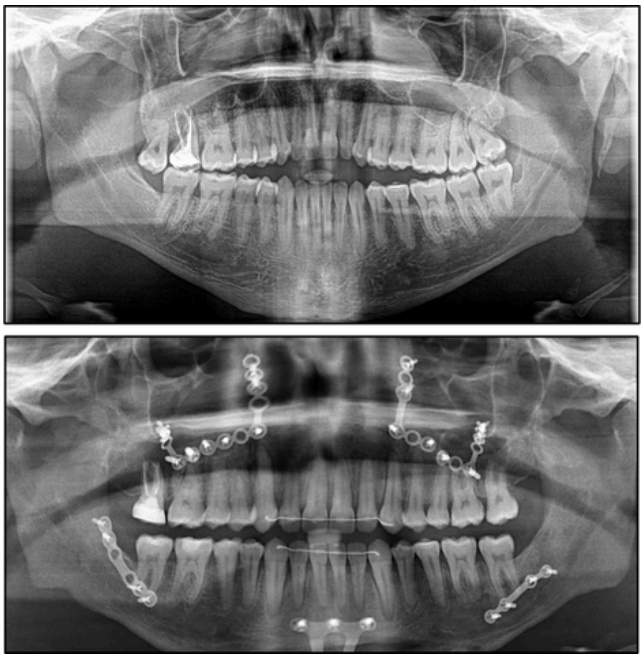
VIRTUAL SURGICAL TREATMENT PLANING

Post surgical phase

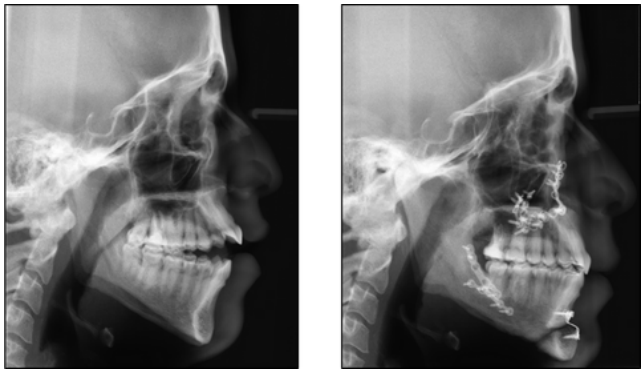
One week post-surgery, the splint and stabilizing archwires were removed. Continuous upper and lower archwires were then placed, along with settling elastics to aid in occlusal refinement. Any remaining spaces were closed using a 0.017×0.025" stainless steel archwire. This was followed by the finishing and detailing phase to achieve optimal occlusion and aesthetics. Finally, the appliances were de-bonded, and final records were taken to document the treatment outcome.

Retention plan

The retention plan includes a fixed retainer from canine to canine (3-3) in the upper arch, supplemented by a Hawley retainer to be worn during the day. At night, the patient is to wear a Hawley retainer with a posterior bite block to maintain occlusal stability. In the lower arch a fixed retainer from canine to canine (3-3) is placed to ensure long term alignment retention.



INITIAL & FINAL OPG RADIOGRAPHS

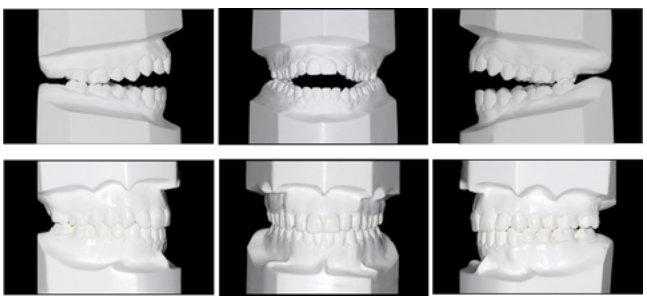


INITIAL AND FINAL CEPHALOMETRIC RADIOGRAPHS

Area of study	Measurement	Mean	Pre-Trea.	Post-Trea.
Skeletal Sagittal Relationship	SNA	82°±2°	77.5°	80.2°
	SNB	80°±2°	73.1°	78.4°
	ANB	2°±2°	4.4°	1.8°
	Wits Appraisal	-1 to 0mm	0.72 mm	-2.2 mm
	SN-Pog	80° ±3	75.2°	77.6°
	NA to A-Pog	0°±5.1°	6.7°	2°
Skeletal Vertical Relationship	SN-PP	8°±3°	4.6°	11°
	SN-MP	32°±5.1°	41.2°	35.5°
	PP-MP	25°±3°	35.7°	27.7°
	Me-tGo-Ar	126°±10°	131.5°	126.4°
	Y-axis (N-S-Gn)	59.4° ±3.8	63.8°	61.8°
	Lower Facial Hight	55%±3%	62.2%	56.4%

Area of study	Measurement	Mean	Pre-Trea.	Post-Trea.
Dental Relationship (Incisor Position)	U Inc. to L Inc.	131°±5°	125.8°	133°
	U Inc. to SN	104°±2°	107.2°	102°
	U Inc. to PP	110°±6°	114.5°	109°
	U Inc. to NA	22°±5.7°	28.4°	19°
		4mm±2.7	7 mm	3 mm
	L Inc. to NB	25°±6°	26.1°	24°
		4mm±1.8	6.3 mm	5 mm
	L Inc. to A-Pog	1mm±2	4.4 mm	2.6 mm
	L Inc. to MP	93°±6°	87.5°	88.5°
Soft Tissue	U lip to E-line	-4±2mm	0 mm	-2 mm
	L lip to E-line	-2±2mm	1 mm	0 mm
	U lip to SnV*	1 to 2mm	5 mm	2 mm
	L lip to SnV*	-1 to 0mm	1 mm	0 mm
	Pog to SnV*	-4 to -1mm	-7 mm	-2.5 mm
	NLA	100°±10°	97°	95.7°

INITIAL & FINAL CEPHALOMETRIC READING



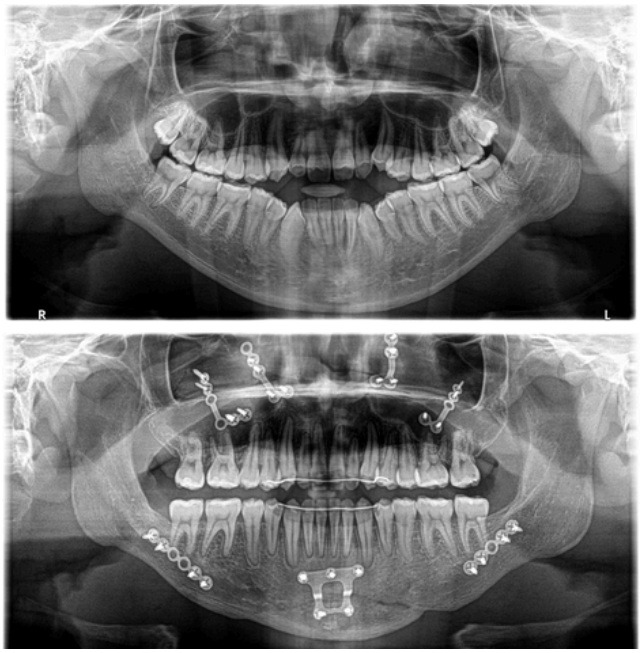
INITIAL & FINAL DENTAL CAST PHOTOS

INITIAL & FINAL INTRA ORAL PHOTOS

Post Treatment image

Case report 2

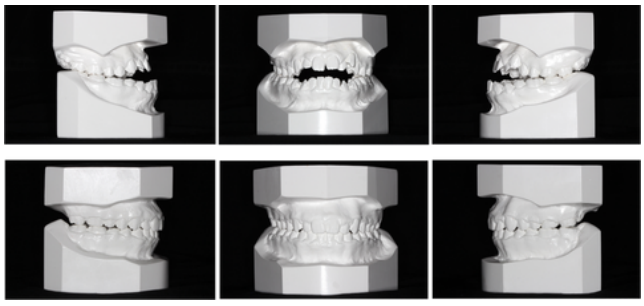
A 18 year old normal looking, healthy body built, Mesofacial form with concave profile, asymmetrical face with chin deviation to the left ,increased lower anterior facial height, inetr-canthal distance is similar width of the alar base and width of the mouth is smaller in right side to the distance between the medial iris margins, 5 mm incisal show at rest, average smile line, 2 mm gingival show upon smile, lip length and morphology within normal , poor lip balance and harmony with incompetent lips, cant of occlusal plane with downward roll of the dentition on the left side relative to inter-commissure line, upper dental midline is deviated to right by .5 mm relative to the facial midline and lower dental midline deviated left 3mm to the upper midline, average nose size and shape, nose is deviated to right, average nasolabial angle and cervico-mental angle, average buccal corridors with non-consonant smile arc.



INITIAL AND FINAL OPG RADIOGRAPHS

Area of study	Measurement	Mean	Pre-Trea.	Post	Area of study	Measurement	Mean	Pre-Trea.	Post
Skeletal Sagittal Relation	SNA	82°±2°	75°	82°	Dental Relation (Incisor Position)	U Inc. to L Inc.	131°±5°	116°	126°
	SNB	80°±2°	76°	80°		U Inc. to SN	104°±2°	105°	104°
	ANB	2°±2°	-1°	2°		U Inc. to PP	110°±6°	113°	110°
	Wits Appraisal	-1 to 0mm	-8mm	-3m		U Inc. to NA	22°±5.7°	27°	24°
	SN-Pog	83°±3°	77.4°	82°			4mm±2.7	6mm	4mm
	NA to A-Pog	0°±5.1°	4.5°	2°		L Inc. to NB	25°±6°	31°	29°
Skeletal Vertical Relation	SN-PP	8°±3°	8.5	5°			4mm±1.8	5.8mm	4mm
	SN-MP	32°±5.1°	45.5°	38°		L Inc. to A-Pog	1mm±2	3mm	1mm
	PP-MP	25°±3°	40°	34°		L Inc. to MP	93°±6°	87°	89°
	Me-tGo-Ar	126°±10°	139°	135°					
	LFH	55%±3%	60%	57%					

INITIAL AND FINAL CEPHALOMETRIC READING



INITIAL AND FINAL DENTAL CAST PHOTOS

INITIAL AND FINAL INTRA ORAL PHOTOS

LITERATURE REVIEW

Skeletal anterior open bite (SOB) is a complex and multifactorial dentofacial deformity characterized by the lack of vertical overlap between the maxillary and mandibular incisors, often associated with excessive vertical facial growth, increased lower anterior facial height, and a steep mandibular plane angle. Unlike dental open bites, which may result from habits like thumb sucking or tongue thrust, skeletal open bites are rooted in an underlying skeletal discrepancy that cannot be adequately corrected with orthodontic means alone in non-growing patients. These cases often present with compensatory dental features such as retroclined or extruded incisors and proclined molars, which can mask or worsen the underlying skeletal disharmony. Treatment planning for skeletal open bite must involve a comprehensive clinical and radiographic evaluation, including cephalometric and, increasingly, 3D imaging assessments to determine the vertical and transverse skeletal contributions and to differentiate them from dental compensations.

In adult patients with completed craniofacial growth, the treatment of skeletal open bite through orthodontic means alone is often insufficient, particularly in moderate to severe cases. Conventional orthodontic strategies, such as vertical control of the posterior dentition using temporary anchorage devices (TADs), can achieve some degree of molar intrusion and incisor extrusion. However, these techniques are often limited in the magnitude of skeletal correction they can provide. When the skeletal discrepancy exceeds what can be orthodontically managed, a combined orthodontic and orthognathic surgical approach is generally indicated. This typically involves presurgical orthodontic decompensation to level and align the arches and eliminate dental compensations, followed by surgical repositioning of the jaws to correct the skeletal relationship and achieve a stable occlusion and improved facial esthetics. Maxillary surgery, most commonly a Le Fort I osteotomy, allows vertical repositioning of the posterior maxilla to reduce vertical maxillary excess and facilitate mandibular autorotation. In cases where mandibular repositioning is required, bilateral sagittal split osteotomy (BSSO) is performed to enable forward or rotational movement of the mandible. In some instances, especially where counterclockwise rotation of the mandible is planned, an inverted L or other ramus-modifying osteotomy may be used to improve vertical jaw relationships (1–3).

Studies have shown that this combined approach can result in significant improvements in overbite and overjet, facial proportions, and patient satisfaction. In particular, surgical impaction of the posterior maxilla and subsequent counterclockwise autorotation of the mandible leads to a reduction in lower anterior facial height, an improvement in lip competence, and a more harmonious facial profile (4). Multisegment Le Fort I osteotomies have also been employed in cases requiring both vertical and transverse corrections, enabling more precise control over maxillary positioning. In a study by Kim et al., 30 adult patients with skeletal open bite underwent segmental maxillary osteotomies with BSSO, and after at least three years of follow-up, the majority maintained stable vertical corrections, although mild relapse was noted in the transverse dimension (5).

Despite these improvements, relapse remains a critical concern. Several studies have documented varying degrees of vertical relapse following combined treatment, particularly in the first one to two years postoperatively. A systematic review by Jang et al. found that although most patients achieved improved overbite and skeletal balance immediately post-treatment, vertical skeletal relapse occurred in up to 30% of cases, particularly in those treated with bimaxillary surgery compared to single-jaw surgery (6). Relapse was most commonly observed as an increase in the mandibular plane angle and reopening of the bite. These changes may result from several factors, including the amount and direction of surgical movement, muscle and soft tissue tension, post-treatment orthodontic tooth movement, or inadequate retention protocols.

It is well recognized that the magnitude of surgical movement directly correlates with relapse potential. Excessive impaction or counterclockwise mandibular rotation increases the risk of skeletal instability, particularly if rigid fixation is not adequately employed. Moreover, a minimal final overbite at the end of treatment has been identified as a risk factor for anterior open bite relapse. A study by De Freitas et al. demonstrated that patients with marginal overbite at debonding were significantly more likely to exhibit bite opening during follow-up (7). Additionally, the persistence of functional habits such as tongue thrusting, open-mouth posture, or improper swallowing mechanics further contributes to relapse. Therefore, post-treatment myofunctional therapy or speech therapy may be beneficial in selected patients.

Comparatively, treatment of open bite using orthodontic intrusion of molars with TADs has shown promising results in selected cases. This approach can achieve several millimeters of molar intrusion and result in favorable mandibular autorotation and bite closure. However, long-term studies suggest that these changes are less stable than those achieved with surgery in cases with significant skeletal discrepancy. A meta-analysis by Tavares et al. reported relapse rates of up to 25% in molar height and overbite measurements one year after completion of TAD-based treatment (8). This suggests that while non-surgical options may be viable in mild to moderate cases, surgical correction provides a more definitive solution for severe skeletal open bite, particularly when aesthetic concerns such as facial height or lip incompetence are also present.

Successful outcomes from combined orthodontic and orthognathic treatment rely not only on the surgical technique but also on appropriate case selection, meticulous orthodontic preparation, and well-planned retention. Patients with significant vertical discrepancy, hyperdivergent growth patterns, or soft tissue imbalance benefit most from surgical intervention. Rigid internal fixation during surgery is essential to enhance stability, and long-term retention protocols are required to preserve results. Retainers that provide vertical support, such as high-pull headgear or clear aligner-type retainers with vertical elastics, have been emplo

-yed post-treatment. It is also important that patients receive education on the importance of retention, as relapse may not be apparent until several years postoperatively.

Aside from occlusal correction, the combined approach also brings about functional and aesthetic benefits. Patients often experience improved speech articulation, more efficient mastication, and better respiratory function when airway obstruction or narrow nasopharyngeal dimensions were contributing to the initial malocclusion. In terms of esthetics, patients report higher satisfaction due to the normalization of facial proportions, elimination of a "gummy" smile in cases with maxillary vertical excess, and improved lip competence. Studies have also noted improved self-esteem and quality of life metrics in patients following combined surgical-orthodontic correction of open bite (9).

Nevertheless, this approach is not without its limitations and risks. Surgical procedures carry inherent risks such as infection, bleeding, nerve injury, or unfavorable healing. Additionally, temporomandibular joint (TMJ) complications may arise, especially in cases involving significant mandibular repositioning or when pre-existing TMJ dysfunction is present. A study by Iwasa et al. found that while many patients reported reduced TMJ symptoms after open bite surgery, some experienced transient worsening or persistent joint discomfort, necessitating further evaluation or conservative management (10). These risks must be discussed thoroughly with patients prior to initiating surgical planning.

In recent years, advances in virtual surgical planning, 3D printing, and computer-aided design have enhanced surgical accuracy and predictability. Surgeons can now simulate osteotomies, predict soft tissue responses, and fabricate patient-specific surgical guides. These technologies, combined with cone-beam CT imaging and digital orthodontic workflows, have significantly improved the planning and execution of combined open bite correction. However, long-term data on their impact on relapse and treatment stability are still emerging.

CONCLUSION

In conclusion, the correction of skeletal open bite through a combined orthodontic and orthognathic surgical approach remains the gold standard for adult patients with significant vertical discrepancies. This method offers substantial improvements in dental function, facial esthetics, and overall patient satisfaction. However, the risk of relapse, particularly in the vertical dimension, remains a clinical concern. Long-term stability depends on precise diagnosis, appropriate surgical technique, optimal orthodontic preparation, control of soft tissue and functional habits, and prolonged retention. Future research should focus on improving patient selection criteria, refining minimally invasive surgical techniques, and understanding the bio-mechanical and biological factors contributing to relapse in order to further enhance treatment outcomes for patients with skeletal open bite.

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