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Management of maxillary non-union following Orthognathic surgery in skeletal class III malocclusion: a case report

Abstract

Background: Maxillary non-union is a rare but serious complication following Le Fort I osteotomy in the surgical management of skeletal Class III malocclusion. It can compromise skeletal stability, occlusion, and facial aesthetics, requiring timely diagnosis and appropriate intervention.

Case presentation: This case report describes a 27-year-old female with skeletal Class III malocclusion characterized by maxillary hypoplasia and mandibular prognathism. Following presurgical orthodontic decompensation, the patient underwent bimaxillary orthognathic surgery involving a 4 mm maxillary advancement and a 6 mm mandibular setback. Nine months postoperatively, clinical examination revealed mobility of the maxillary segment, and radiographic findings confirmed fibrous non-union at the left osteotomy site. Initial management included intermaxillary fixation using IMF screws and adjunctive sclerosing injections. Due to persistent mobility, a revision procedure with circumzygomatic wiring and debridement of fibrous tissue was performed without the need for bone grafting.

Results: Successful stabilization and osseous healing of the maxilla were achieved within six months following revision surgery. Subsequent postsurgical orthodontic treatment resulted in a stable occlusion with positive overjet and overbite, Class I canine and molar relationships, correction of crossbites, and significant improvement in facial aesthetics. The patient expressed high satisfaction with the functional and esthetic outcomes.

Conclusion: Maxillary non-union after Le Fort I osteotomy, although uncommon, should be considered when postoperative mobility persists. Circumzygomatic wiring combined with adequate immobilization can be an effective alternative to bone grafting in selected cases. Early recognition and appropriate management are essential for achieving stable functional and esthetic results.

Keywords: skeletal class iii malocclusion, le fort i osteotomy, maxillary non-union, pseudoarthrosis, circumzygomatic wiring, orthognathic surgery

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Introduction

Class III malocclusion is one of the most challenging malocclusions to treat, as correction aims to achieve both esthetic improvement and functional rehabilitation. Its prevalence varies among different ethnic groups, ranging from 4–14% in Asian populations, 5–8% in Negro populations, and 1–4% in Caucasian/white populations.[1–3] It is relatively uncommon and has a multifactorial etiology, including genetic factors, environmental influences such as functional anterior shift, abnormal tongue posture or nasal respiratory problems, and pathological causes such as pituitary tumors causing acromegaly.[4] Charles H. Tweed classified Class III malocclusion into pseudo Class III and skeletal Class III.[5] Pseudo Class III refers to anterior crossbite with functional forward mandibular displacement, whereas skeletal Class III results from mandibular prognathism, maxillary deficiency, or a combination of both. Class III malocclusion may also be categorized as developing or non-developing, and as skeletal or dental in nature.[6] In growing patients, orthopaedic correction is commonly advocated, with greater effects reported in children between 7–9 years of age.[7] In non-growing patients, mild to moderate skeletal Class III malocclusion may be managed with orthodontic camouflage, whereas severe skeletal discrepancies usually require surgical correction.

Facial growth pattern also influences treatment planning. A horizontal growth pattern with reduced anterior facial height has a better prognosis for camouflage treatment, while a vertical growth pattern with increased anterior facial height often favors surgical intervention, as orthodontic camouflage may worsen vertical facial dimensions.[8] Common postoperative complications after orthognathic surgery include infection, bone necrosis, temporomandibular joint problems, nerve injury, vascular complications, periodontal problems, visual or auditory disturbances, and neuropsychiatric complications.[9] Among the serious but rare complications of Le Fort I osteotomy are delayed union and non-union of the maxilla.[10] This case report presents the management of maxillary non-union following surgical orthodontic treatment of skeletal Class III malocclusion.

Case report

A 27-year-old woman visited the Department of Orthodontics and Dentofacial Orthopedics in Faculty of dentistry with the chief complaint of unaesthetic facial appearance with forwardly placed lower jaw. No relevant family and surgical history were evident. Patient had a history of trauma 15 years back. Patient has a history of extraction of right lower first and second molars. Patient was under treatment of epilepsy taking phenobarbitones. On general

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examination patient had a bowing of right leg/ knee. She has been taking oral calcium supplements. Clinically, patient showed skeletal class III facial pattern with prominent chin and hypoplastic maxilla. The patient had a concave profile with mandibular protrusion and slight asymmetry in lower third region with deviation of chin towards left side was noted. Thin deficient upper lip with steep mandibular plane was observed. Intraoral examination showed Class III molar relation on left side and canine relation on both sides with anterior and transverse bilateral posterior cross bites. Clinical and radiographic examination showed the absence of the right mandibular first and second molar. Cephalometric analysis showed a skeletal Class III pattern with prognathic mandible and retrusive maxilla, increased anterior facial height with high gonial and mandibular plane angle (COGS). The skeletal compensation for anteroposterior discrepancy was evident as mandibular incisors were lingually tipped.

Treatment objectives

The treatment objectives was to correct the skeletal relation by decompensating the alignment of teeth according to their basal bone followed by surgical correction. Surgical correction involved advancement of maxilla and retrusion of mandible in order to correct the facial esthetics of the patient. Dentoalveolar compensation and camouflage was not indicated for the patient as an alternative due to severity of malocclusion.

Treatment progress

Written informed consent was obtained from the patient for publication of clinical details and photographs. Institutional ethical approval was not required for a single case report according to institutional guidelines. The treatment started with presurgical decompensation by Pre-adjusted edgewise appliance (MBT prescription, .022*.028 inch) (Figure 1). The first phase levelling and alignment was done on round NiTi wires followed by rectangular stainless steel wires. The correction of compensatory tipping according to the basal bone was carried out for about 10-12 months and then on 19*25 SS rigid wire, the patient was referred to the Department of oral and maxillofacial surgery in MAIDS for correction of A-P discrepancy by surgery. Before surgery, incisal exposure at rest was 0 mm and at smile, the upper incisors were fully visible. The upper dental midline coincided with upper skeletal midline with deep palate. There was reverse over jet of -5mm and over bite of -2.5mm and lower midline shifted by 3mm with respect to upper dental midline. Gingival display at rest was 7mm and incisal display at rest was 0 mm. Mock surgery was done in order to assess the advancement and direction of the maxillary osteotomy and set back in the mandibular arch. Two surgical procedures were done:

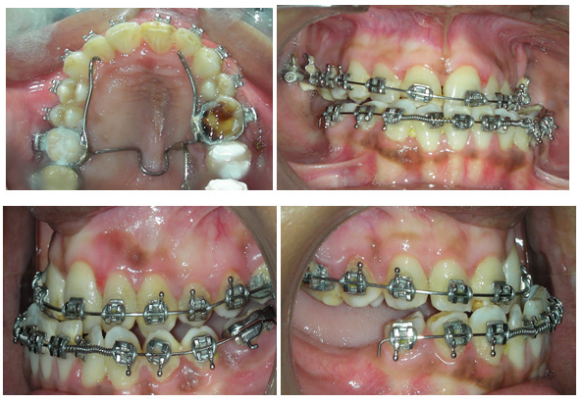

Figure 1 Mid Treatment.

I. Forward and upward positioning of maxilla about 4mm and it was fixed with 4 plates.

II. Inverted L osteotomy with mandibular set back of 6mm with rotation with 2 screws on each side was performed.

In maxilla, osteotomy was stabilized with 1.5mm orthomax miniplate system (L shaped) consisting of 4 plates, two on each side placed on zygomatic buttress region and posteriorly with respect to molar region. 16 screws were used to fix the plates and the dimension of the screw was 1.5 x 6mm. In mandible, the fixation was done with positional screws (2 screws) of dimension 2.5 x 18mm. In the postoperative course, patients were managed on a soft diet and elastics were given to wear for 3 to 4 months. After 9 months of surgery, patient was called for routine checkup when she was observed with mobility of the maxillary segment on occlusal tapping and showed fibrous union on left side of maxillary osteotomy site. The patient was placed on Intermaxillary fixation using IMF screws (4 in each arch) and eyelets were placed under local anesthesia for about 1 month. During the intermaxillary fixation, the patient was also given an injection of 2ml sodium tetradecylate locally at the site of mobility. 2 injections were given once a week. The patient was started on oral calcium supplements and calcinase nasal spray as adjuncts. The patient was then planned for the second surgery that is, Circumzygomatic wiring under local anesthesia. It was identified that the mobility of the maxilla was due to non-healing bone tissues. Vestibular incision was given on left side of maxilla. The Lefort I osteotomy cuts were re explored. The fibrous union present between the segments were scrapped off and the bony margins were freshened up. A long wire was passed through the zygomatic arch intra orally using bone awl and tightening was done. The ends were connected to the corresponding eyelets in the dentate segment. Although autogenous cancellous bone grafting is commonly recommended in the management of maxillary non-union, the defect in the present case was relatively localized without significant segmental bone loss. Adequate freshening of the bony margins and achievement of stable fixation through circumzygomatic wiring were considered sufficient to promote healing. Furthermore, satisfactory postoperative stability and progressive healing were achieved without the need for graft augmentation. Previous reports have generally advocated revision surgery with rigid fixation combined with autogenous cancellous bone grafting for management of maxillary non-union. Kurohara et al. reported successful treatment using iliac cancellous bone grafts along with rigid fixation. In contrast, the present case demonstrated successful healing with circumzygomatic wiring alone after debridement and stabilization, suggesting that grafting may not be mandatory in selected localized cases with adequate bone contact and stability. Primary closure was done. The patient was followed up for the next 6 months which showed healing without mobility. After healing, the patient was referred to orthodontics for post-surgical orthodontics. The post-surgical orthodontics was continued for 12 months to gain a proper intercuspation of teeth along with positive overjet and overbite.

Treatment results

The end treatment result showed enhanced facial esthetics with a convex profile. The upper lip gained enough tooth support from the maxillary incisors. Post treatment result showed correction of anterior and transverse crossbites with a positive overjet and overbite. Intraorally, the patient had achieved good occlusion with Class I canine relation on both sides and Class I molar relation on left side. Occlusal canting was corrected. The patient was satisfied with her teeth and profile. Good intercuspation, interproximal contacts, and satisfactory

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root parallelism were achieved. Post treatment cephalometric analysis showed root parallelism (Figure 2a–2i).

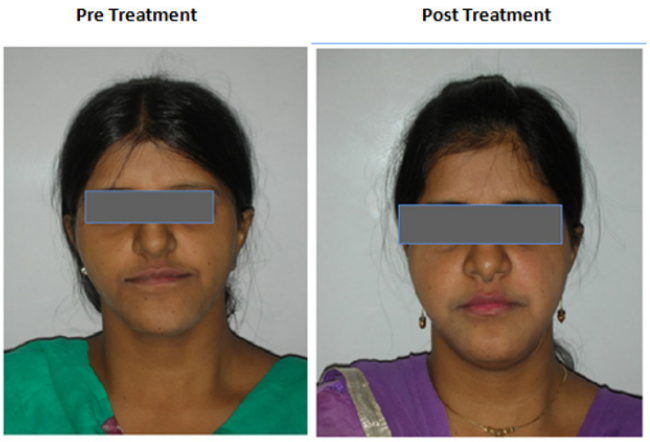

Figure 2a Pre-treatment and post-treatment comparison.

Figure 2b Pre-treatment and post-treatment comparison.

Figure 2c Pre-treatment and post-treatment comparison.

Figure 2d Pre-treatment and post-treatment comparison.

Figure 2e Pre-treatment and post-treatment comparison.

Figure 2f Pre-treatment and post-treatment comparison.

Figure 2g Pre-treatment and post-treatment comparison.

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Figure 2h Pre-treatment and post-treatment comparison.

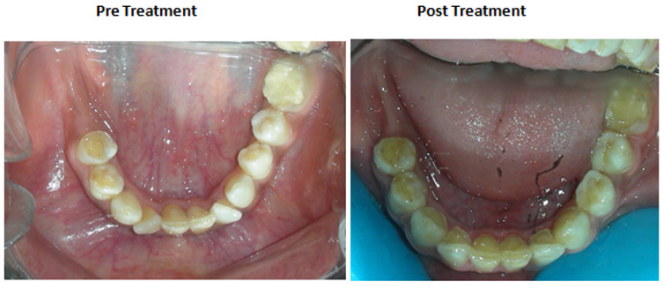

Figure 2i Pre-treatment and post-treatment comparison.

Discussion

Although orthognathic surgery has advanced considerably, postoperative complications may still occur and can be challenging to manage. One rare but clinically significant complication is maxillary non-union, also referred to as pseudoarthrosis. Weber and Coch introduced the term "pseudoarthrosis" in 1976 to describe failure of union in a long bone fracture due to interposition of cartilaginous tissue and synovial epithelium between the bone fragments.[11] The term "non-union" was later used by Spiessl in 1988 to describe failure of mandibular fracture consolidation six months after surgery.[12] Non-union may occur following both mandibular and maxillary osteotomies. Several studies have reported non-union as a postoperative complication following orthognathic surgery. The incidence of non-union reported in previous literature ranges from 0.31% to 4.55%.[10,13-17] Adequate immobilization of the bony segments and jaws is critical during orthognathic surgery to prevent impairment of normal bone healing.[11] Several local and systemic factors may influence bone healing. According to Van Sickels, multiple etiological factors can contribute to delayed union or non-union, including anatomical factors such as underlying skeletal and soft-tissue deformities that may compromise healing.[19] Other contributing factors include unstable osteosynthesis due to inadequate immobilization, reduced vascular supply at the osteotomy site, postoperative infection, large maxillary advancement resulting in an increased interfragmentary gap, and soft-tissue interposition between the bony segments. In addition, inadequate fixation of the maxillary segment with miniplates, particularly due to positional limitations, may result in improper osteosynthesis and subsequent non-union.

According to Bays, postoperative maxillary mobility may also result from traumatic or unstable occlusion.[20] Premature tooth contact can create an imbalance in occlusal forces, leading to mobility of the maxillary segment. If such mobility persists, fibrous tissue may develop between the bony margins, ultimately delaying the healing process. Prolonged segmental movement may also result in vertical bone resorption. Therefore, stable occlusion plays an important role in immobilization and healing of the maxilla. In the present case, the patient had an occlusal discrepancy and unstable occlusal relationship, which may have adversely affected osteosynthesis. Occlusal prematurity could have produced excessive localized forces, resulting in micromovement and mobility of the maxillary segment. This instability may also have reduced the ability of the maxilla to withstand postoperative orthodontic forces, thereby contributing to persistent mobility and fibrous tissue interposition between the bony margins. Another possible contributing factor was an underlying metabolic bone disorder. The patient had a history of long-term phenobarbital use for epilepsy, bowing of the lower limb, and calcium supplementation, all of which may suggest compromised bone metabolism. Long-term anticonvulsant therapy has been associated with altered vitamin D metabolism, reduced bone mineral density, osteomalacia, and delayed bone healing. Although biochemical investigations and bone mineral density assessment were not performed, impaired bone metabolism may have contributed to delayed union or non-union in this case. This highlights the importance of systemic evaluation in patients with unexplained impaired bone healing after orthognathic surgery. An interesting observation in previous reports as well as in the present case is that maxillary non-union appears to have been reported more frequently in female patients. However, the available evidence is insufficient to establish a causal association or explain this apparent trend. The ideal management of non-union generally involves revision surgery with autologous cancellous bone grafting. Cancellous bone grafts help fill the gap between bony segments and provide osteoconductive and osteoinductive support to promote bone healing.[18] However, in the present case, revision surgery with circumzygomatic wiring on the left side provided adequate stabilization. The osteotomy site was re-explored, fibrous tissue between the segments was removed by curettage, and the bony margins were freshened. Bone grafting was not performed because the defect was localized, there was no major segmental bone loss, and stable fixation could be achieved with circumzygomatic wiring. Postoperative care was provided according to standard protocols, and calcium supplementation and calcitonin nasal spray were prescribed as adjuncts to support bone healing.

Conclusion

Maxillary non-union following Le Fort I osteotomy is a rare but serious complication. Careful assessment of occlusal stability, fixation adequacy, and systemic factors affecting bone metabolism is essential in management. In selected cases, circumzygomatic wiring with debridement and stable fixation may achieve satisfactory healing without the need for bone grafting.

Acknowledgments

None.

Conflicts of interest

The authors declare no conflicts of interest.

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