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Mandibular Distraction Osteogenesis for Severe Post-Traumatic Micrognathia: A Case Report from Gaza Strip

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Abstract | **Case Report**

Background: Mandibular hypoplasia following childhood trauma represents a complex reconstructive challenge. Mandibular distraction osteogenesis (MDO) has emerged as a reliable technique for skeletal and functional rehabilitation. ***Case Presentation****:* A 23-year-old male with a history of bilateral condylar fractures at age 8 developed severe micrognathia, trismus, dysphagia, and airway compromise. A combined approach including coronoidectomy and MDO was performed. ***Results:*** Significant improvement in mouth opening, swallowing improvement, airway function, and mandibular projection was observed within 3 weeks. ***Conclusion:*** Based on this experience and a search of the literatures, it is hypothesized that MDO is an effective modality for managing complex post-traumatic mandibular deficiencies with excellent functional outcomes.

Keywords: Mandibular distraction osteogenesis; Micrognathia; Condylar fracture; Airway obstruction; Craniofacial surgery.

INTRODUCTION

Mandibular hypoplasia is a multifactorial condition that may result from congenital, developmental, or traumatic etiologies. Among these, pediatric condylar fractures are particularly significant due to their impact on mandibular growth centers, leading to long-term skeletal deformities (Kaban & Troulis, 2004; Posnick, 2000).

Mandibular hypoplasia is a common dentofacial deformity requiring a combination of orthodontic and surgical treatment. various orthognathic surgical procedures were carried out to treat mandibular hypoplasia. Orthognathic procedures like corpus lengthening by bilateral sagittal split ramus osteotomy and genioplasty are commonly practised all over the world to address the high esthetic demands and functional problems. But hardly there are any established orthognathic surgical procedures to address the deficiency of the posterior part of the mandible that is ramus and condyle. Transverse mandibular deficiency is one of the most difficult problems to be addressed surgically (Nanda Kishore, 2019)

Distraction osteogenesis, introduced by Ilizarov, relies on controlled mechanical tension to stimulate new bone formation and soft tissue adaptation (Ilizarov, 1988). It has gained acceptance and has been widely used by orthopaedic surgeons. Recent advances have expanded its application, particularly in airway management and severe craniofacial deformities and in reconstruction of the severely resorbed mandible (Dominguez *et al.,* 2026; Han *et al.,* 2026).

Distraction osteogenesis has been shown to be an effective technique for mandibular widening and lengthening where traditional orthognathic surgery has important limitations. The intraoral approach to these procedures prevents damage to the inferior alveolar nerve and the developing dental follicles, and eliminates hypertrophic facial scars. Intraoral distraction osteogenesis also avoids donor-site morbidity, and minimizes the need for blood transfusion or prolonged fixation. This intraoral application provides for enhanced patient acceptance and reduces the potentially negative psychosocial effects of wearing an extraoral distraction appliance. (panelCesar A. Guerrero, 1999)

Despite the widespread use of mandibular distraction osteogenesis, several recent studies have highlighted its limitations, particularly regarding long-term stability and failure in complex cases. A recent systematic review reported relapse rates ranging from

67.8% to 72.5%, with increasing instability over long-term follow-up (Li *et al.,* 2025). Similarly, clinical studies have demonstrated that relapse occurs in the majority of micrognathia patients, with up to 4 out of 6 cases showing varying degrees of recurrence (Theologie-Lygidakis *et al.,* Radiographic evidence further supports these findings, revealing significant vertical relapse (27%) and occlusal instability (35%) after distraction (Li *et al.,* 2024). Moreover, the magnitude of distraction has been shown to correlate directly with relapse, particularly in severe deformities (Adult study – 2022). In addition, failure rates of up to 8.5% have been reported, with some cases requiring tracheostomy or resulting in mortality, especially in patients with associated comorbidities (Hammoudeh *et al.,* 2018). These findings suggest that although MDO is an effective technique, its outcomes remain highly dependent on patient selection, severity of deformity, and long-term follow-up.

There are contradictory reports in the literature showing cases in which mandibular distraction osteogenesis for micrognathia was unsuccessful such as, (Lam *et al.,*2014, Hammoudeh *et al.,*2018, Master *et al.,*2010, Li *et al.,* 2025 ,Theologie-Lygidakis *et al.,* 2024). In these papers a case is presented in which distraction osteogenesis was applied unsuccessfully to reconstruct the mandible. The subsequent treatment to resolve this problem is described and the conditions allowing for distraction osteogenesis of hypoplastic mandible are reviewed.

Case Report

A 23-year-old male patient presented with severe mandibular deficiency and functional impairment secondary to bilateral condylar fractures sustained at the age of 8 years following a motor vehicle accident. According to the patient's history, both condyles were surgically removed at the time of trauma, resulting in the loss of the primary mandibular growth centers. This led to progressive mandibular atrophy, micrognathia, and significant functional deterioration over time. It is well established that the mandibular condyle plays a critical role as a growth center, and its loss during childhood results in arrested mandibular development and skeletal deformity.

Over the years, the patient underwent multiple conservative and orthodontic attempts to correct the deformity, including fixed orthodontic treatment and the use of extraoral headgear aimed at restraining maxillary growth and encouraging mandibular advancement. However, these interventions failed to achieve any meaningful functional or skeletal improvement. The patient continued to experience worsening symptoms, including limited mouth opening, difficulty in swallowing (dysphagia), and breathing difficulties suggestive of compromised airway space.

Clinical examination revealed a retrognathic mandible with poor lower facial projection and severe limitation in mandibular mobility (Fig. 1). Maximum mouth opening was significantly restricted, measuring less than two fingers in width. The patient also exhibited signs of functional distress, including impaired mastication and speech difficulties.

Given the severity of the condition and the failure of conservative treatment, a comprehensive surgical intervention was planned. Notably, the procedure was performed under challenging conditions in Gaza, where access to advanced surgical equipment was limited due to ongoing conflict. The required distraction devices were obtained through a humanitarian medical delegation, which further emphasizes the complexity of the clinical setting.

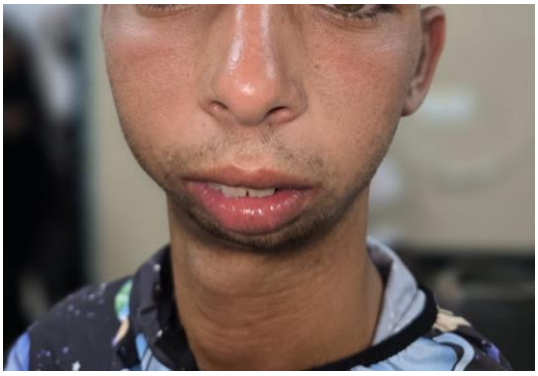

Fig-1: preoperative view showing mandibular micrognathia

The surgical plan included bilateral coronoidectomy to address the limitation in mouth opening. This was performed using a combined approach: an extraoral approach on one side and an intraoral approach on the contralateral side. The rationale for coronoidectomy was to release the temporalis muscle restriction, which is a known contributing factor to trismus in long-standing mandibular hypoplasia.

During the same surgical session, bilateral osteotomies were performed at two levels: the mandibular ramus and the angle of the mandible. These

osteotomies were carried out using a surgical bur and osteotome to allow controlled segmentation of the bone. Four internal distractors were then placed two on each side strategically positioned to achieve multidirectional mandibular elongation. Specifically, one distractor was placed at the ramus to achieve horizontal (anteroposterior) advancement, while the second distractor at the angle was used to achieve vertical elongation. Each vector contributed approximately 14 mm of distraction, resulting in combined improvement in both mandibular length and height. (Fig. 2).

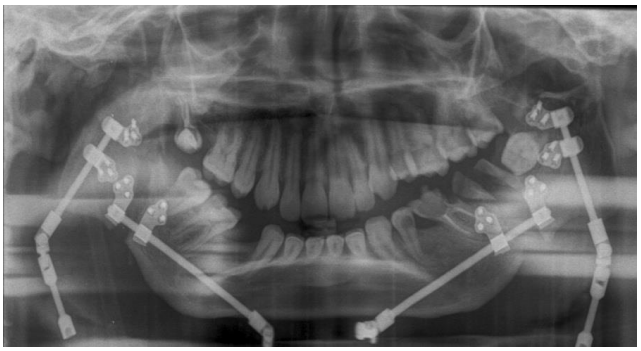

Fig-2: panoramic radiograph after insertion of distraction device

An external activation system (uniplanar device) was utilized to control the direction and magnitude of distraction. The distraction protocol was initiated one week postoperatively, following a standard latency period. Initially, distraction was performed at a rate of 1 mm/day in both horizontal and vertical directions. After the first week, modifications were made to the distraction protocol based on clinical response. The horizontal distraction continued at 1 mm/day, while vertical distraction was reduced to 0.5 mm/day(Fig. 3).

Fig-3: profile view after 2 weeks showing external device.

Fig-4: postoperative profile view after 3 weeks

Subsequently, horizontal distraction was discontinued after the development of a dental Class III relationship, indicating overcorrection in the anteroposterior dimension. At that point, only vertical distraction was continued to further improve mandibular height and facial balance. (Fig. 4).

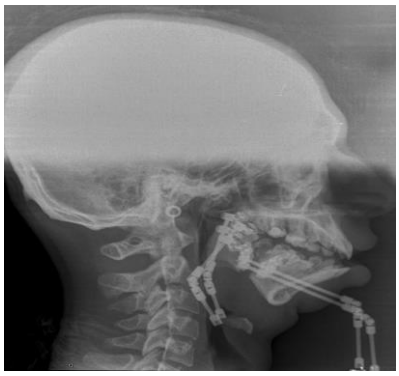

Fig-5: cephalometric view showing dental class III relationship

Toward the final phase of treatment, the distraction rate was further adjusted. Horizontal activation was reduced to 0.25 mm/day during the last four days before cessation, while vertical distraction followed a staged protocol: the first 7 mm were achieved at 1 mm/day, followed by the remaining 7 mm at a reduced rate of 0.5 mm/day. These adjustments were made to optimize bone formation and minimize complications. (Fig. 5)

At this stage, the distraction process will be discontinued, and the patient will be kept under close follow-up until adequate bone regeneration and consolidation are achieved within the created gap following mandibular advancement. Once satisfactory bony fill is confirmed, a secondary genioplasty will be planned to further refine the chin contour and overall lower facial harmony. Orthodontic treatment will subsequently be initiated after sufficient healing to optimize occlusion and finalize the functional and aesthetic outcome. This staged approach is intended to ensure stable skeletal regeneration and predictable long-term results. (Fig. 6).

Fig-6: postoperative cephalometric view after 3 weeks

Postoperatively, the patient reported the onset of numbness, this is likely related to nerve stretching or manipulation during distraction. The patient was managed conservatively with vitamin B complex supplementation to support nerve recovery.

RESULTS

At 3 weeks following the initiation of distraction, the patient demonstrated marked clinical improvement. Mouth opening improved significantly, reaching more than two fingers in width, which represents a substantial functional gain compared to the preoperative state. The patient also reported considerable improvement in swallowing and breathing, indicating successful alleviation of airway compromise.

Facial profile analysis revealed noticeable advancement and elongation of the mandible, resulting in improved facial balance and esthetics. The combination of horizontal and vertical distraction successfully addressed both mandibular deficiency and reduced lower facial height.

Radiographic evaluation confirmed appropriate positioning of distractors and evidence of new bone formation within the distraction gap, consistent with early ossification. The patient tolerated the procedure well and expressed high satisfaction with the functional and esthetic outcomes.

The distractors are planned to remain in place for an additional 2–3 months to allow adequate consolidation and complete ossification of the regenerated bone. Future treatment options under consideration include continuation of orthodontic therapy followed by genioplasty, or orthognathic surgery in the form of Le Fort I osteotomy to advance the maxilla, depending on final occlusal relationships.

DISCUSSION

Mandibular distraction osteogenesis (MDO) has become a cornerstone technique in the management of severe mandibular hypoplasia; however, its long-term stability and predictability remain subjects of ongoing debate. The present case represents a complex post-traumatic deformity resulting from early bilateral condylar loss, which is recognized as one of the most challenging etiologies due to disruption of mandibular growth centers and progressive skeletal deficiency.

The mandibular condyle is widely recognized as a critical growth center. Its removal or damage during developmental years can result in significant skeletal discrepancies, as observed in this patient. The long-term consequences include micrognathia, airway compromise, and functional limitations, all of which were evident in this case.

Recent high-quality studies have emphasized that although MDO provides significant short-term

functional and esthetic improvements, long-term outcomes are often less predictable. A systematic review and meta-analysis published in 2025 demonstrated relapse rates exceeding 67–72%, regardless of the age at intervention, with relapse increasing over long-term follow-up periods (Li X, 2025). These findings suggest that skeletal stability following distraction is not guaranteed, particularly in cases requiring large advancements, similar to the present case where both vertical and horizontal elongation were performed.

Furthermore, clinical studies specifically evaluating micrognathia patients have shown that relapse is not only common but may affect the majority of cases. Theologie-Lygidakis *et al.,*(2024) reported that relapse of varying degrees occurred in 4 out of 6 patients with micrognathia, highlighting the inherent instability of distraction outcomes in this subgroup. This is particularly relevant to the current case, where the patient required significant multidirectional distraction, a factor known to increase mechanical and biological stress on the regenerated bone.

Another critical limitation of MDO lies in its biological response. Although distraction promotes new bone formation, studies have shown that the quality and morphology of regenerated bone may vary. In micrognathia patients, regenerated bone tends to be more regular compared to syndromic deformities; however, relapse remains evident despite apparently normal bone quality (Theologie-Lygidakis N, *et al.,* 2024). This indicates that relapse is not solely dependent on bone formation but also influenced by soft tissue tension, neuromuscular adaptation, and functional loading.

Additionally, complications involving the temporomandibular joint (TMJ) have been increasingly reported in recent literature. A 2023 study demonstrated that condylar resorption may occur following MDO, particularly in cases involving significant distraction distances and altered biomechanical loading (Zhang R, Li J, Wang X, *et al.,* 2023). This is highly relevant in post-traumatic patients, where the condyle is already compromised or absent, as in the present case. The absence of a functional condylar unit may further increase the risk of instability and relapse.

From a biomechanical perspective, the magnitude and direction of distraction play a crucial role in determining outcomes. Evidence from adult studies indicates a direct correlation between the amount of mandibular advancement and the degree of relapse, suggesting that larger movements are inherently less stable (Al-Moraissi EA, Ellis E III. 2022). In the current case, distraction was performed in both horizontal and vertical vectors, reaching approximately 14 mm in each direction. Such extensive movement increases the risk of relapse and requires careful vector control, as demonstrated by the need to discontinue horizontal distraction after the development of a Class III relationship.

Another important factor influencing outcomes is soft tissue adaptation. While MDO allows gradual expansion of soft tissues, recent studies have shown that muscular changes may not be stable over time. For example, a 2024 study evaluating masseter muscle adaptation reported initial postoperative improvement followed by partial regression during follow-up (Liu Y, Chen X, Zhang S, *et al.,* 2024), indicating that soft tissue remodeling may not fully support long-term skeletal stability. This highlights the importance of considering not only bone elongation but also long-term neuromuscular adaptation.

Device-related complications also remain a concern. Radiographic studies have demonstrated the occurrence of dental complications, including root damage and occlusal disturbances, depending on osteotomy design and distractor positioning (Kim HJ, Park JU, Lee SH, *et al.,*2023). In the present case, careful adjustment of the distraction protocol was required to avoid worsening occlusion, particularly after the development of class III relationship, further emphasizing the technique-sensitive nature of MDO.

Despite these limitations, it is important to recognize that MDO remains highly effective in achieving immediate functional improvement, particularly in airway management. In the current patient, significant improvement in breathing, swallowing, and mouth opening was achieved within a short postoperative period, consistent with the primary advantages of distraction osteogenesis.

Another unique aspect of this case is the surgical context. The procedure was performed in a resource-limited environment in Gaza, where access to advanced equipment was restricted. Despite these challenges, successful outcomes were achieved, highlighting the adaptability and robustness of MDO as a reconstructive technique.

Finally, when comparing MDO with conventional orthognathic surgery, it is evident that each approach has its advantages and limitations. While MDO allows gradual correction and soft tissue adaptation, orthognathic surgery may provide more immediate and stable skeletal repositioning in certain adult cases. In the present patient, future options such as genioplasty or Le Fort I osteotomy remain valid adjunctive procedures to optimize occlusion and facial balance.

CONCLUSION

This case demonstrates that mandibular distraction osteogenesis is a highly effective technique for the management of severe post-traumatic mandibular hypoplasia. The combined use of coronoidectomy and

multidirectional distraction allowed for significant improvement in both function and facial esthetics.

The case also highlights the importance of individualized treatment planning, careful control of distraction vectors, and the need for adaptability during the treatment process. Despite the inherent challenges and potential complications, MDO remains a powerful and versatile tool in craniofacial reconstruction.

Long-term follow-up is essential to assess stability, monitor neurosensory recovery, and determine the need for additional surgical interventions.

Author Contributions

Dr. Noha N. Al-aqqad contributed to study design, data collection, manuscript writing, and final revision.
Dr. Ali H. Madi contributed to surgical assistance, clinical management, and manuscript review.
Dr. Emad El Tamimi contributed to surgical planning, surgical assistance and execution.
Dr. Mahmoud Sobhi performed the mandibular distraction osteogenesis procedure and contributed to surgical planning and execution.
Dr. Raymundo Ramirez Lugo contributed to surgical planning, surgical assistance and execution.
All authors approved the final manuscript

REFERENCES

- Al-Moraissi EA, Ellis E III. Relapse after mandibular advancement: A systematic review and meta-analysis. Journal of Stomatology, Oral and Maxillofacial Surgery. 2022;123(3): e45–e52.
- Hammoudeh JA, Fahradyan A, Gould DJ, Liang F, Urata MM. Predictors of failure in mandibular distraction osteogenesis for airway obstruction. Plastic and Reconstructive Surgery. 2018;141(4):895–905.
- Kim HJ, Park JU, Lee SH, *et al.,* Dental and skeletal complications associated with mandibular distraction osteogenesis: A radiographic analysis. International Journal of Oral and Maxillofacial Surgery. 2023;52(9):1150–1157.
- Lam DJ, Tabangin M, Shikary T, *et al.,* Outcomes of mandibular distraction osteogenesis in the treatment of airway obstruction. Otolaryngology–Head and Neck Surgery. 2014;150(2):295–302.
- Li X, Chen Z, Wang Y, Zhang Q. Radiographic evaluation of relapse after mandibular distraction osteogenesis in adult patients. International Journal of Oral and Maxillofacial Surgery. 2024;53(5):612–619.
- Li X, Zhang Y, Wang L, Chen Z. Long-term stability and relapse following mandibular distraction osteogenesis: A systematic review and meta-analysis. journal of Craniofacial Surgery. 2025; Epub ahead of print.
- Liu Y, Chen X, Zhang S, *et al.,* Masseter muscle adaptation following mandibular distraction osteogenesis: A longitudinal study. Frontiers in Pediatrics. 2024; 12:1453270.
- Nanda Kishore, Journal of Craniofacial Surgery 30(8): p e743-e746, November-December 2019. | DOI: 10.1097/SCS.0000000000005753
- panelCesar A. Guerrero, Seminars in Orthodontics (Intraoral mandibular distraction osteogenesi) Volume 5, Issue 1, March 1999, Pages 35-40
- panel Michael Miloro D, Journal of Oral and Maxillofacial Surgery Volume 68, Issue 7, July 2010, Pages 1512-1523
- Theologie-Lygidakis N, Iatrou I, Alexandridis C. Long-term outcomes and relapse rates in mandibular distraction osteogenesis for micrognathia patients. Journal of Oral and Maxillofacial Surgery. 2024;82(2):245–252.
- Zhang R, Li J, Wang X, *et al.,* Condylar resorption and temporomandibular joint changes following mandibular distraction osteogenesis. Journal of Oral and Maxillofacial Surgery. 2023;81(10):1785–1793.
- Zhao L, Sun H, Patel PK, *et al.,* The role of innervation in bone regeneration during distraction osteogenesis. Bone. 2023; 167:116567