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INTERDENTAL TENSION BAND WIRING AS A REDUCTION ADJUNCT IN OPEN COMMINUTED MANDIBULAR PARASYMPHYSEAL FRACTURE WITH DENTAL MALALIGNMENT: A CASE REPORT

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ABSTRACT
Background*: Open comminuted mandibular parasymphyseal fractures present significant challenges due to fragment instability, disrupted occlusion, and increased risk of complications, particularly in cases with dental malalignment where conventional stabilization methods are limited. Objective: To report the application of interdental tension band wiring as a pre-ORIF reduction adjunct in an open comminuted mandibular parasymphyseal fracture.* ***Case****: A 41-year-old male presented with anterior open bite and intraoral bleeding following a motor vehicle accident. Clinical and radiographic findings confirmed an open OCSS CMF Type II left mandibular parasymphyseal fracture with dental malalignment. Conventional adjuncts such as arch bars were considered suboptimal due to the risk of further displacement and periodontal injury.* ***Case Management****: Interdental tension band wiring using a 0.4-mm multiple loop configuration was applied as a pre-ORIF reduction aid, followed by definitive fixation with a 2.4-mm reconstruction plate. The technique enabled controlled fragment approximation through dental–periodontal anchorage. At one-month follow-up, satisfactory wound healing, stable occlusion, and normal mandibular function were achieved without complications.* ***Conclusion****: Interdental tension band wiring may serve as a practical and cost-effective reduction adjunct in selected cases of open comminuted mandibular parasymphyseal fracture with dental malalignment, offering a clinically adaptable approach when conventional techniques are limited.*

Keywords: *Bone plates, fracture fixation, malocclusion, mandibular fractures*

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INTRODUCTION

Mandibular fractures are the most common injuries within the craniofacial skeleton, with symphyseal and parasymphyseal regions accounting for approximately 44–54.1% of cases.[1] Although comminuted fractures are relatively uncommon, they present a disproportionately high clinical burden due to fragment instability, compromised occlusion, and increased risk of infection and poor healing outcomes.[2,3] These challenges are further exacerbated in open fractures, particularly in patients with malaligned anterior teeth, where conventional occlusal stabilization becomes difficult and may lead to functional impairment affecting speech, mastication, and overall quality of life.[4,5]

Current management strategies primarily rely on open reduction and internal fixation (ORIF) with miniplates or reconstruction plates, often supplemented by arch bars or intermaxillary fixation to achieve occlusal stability.[6,7] However, these approaches are not universally applicable. Arch bars may be contraindicated or ineffective in cases with malaligned, periodontally compromised, or dentally unstable conditions, and may even introduce additional risks such as periodontal injury, root damage, and unintended fragment displacement during wire tightening.[8,9] Despite these limitations, there remains no standardized reduction strategy specifically addressing open comminuted parasymphyseal fractures complicated by anterior dental malalignment.

Interdental wiring techniques have been previously described as simple and cost-effective methods for stabilizing non-comminuted mandibular fractures, with favorable outcomes and minimal complications.[10] However, their role as a biomechanical adjunct in complex comminuted fractures remains underexplored. This report highlights a clinically

challenging case of open comminuted mandibular parasymphyseal fracture with malaligned anterior teeth and introduces the novel use of interdental tension band wiring as a pre-ORIF reduction aid. By leveraging dental–periodontal anchorage to achieve controlled fragment approximation prior to rigid fixation, This report is the first to repurpose interdental tension band wiring as a pre-ORIF reduction strategy for open comminuted mandibular parasymphyseal fractures with malaligned anterior teeth, addressing a critical gap where conventional fixation adjuncts are inadequate.

CASE

A 41-year-old male patient arrived at Haji General Hospital Surabaya with a complaint of anterior openbite and profuse intraoral bleeding. The patient was involved in a motor vehicle accident a day before their arrival, resulting in a significant impact to the chin. The patient experienced a brief episode of fainting. The chin was appropriately cleaned and sutured at the nearest medical facility, while the intraoral area remained untreated. No history of systemic disease and patient was working as merchant.

On examination, the patient was in good general condition. Extraoral findings revealed vulnus excoriation of the upper lip and a sutured vulnus appertum in the mental region without signs of cranial base fracture (Figure 1a–b). Palpation identified step-off deformity and crepitus. Mandibular movement was restricted, with a maximal interincisal opening of approximately 1 cm. Intraoral examination showed mucosal discontinuity between teeth 32 and 33 with active lingual bleeding and minor dental displacement.

Figure 1: (a) Anterior extraoral view showing upper lip excoriation; (b) submental view demonstrating a sutured wound in the mental region (red arrow); (c) right lateral view; (d) left lateral view; (e) intraoral view showing mucosal discontinuity between teeth 32 and 33 with active bleeding and poor oral hygiene; (f) panoramic radiograph demonstrating a fracture line in the left mandibular parasymphysis with a triangular fragment at the inferior border; (g) anteroposterior skull radiograph showing a parasymphyseal fracture line; (h) lateral skull radiograph showing no evidence of condylar fracture.

Radiographic evaluation demonstrated a fracture line in the left mandibular parasymphysis and a triangular fragment at the inferior border (Figure 1f–h), without condylar involvement. Based on clinical and radiological findings, the case was diagnosed as open OCSS CMF Type II left mandibular parasymphyseal fracture.

The classification of this case as open OCSS CMF Type II is supported by both clinical and radiographic findings. From an occlusal relationship (O) perspective, the presence of anterior open bite and dental malalignment indicates disrupted occlusion. Regarding continuous mandibular morphology (C), the identification of a clear fracture line in the left parasymphyseal region with step-off deformity and crepitus confirms loss of mandibular continuity. The degree of comminution (C) is evidenced by the presence of a triangular fracture fragment at the inferior border, indicating multiple fracture components rather than a simple linear fracture. However, there was no radiographic or

intraoperative evidence of a critical segmental bone defect (S), as bone continuity could be restored without the need for grafting. Additionally, the presence of intraoral mucosal discontinuity with active bleeding confirms the fracture as open. Collectively, these findings are consistent with an OCSS CMF Type II classification, which represents a comminuted fracture with preserved segmental bone integrity but requiring careful reduction due to instability.

CASE MANAGEMENT

Given the presence of anterior dental malalignment (teeth 31–42), the use of conventional arch bars or intermaxillary fixation was considered suboptimal due to the increased risk of further displacement during wire tightening and potential periodontal injury, as reported in previous studies.[8,9] In addition, economic considerations limited the use of more complex fixation adjuncts.

Therefore, interdental tension band wiring using a 0.4-mm multiple loop configuration was selectively employed as a pre-ORIF reduction aid. This approach was chosen based on its biomechanical advantage in converting tensile forces into compressive stabilization across the fracture line through dental–periodontal anchorage, while minimizing additional trauma to compromised dentition. Although traditionally indicated for non-comminuted fractures, its application in this case was adapted to facilitate controlled approximation of fracture segments prior to rigid fixation.

Surgical management proceeded with re-debridement of a 6-cm wound with non-intact periosteum and exposed bone fragments at the mental region. The wound was extended using a No. 10 blade and dissected layer by layer to achieve adequate exposure. The periosteum was elevated with a raspatory while preserving the mental nerve. Following initial stabilization with interdental wiring, definitive fixation was achieved using a 2.4-mm, 5-hole mandibular reconstruction plate (Osteomed®) secured with five screws. Mandibular range of motion was normalized intraoperatively, and layered wound closure was performed without complications.

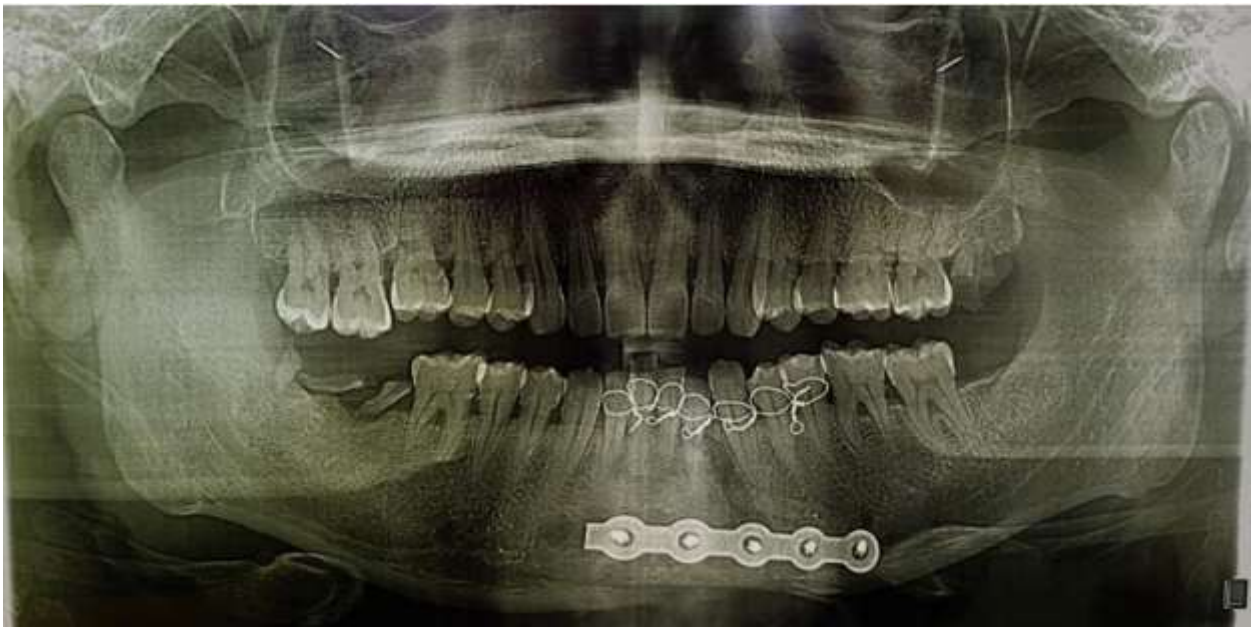

Figure 2: Postoperative panoramic radiography. The 5-hole 2.4 reconstruction plate was installed with 5 screws, along with a picture of multiple loop wiring attached to teeth 31, 32, 33, 34, 41, 42.

Postoperative panoramic radiography confirmed satisfactory alignment and fixation (Figure 2). At one-month follow-up, the patient reported no complaints. Clinical examination demonstrated complete wound healing, stable occlusion, and normal mandibular function (Figure 3a–g). The interdental wiring was subsequently removed.

This case highlights the combined novelty of applying interdental tension band wiring as a biomechanical reduction adjunct in a clinically challenging scenario of open comminuted mandibular parasymphyseal fracture with anterior dental malalignment, where conventional occlusal stabilization techniques are limited.

Figure 3. (a) Anterior extraoral view showing healed post-surgical wound (white arrow); (b) submental view demonstrating complete healing of the mental region; (c) right lateral view; (d) left lateral view; (e) anterior intraoral view showing stable occlusion; (f) right lateral intraoral view; (g) left lateral intraoral view at one month after surgery.

DISCUSSION

Mandibular symphyseal and parasymphyseal fractures represent a substantial proportion of maxillofacial trauma, typically presenting with malocclusion, sublingual ecchymosis, limited mandibular movement, and crepitus.[4] In the present case, anterior open bite, step-off deformity, and intraoral mucosal discontinuity, supported by radiographic findings, confirmed the diagnosis of an open comminuted parasymphyseal fracture (OCSS CMF Type II), characterized by fracture comminution without segmental bone defect.[2] The primary objectives of treatment are restoration of pre-injury occlusion, accurate fracture reduction, and stable fixation.[11] Although the OCSS CMF algorithm recommends plate fixation for Type II fractures, achieving optimal reduction remains challenging in the presence of anterior dental malalignment, as seen in this patient, where conventional adjuncts such as arch bars or intermaxillary fixation may be suboptimal or even detrimental due to risks of unintended tooth movement, periodontal injury, and further displacement during wire tightening.[8,9]

The mandibular parasymphysis region is subjected to torsional forces during function (Figure 4) due to the pull of the digastric, mylohyoid, and geniohyoid muscles, with an estimated force range of 0.03–0.08 N/m² during passive movement and 9.45–28.7 N/m² during active contraction.[12–15] To estimate torque force, the average posterior bite force and the length of the mandibular corpus in the parasymphyseal region are multiplied, yielding an estimated torque of 35.16 N.[16–19] To overcome these biomechanical challenges, Champy proposed the placement of one plate at the inferior border and a second plate at the base of the alveolar process, known as the tension line. Although this principle remains widely adopted, the use of a single plate combined with an arch bar as an alternative tension band has been considered more economical and associated with reduced risks of infection, mental nerve sensory impairment, wound dehiscence, and injury to adjacent teeth.[6] Arch bars, typically fabricated from 316L stainless steel, exhibit high tensile strength (approximately 1218 N/mm²), allowing resistance to deformation and maintenance of torsional and torque forces in the parasymphyseal region. However, their high Young's modulus (approximately 211 GPa) reflects considerable rigidity, which may result in unintended tooth movement, particularly in malaligned dentition when secured with circumdental wiring.[8,20] In addition, cost considerations and longer application time remain notable disadvantages, especially when modified arch bar systems are used.[8]

Figure 4: Illustration of forces in the parasymphysis OCSS CMF Type II of our report

From a biomechanical standpoint, the parasymphyseal region is subjected to torsional and tensile forces generated by muscular attachments during mandibular function; however, these values are derived from theoretical estimations and were not directly measured in this case. Thus, the application of interdental tension band wiring should be interpreted as a clinically driven stabilization strategy rather than a quantitatively validated biomechanical intervention. Compared with established techniques, dual miniplate fixation following Champy's principle provides effective control of tensile and compressive forces but may increase surgical complexity, operative time, and the risk of complications such as infection or mental nerve injury,[6] while arch bars, although widely used as tension band adjuncts, exhibit high rigidity and circumdental fixation that may induce unwanted tooth movement in malaligned dentition and require longer application time.[8]

In this report, the author utilized a 2.4-plate reconstruction with a 0.4-mm multiple loop wiring as an alternative. This can stabilize the torsional force in the mandible with the same tensile strength as the arch bar.[21] A stout wiring technique uses the same material as an arch bar, with a 0.4 mm diameter, which has a Young's modulus indicating the threshold between rigid and flexible materials. This is beneficial in patients with misaligned teeth as it may be adapted to the acceptable position of the teeth in its remaining position.[22] Further, the application is easy and fast with low cost and an incomparable complication rate when using two mini plates or arch bars. A rigid fixation technique can counter compressive axial and torsional forces at the fracture site. This improves the stability of the construct, which decreases the gap strain and the overall complications that occur when adequate stabilization is no longer guaranteed.[6]

Recent comparative studies further highlight these limitations, demonstrating that conventional arch bar techniques are associated with longer operative time, increased postoperative discomfort, and higher operator-related complications compared to alternative fixation methods such as intermaxillary fixation (IMF) screws or hybrid systems, despite achieving comparable occlusal outcomes.[23] Similarly, IMF screws and Ivy eyelet wiring have been shown to reduce procedural time and improve operator safety without compromising stability.[24] (Yadav *et al.*, 2024), while cohort and patient-centered data suggest improved cost-efficiency, oral hygiene maintenance, and patient comfort with simplified fixation systems compared to traditional arch bars.[25,26]

In contrast, interdental tension band wiring in this case was utilized as a pre-ORIF reduction adjunct, enabling controlled approximation of fracture segments through dental–periodontal anchorage prior to definitive fixation with a reconstruction plate. This application differs from its conventional use in non-comminuted fractures and represents a context-specific adaptation addressing the combined challenges of comminution and anterior dental malalignment. Previous reports have described interdental or embrasure wiring as cost-effective and less complex alternatives in selected mandibular fractures,[22,27] although their application in open comminuted parasymphyseal fractures remains limited.

The clinical applicability of this technique should therefore be interpreted cautiously, as it may be considered in selected cases with preserved dentition, particularly where dental malalignment limits the effectiveness of arch bars or in resource-limited settings, while being less suitable in cases with poor periodontal support, insufficient dental anchorage, or significant segmental bone defects. Potential complications include localized periodontal trauma, wire loosening, and challenges in maintaining oral hygiene, as interdental fixation techniques have been associated with variable periodontal outcomes and require adequate hygiene maintenance to prevent tissue deterioration.[28]

Furthermore, although interdental wiring techniques are generally considered minimally invasive and associated with low complication rates, they remain dependent on dental integrity and periodontal condition for stability.[29] In the present case, no intraoperative or short-term postoperative complications were observed, and satisfactory occlusion and mandibular function were achieved at one-month follow-up.

Nevertheless, this report has several limitations. As a single-case study, its findings cannot be generalized, and the short follow-up duration precludes assessment of long-term outcomes such as relapse, hardware-related complications, or delayed union. This is consistent with current literature indicating that mandibular fracture complications may occur in delayed phases (weeks to months), including malunion, nonunion, infection, and hardware-related failure, which require longer follow-up for proper evaluation.[30] Additionally, although biomechanical principles are discussed to support the rationale, no direct biomechanical measurements were performed, limiting conclusions regarding mechanical superiority, as qualitative clinical observations alone are insufficient to fully assess mechanical stability in complex fractures.[31,32] Notably, this case contributes to the existing literature by demonstrating the use of interdental tension band wiring not as a primary fixation method, but as a pre-ORIF reduction adjunct in a complex clinical scenario involving comminution and anterior dental malalignment, where conventional techniques may be limited. These limitations are recognized to provide limited generalizability and require further validation through larger studies and long-term follow-up to assess stability and complication rates, while contemporary studies emphasize that treatment outcomes in mandibular fractures depend on fracture complexity, fixation method, and follow-up duration, highlighting the need for longitudinal evaluation of functional and structural outcomes.[33,34]

CONCLUSION

This case demonstrates that interdental tension band wiring can be successfully repurposed as a reduction adjunct in open comminuted mandibular parasymphyseal fractures with dental malalignment. The technique offers a novel, low-cost, and clinically adaptable solution to overcome limitations of conventional fixation adjuncts in complex mandibular fracture management.

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