

## Infantile Mandibular Fracture Treatment with Double-crossed Skeletal and Circummandibular Wires: A Case Report

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### Abstract

The prevalence of mandibular fracture is relatively lower in the pediatric population compared to adults. The treatment of these fractures is more challenging for oral and maxillofacial surgeons due to the concerns regarding mandible growth and the presence of developing tooth buds. According to the literature, conventional methods (e.g., soft diets or closed reduction) are more effective in the treatment of nondisplaced pediatric mandibular fractures. There are few case reports regarding the treatment of mandibular fractures in infants, which have mainly introduced new technique using double-crossed direct skeletal wires to reinforce circummandibular wirings for the conservative treatment of infantile mandibular fractures. The present study aimed to describe the case of a 12-month male infant with significant dislocated right mandibular parasymphysis fracture. Initially, two circummandibular wires were passed bilaterally to pull the mandibular segments for their vertical alignment. Afterwards, the skeletal buccal and lingual direct wires reinforced the previous circummandibular wiring to fit the fracture segments. Finally, all the wires were tightened simultaneously to maintain satisfactory bone reduction. Furthermore, the addition of skeletal buccal and lingual direct wires could reinforce the previous circummandibular wiring to fit the fracture segments anteroposteriorly. The fracture healed

uneventfully with no complications, and intermaxillary fixation was not required in the patient. Moreover, the alveolar segments were in an appropriate position, and the maximum mouth opening of the patient was normal with no deviation, indicating a successful clinical outcome. This method was relatively reliable, noninvasive, and inexpensive, associated with the decreased discomfort and morbidity associated with maxillomandibular fixation, open reduction, and internal fixation in infants.

**Keywords:** Mandibular Fracture, Closed Reduction, Infant, Circummandibular Wiring.

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## Introduction

Maxillofacial fractures are less prevalent in the pediatric population (1-3), and the prevalence rate is estimated at 1% in children aged less than five years (2). The management of pediatric mandibular fractures is challenging for maxillofacial surgeons due to their physiological, anatomic, and developmental features, such as uncompleted mandibular growth involving the tooth buds (3-5). The treatment protocol of such fractures has been the focus of several recent studies (1, 4, 6-10).

The conservative approach is commonly applied in the treatment of maxillofacial fractures in pediatric patients for many reasons, including the presence of permanent tooth buds and elasticity of the pediatric bones. On the other hand, open reduction and fixation are often avoided in order to prevent tooth injury (3, 9). According to the literature, conventional methods (e.g., soft diets and closed reduction) are more effective in the treatment of nondisplaced pediatric mandibular fractures (1,4, 6-10). The generally accepted methods for the closed treatment of mandibular fractures in children are the conservative approaches involving the use of acrylic splints, lateral compression with an open-cap splint stabilized by circummandibular wiring, and intermaxillary fixation (IMF) using an arch bar and eyelet wiring (1, 4, 7, 11-13).

Although displaced fractures could be more effectively treated by open reduction and internal fixation with resorbable plates (2, 3), the nature of growing facial skeleton along with the presence of tooth buds makes the conservative approach more practical for the treatment of pediatric mandibular fractures (1). There are few case

reports regarding the treatment of mandibular fractures in infants aged less than two years (14-17).

This case report aimed to present a novel method of conservative treatment for mandibular fractures using double-crossed direct skeletal wires reinforcing the circummandibular wiring in a 12-month infant.

## Case Presentation

A 12-months-old male infant was referred to the Department of Maxillofacial Surgery at Shahid Kamyab Hospital in Mashhad, Iran following a mandibular trauma due to a fall in October 2017. The patient had no signs of unconsciousness and was discharged from the neurosurgery service. In addition, the patient had no prior medical conditions or family history of diseases.

The extraoral examination showed a three-centimeter through-and-through lip laceration on the right side of the mandible, which was sutured in the emergency section. Moreover, the intraoral examination revealed a clear osseous gap, as well as a step deformity in the right mandibular para-symphysis region between the right primary first and second incisors with notable tenderness. The patient had no fracture of the mandibular condyles or other bony structures of the jaws. It is notable that the posterior primary teeth had not yet erupted, and the primary canines of the patient were not completely erupted (Fig. 1-A).

Pre-operative CT-scan radiography revealed right mandibular parasymphysis fracture between the right primary first and second incisors with significant displacement (Figs. 1-B, 1-C).



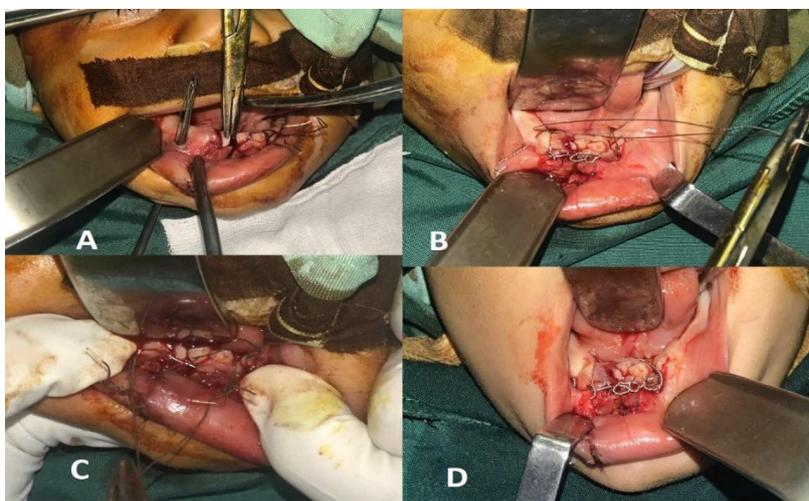
**Figure 1. A-C.** Preoperative Clinical and Radiographic View of Right Mandibular Parasymphysis Fracture with Significant Displacement

The clinical findings and diagnosis were explained to the patient's parents, and informed consent was obtained. The study protocol was approved by the Ethics Committee of Mashhad University of Medical Sciences (code: IR. Mums. Sd .REC.139.127).

Considering the age and dentition stage of the patient, a conservative treatment approach was preferred. Since most of the primary teeth were not completely erupted in the patient, the application of arch bars or lingual splints was not feasible. Furthermore, the parents of the patient could not afford resorbable plates and screws; therefore, we attempted a modified closed reduction approach for the effective and immediate treatment of the mandibular fracture.

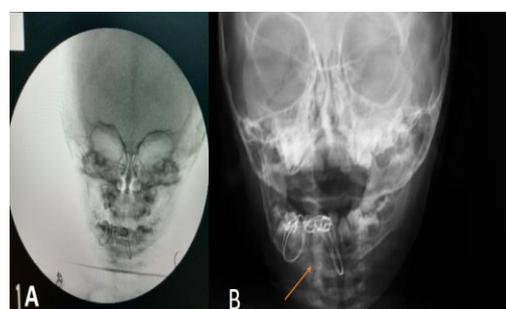
After the induction of general anesthesia (GA), the fracture segments were manipulated and reduced using

a bimanual maneuver. Initially, two 25-gauge circummandibular wires were passed bilaterally using an awl (Fig. 2-A). The wires pulled the mandibular segments to be aligned vertically, while they were not tightened completely in order to allow the passage of both buccal and lingual skeletal direct wires horizontally. The addition of the skeletal buccal and lingual direct wires could reinforce the previous circummandibular wiring to fit the fracture segments anteroposteriorly (Figs 2-B, 2-C). Finally, all the wires were tightened simultaneously in order to maintain proper bone reduction (Figs. 2-D). Moreover, this method could effectively prevent the malunion probability with no IMF. However, using the arch bar was not practical in the infant due to the low number of the erupted teeth.



**Figure 2. A-D.** New Technique of Double-crossed Direct Skeletal Wires Reinforcing circummandibular wiring for Management of Infantile Mandibular Parasymphysis Fracture

Although the anterior deciduous teeth of the patient had grade-one mobility due to lateral luxation, their removal was not indicated due to the risk of bone destruction after dental extraction. In this case, the achievement of adequate mandibular bone reduction using the mentioned alternative technique was confirmed based on the intraoperative C-arm portable radiography and postoperative PA-mandibular view (Figs. 3-a, 3-b). It is notable that the parents did not allow CT-scans or panoramic views to be obtained from their uncooperative infant under additional GA.



**Figure 3. A, B.** Adequate Bone Reduction Confirmed by Intraoperative C-arm Radiography and Postoperative PA-mandibular View

The patient was examined every week to assess the healing process and function. One month later, the wires were removed under conscious sedation, and the fracture healed uneventfully. Furthermore, the alveolar segments were in an appropriate position, and the maximum mouth opening of the patient was normal with no deviation in function, indicating the successful clinical reduction outcome. The clinical follow-up photography depicted also symmetry in the face, as well as successful treatment outcomes, in the patient (Fig. 4). Since the patient had no discomfort in the follow-up after six months, his parents refused to undergo postoperative CT-scans.



**Figure 4.** Clinical Follow-up Photography Showing Symmetry in Patient's Face and Successful Treatment Outcomes

## Discussion

The prevalence of mandibular fractures is relatively lower in children compared to adults (1, 3, 4, 8, 10). While the incidence of all maxillofacial fractures is estimated at 1-15% in pediatric and adolescent patients, this rate drops to less than 1% in children aged less than five years (4, 9, 18). In these fractures, the mandible is the most common anatomic site, accounting for 15-86.7% of all pediatric maxillofacial fractures (9, 18). This difference could be due to the relatively protected position of the mandible in relation to the cranium in the pediatric population (1, 5, 16).

There are few case reports regarding mandibular fractures and their treatment plans in the infants aged less than two years (14-17). Table I shows these case reports and the proposed treatment plans for infantile mandibular fractures. However, there is still controversy regarding the management of pediatric mandibular fractures. One treatment approach is conservative closed reduction with splint therapy and circummandibular wiring or IMF using dental arch bars (1, 3-6, 8, 9, 18, 19). The conservative approach is focused on fixating the maxillomandibular relations of dental occlusion in order to place the fractured segments in a proper relation, leaving the fracture site untouched (1, 3, 4, 6, 8, 9, 18, 19).

**Table I.** Case Reports on Mandibular Fractures and Treatment Plans in Infants Aged Less than Two Years

No	Author	Patient's Nationality	Number of Reported Cases	Patient's Age and Gender	Site of Mandibular Fracture	Treatment Method
1	Yamamoto et al.(17)	Japanese	1	17-month-old Female	Symphysis	Manual Reduction and Fixation with a Thermoforming Splint and Circumferential Wiring
2	Adlakha et al. (14)	Indian	1	18-month-old Female	Symphysis	Fixation with an Acrylic Cap Splint and Circummandibular Wiring
3	Baldi et al. (15)	Uruguayan	1	2-year-old Female	Bilateral Mandibular Body	Internal Fixation with Titanium Miniplates
4	Kim et al. (5)	Korean	1	11-month-old Female	Fracture between Lower Right First and Second Primary Incisor Teeth	Open Reduction and Internal Fixation with Microplate
5	Wu et al. (10)	Japanese	1	15-month-old Male	Complete Fracture in Symphysis and Dislocated Condylar Fracture on Right Side of Mandible	Open Reduction and Internal Fixation with Absorbable Plates
6	Khoshsirrat et al.	Iranian	1	12-month-old Male	Right Mandibular Parasymphysis	Double-crossed Direct Skeletal Wires Reinforced on Circummandibular Wiring

The second approach is to perform an open reduction followed by rigid internal fixation (ORIF) so as to reposition and provide the favorable conditions for the restoration of normal function (3, 5, 6, 9, 13). It is notable that ORIF with resorbable plates could be effective in the pediatric mandibular fractures with significant displacement. Although this technique has advantages such as direct vision, primary healing, and shorter treatment period without the need for a second operation for plate removal, ORIF is associated with disadvantages such as growth limitations due to periosteal stripping, high costs of resorbable plates, risk of damage to the primary teeth and permanent tooth buds, pain, and postoperative plate infection (2, 3, 20-22). Therefore, a conservative approach to the treatment of pediatric mandibular fractures with significant displacement is a valuable alternative. Furthermore, a conservative approach is often recommended as pediatric mandibular fractures have greater potential to be remodeled compared to the cases in adults (1, 4, 7, 8, 11).

The review of the literature in this regard shows that despite the advancement in surgical techniques and armamentarium in oral and maxillofacial surgery, conservative treatment is the most reliable approach to the management of pediatric maxillofacial fractures (1, 3, 6). Various forms of acrylic splints with circummandibular wiring have been successfully utilized in the conservative treatment of pediatric mandible fractures (3, 21, 23). However, these approaches require impression taking and adequate time to make and trim the splint several times. In addition, splints have been reported to release free monomers in the mouth, which could induce toxicity (1, 14, 20, 24).

The technique used in the current research was relatively reliable and provided adequate stability to support the segments during fracture line healing. While two circummandibular wires passing bilaterally pulled the mandibular segments to be aligned vertically, the buccal and lingual skeletal direct wires crossed horizontally. The addition of skeletal buccal and lingual direct wires could reinforce the previous circummandibular wiring to fit the fracture segments anteroposteriorly. Ultimately, the wires were tightened simultaneously in order to maintain proper bone reduction. On the other hand, this method could effectively prevent the possibility of malunion.

According to the literature, rigid fixation is not required in infantile mandibular fractures, and only semi-rigid fixation would suffice, which was provided by the novel wiring technique (1, 4, 7, 8, 11). The main limitation of this technique was the mild postoperative deciduous teeth misalignment due to grade-one mobility and lateral luxation. This is because the application of an arch bar was not practical in the patient due to the low

number of the erupted teeth. However, the accomplished mandibular reduction was of great importance as compared to the mild dental mal-position issue. Therefore, it could be concluded that this noninvasive, cost-efficient method could be employed in the treatment of infantile mandibular parasymphysis fracture.

## Conclusion

According to the results, the conservative treatment of infantile mandibular fractures using double-crossed direct skeletal wires reinforcing the circummandibular wiring could be considered a reliable treatment option, which is relatively straightforward and cost-effective, resulting in patient acceptance and comfort. Furthermore, this technique decreases the discomfort and morbidity associated with maxillomandibular fixation, open reduction, and internal fixation in infants.

## Conflicts of interest

None declared.

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