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Case Report Article

Atraumatic Management of Mandibular Fractures in Pediatric Patients: Cap Splint

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ABSTRACT

Pediatric mandibular fractures, although less common than in adults, represent a significant portion of facial injuries in children, typically resulting from falls, sports, or motor vehicle accidents. Due to the unique biomechanical properties of the developing mandible, such as its increased elasticity and osteogenic potential, these fractures often present distinct patterns and require specialized management strategies. Conventional treatment methods, including open reduction and internal fixation, carry risks like damage to tooth buds and interference with mandibular growth. Cap splints, a minimally invasive alternative, have emerged as an effective method for managing pediatric mandibular fractures. Custom-fabricated acrylic appliances, used with circumferential wiring or orthodontic elastics, provide stable fixation while sparing tooth buds and minimizing soft tissue trauma. This review discusses the indications, fabrication protocols, and clinical outcomes associated with cap splints, emphasizing their role in optimizing fracture healing, maintaining occlusal integrity, and preserving long-term mandibular development. Case reports demonstrate favorable results, supporting cap splints as a safe and effective treatment modality in pediatric mandibular fracture management.

Keywords: Pediatric mandibular fractures ,Cap splint , Atraumatic management , Mandibular trauma in children , Custom acrylic appliances , Circumferential wiring , Soft tissue preservation , Tooth bud protection.

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INTRODUCTION

Pediatric mandibular fractures account for a small but clinically significant proportion of facial injuries in children, representing approximately 10–20% of all facial fractures in the pediatric population. These injuries most commonly result from falls, sports-related accidents, and motor vehicle collisions, with the highest incidence observed in children aged 6–12 years as they engage in increasingly vigorous activities. Although less frequent than in adults, the unique biomechanical properties of the developing mandible, such as its relative elasticity and higher collagen content, lead to distinctive fracture patterns that require specialized management strategies to ensure optimal outcomes.

Healing and functional recovery. The pediatric mandible differs markedly from its adult counterpart in both anatomy and physiology. Immature bone exhibits a thicker periosteum and greater osteogenic potential, facilitating rapid healing but also predisposing to greenstick and incomplete fractures. Moreover, the presence of unerupted tooth buds within the alveolar process and the proximity of active condylar growth centers necessitate cautious intervention; even minimally invasive procedures risk disturbing future mandibular development and dentition[1,2].

Conventional approaches to mandibular fracture fixation—such as open reduction and internal fixation with miniplates and screws—provide rigid stabilization but carry significant risks in children. Transosseous hardware can damage developing tooth roots, disrupt eruption pathways, and impair growth plate function, potentially leading to malocclusion, facial asymmetry, and temporomandibular joint dysfunction if placed in the condylar region. Closed reduction techniques, including intermaxillary fixation with arch bars, while .

less invasive, may still be poorly tolerated by young patients, and can interfere with nutrition and oral hygiene [3].

Cap splints, first described in the 1990s, offer an atraumatic alternative tailored to the pediatric anatomy. These custom-fabricated acrylic appliances fit over the dental arches and are stabilized using circumferential wiring, orthodontic elastics, or a combination thereof, thereby distributing masticatory forces evenly across the alveolar ridge. The absence of transgingival screws minimizes soft-tissue trauma, avoids injury to tooth buds, and preserves periosteal blood supply, promoting uneventful osseous union while maintaining patient comfort and enabling early return to function. This review outlines the principles of atraumatic mandibular fracture management in pediatric patients using cap splints, detailing indications, fabrication protocols, and postoperative care. We discuss clinical outcomes from existing case series, evaluate potential complications, and compare this conservative modality with alternative fixation methods. By emphasizing a growth-sparing, patient-centered approach, cap splints aim to optimize fracture healing, maintain occlusal integrity, and safeguard long-term mandibular development[5,4].

CASE REPORT

The patient was a 10-year-old female who reported no history of any chronic illness, and was admitted as a case of a road traffic accident 1 hour before admission with mainly facial trauma, particularly in the mandible. Overall assessment of the patient revealed she was alert and oriented, yet restless and anxious. In addition, no swelling or signs of bleeding were found.

Upon intraoral examination of the mandible, bimanual mobility testing was negative. However, CT scan revealed a right parasymphyseal fracture.

Figure 1: Preoperative CT scan confirmed right para-symphysis

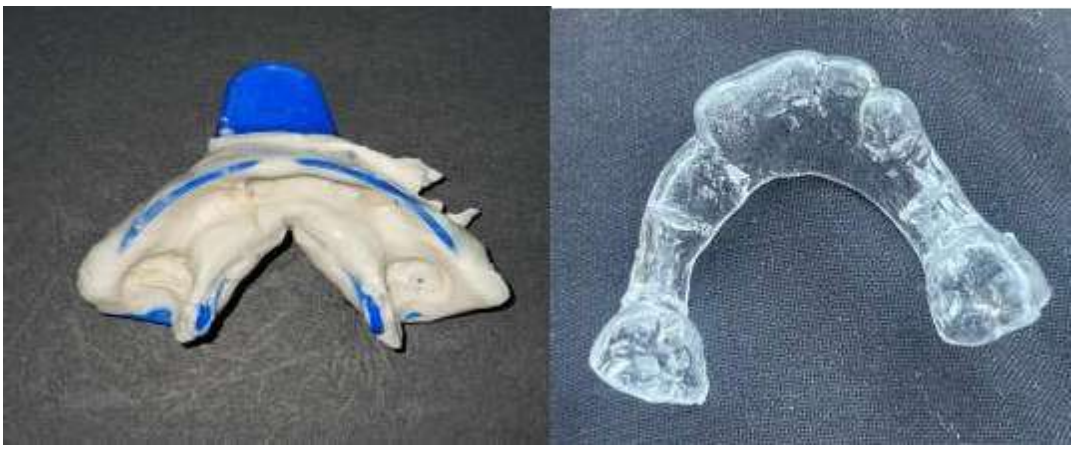

Figure 2: Impressions were taken using irreversible hydrocolloid, and dental stone was used to pour the casts. An acrylic cap splint was then fabricated based on these models.

Figure 3: Under LA and GA, Circummandibular wiring and acrylic cap splint seated intraorally

Figure 4: Post op OPG showing complete reduction and no trauma for permanent tooth buds

Ethical Approval and Patient Consent Statement

This study was approved by the Ethics Committee at Al-Jalaa Trauma Hospital, Benghazi, Libya. The patient was fully informed about the purpose of the research and the potential publication of their clinical case in a medical journal. Written informed consent was obtained, ensuring the patient's understanding of the use of their clinical data and images for academic and research purposes. All efforts were made to maintain confidentiality and anonymity throughout the process.

DISCUSSION

Mandibular fractures in children must be approached delicately because of developing tooth buds, elasticity of the bone, and possible interference with future growth potential. Rigid fixation is usually the option in adult fractures; nevertheless, for minimally traumatic procedures in growing children, techniques focused on ensuring good healing consist of avoiding untoward interference with the tooth bud and growth disturbances [6].

In this case, treatment was carried out with a cap splint and circummandibular wiring, which favored good stability of immobilization while limiting extensive trauma to the mandible during treatment. The successful outcome of the complete reduction of the fracture without harming permanent tooth buds indicates that this was successful in this specific case study. The cap splint then helped ensure appropriate jaw alignment while resisting any excessive forces on the developing dentition by evenly distributing the forces through the dental arch. The circummandibular wiring further stabilized the fracture without deeply penetrating the bone, reducing the risk of damage to underlying structures [7].

Crucial in this approach is the preservation of tooth buds, a major concern in the management of trauma in the pediatric age group. The cap splint, unlike rigid fixation with titanium plates, which complicates such procedures in requiring removal at a later date and potentially causing harm to developing teeth, proves particularly useful as a less invasive alternative while providing biomechanical stability [8]. From this case, supporters of cap splints find more justification in literature: safe and effective treatment of the pediatric mandibular fracture, reduced infection rate, faster healing, and avoidance of foreign body reactions [6].

Patient compliance, nonetheless, is the most significant aspect to ensure complete healing. Observing a soft diet, maintaining oral hygiene, and consistent follow-ups will assist in monitoring the healing process and preventing complications, such as malocclusion or delayed union [6]. Nonetheless, this soft diet would predispose to weight loss and malnutrition, which needs to be carefully monitored by their pediatrician.

In conclusion, this case stresses the need for atraumatic management in pediatric mandibular fractures. Thanks to the cap splint plus circummandibular wiring, it was possible to achieve a safe, effective, and minimally invasive solution for complete fracture reduction while sparing all permanent tooth buds; this

cements its role as a preferred treatment modality in pediatric patients, which needs further research for refinement and standardization for clinical applications [9].

CONCLUSION

This case stresses the need for atraumatic management in pediatric mandibular fractures. Thanks to the cap splint plus circummandibular wiring, it was possible to achieve a safe, effective, and minimally invasive solution for complete fracture reduction while sparing all permanent tooth buds; this cements its role as a preferred treatment modality in pediatric patients, which needs further research for refinement and standardization for clinical applications.

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