

A Report of a Novel Approach for the Management of Paediatric Mandibular Fracture Using a Prefabricated Adaptable Surgical Splint

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Abstract

Paediatric facial fractures are relatively rare. The inherent elasticity of the bones with more of the cartilage than that of the mineralised bone accounts for this. The principles involved in the management of facial fractures are the same irrespective of the age of the patient; however, in children, the techniques used are necessarily modified by certain anatomical, physiological, psychological and feeding factors related to childhood and the parents. In an attempt to keep the treatment and fixation technique simple, the case, presented here, describes the management of a mandibular parasymphyseal fracture in a 16-month-old child with the use of a prefabricated adaptable surgical splint.

Keywords: Conservative approach, mandibular fracture, paediatric facial fractures, prefabricated adaptable surgical splints

INTRODUCTION

The overall incidence of paediatric facial fractures is much lower than that in adults. Furthermore, the prevalence of paediatric facial fractures is lowest in infants increasing progressively with increasing age accounting for an overall incidence of 0.6%–1.2% under the age of 5 years.^[1] These fractures require different clinical treatment strategies compared with the fractures in the adult population keeping in mind the mandate of a conservative approach in most cases. The growth and development of maxillofacial structures during this period is another important consideration.^[2] Open reduction with internal fixation (ORIF) and osteosynthesis of paediatric facial fractures with titanium plates and screws are thought to have a negative impact on the developing dentition as well as the growth of the maxillomandibular skeleton. It involves a two-stage surgical procedure with a second procedure required for the removal of fixative devices after completion of the

healing process. In addition, an extensive tissue manipulation during the surgical procedure can have a detrimental impact on the growing tissues.^[3] Contrary to this, the use of resorbable plates and screws is less likely to disturb facial skeletal growth, but still being associated with the risk of damaging unerupted teeth even when using monocortical screws.^[4] These obvious risks make closed reduction preferable in most of the cases of paediatric facial injuries. The purpose of the present case report is to present the advantages of a prefabricated adaptable surgical splint which was chosen as a convenient and effective conservative treatment strategy for the management of a mandibular parasymphyseal fracture in a 16-month-old child.

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CASE REPORT

A 16-month-old child was presented by his parents with a history of recent facial trauma following fall from the staircase. Clinical examination revealed a diffuse extraoral swelling in relation to the left side of the face; however, no bleeding from the ear and nose could be elicited. There was mild circumorbital ecchymosis noted in relation to the left eye. Furthermore, bruises with encrustations were observed in relation to the right side of the chin [Figure 1]. Intraoral examination revealed right mandibular parasymphiseal fracture with overriding fractured fragments. Step deformity with tenderness and mobility was elicited along the inferior border of the right side of the mandible. An anteroposterior radiological examination of the mandible showed discontinuity of the bone from the interdental region of the mandibular right lateral incisor extending to the inferior border of the mandible [Figure 2].

An open adaptable stent was obtained for the oropharyngeal airway confirming with the size and shape of the mandibular curvature in the anterior teeth region [Figure 3]. The tubing was separated from the guard and then split longitudinally [Figure 4]. The stent was checked to fit the mandibular anterior region and then was fenestrated in the centre to accommodate the teeth present. Under general anaesthesia, the fractured fragments were reduced and fixed and then, subsequently, immobilised by means of the prepared stent retained by bridle wiring on either side of the fracture line [Figure 5]. Circummandibular wiring was done using an 18-gauge hypodermic needle, which was inserted extraorally from beneath the inferior border of the mandible to come out inside the oral cavity on the lingual

side [Figure 6]. A hypodermic needle was used to avoid trauma to the adjacent tissues and surrounding structures.

Post-operative radiograph was taken to confirm the treatment and serve as a baseline treatment radiograph for future comparisons [Figure 7]. The patient was kept on follow-up, and at the end of the third post-operative week, the circummandibular wiring with the splint was removed under sedation. Post-operative resumption was found to be uneventful.

DISCUSSION

Only 0.87%–1.0% of the facial fractures occur in children younger than 5 years of age, whereas 1.0%–14.7% occur in patients older than 16 years. The aetiology of mandibular fractures in children differs from that conventionally seen in adults. The most widespread reasons for mandibular fractures in adults include road traffic accidents (RTAs), falls and sports.^[5] Nonetheless, the mandible is packed of tooth buds, and hence, the ratio of the tooth bud to the bone is high in children, which predisposes to fractures seen with the said bone to be seen most commonly in this age. During treatment planning, too, similar factors are supposed to be taken into consideration including the age of the patient, degree of compliance, the anatomic site of the fracture, the stage of growth and development (anatomic, physiologic and psychologic), the complexity of the injury and the time elapsed for the same.^[6]

There are various options available for the treatment of mandibular fractures including closed reduction and intermaxillary fixation (IMF). By the age of 2 years, ten teeth exist in each jaw and maxillofacial fixation can be easily achieved. However, in the present case, the child was just



Figure 1: Frontal profile of the patient

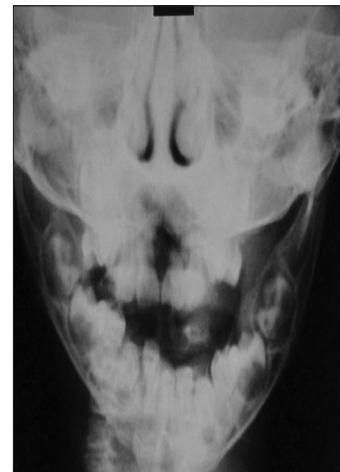


Figure 2: Anterior–posterior view of the mandible



Figure 3: Open adaptable stent



Figure 4: Tubing separated from the guard and split longitudinally

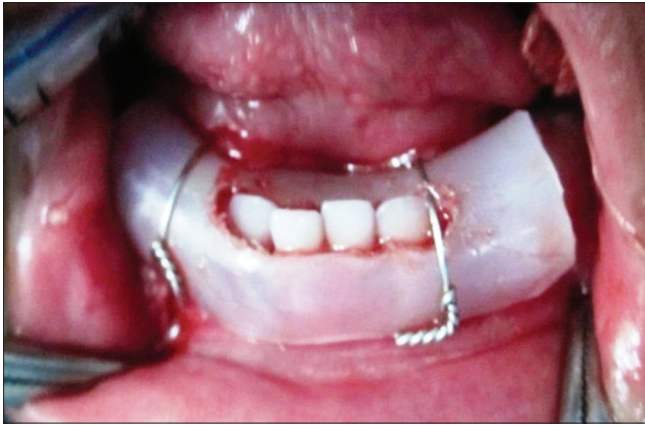


Figure 5: Fenestrated stent secured at the site of fracture



Figure 6: Circummandibular wiring being done using 18-gauge hypodermic needle



Figure 7: Post-operative radiograph of the patient

16-month-old and only four teeth were present in the lower arch which ruled out the option of IMF. Furthermore, the height of the contour of the primary dentition is lower as compared to the permanent dentition implying lesser vertical height of the mandible in children, thereby switching us towards the option of an acrylic stent with circummandibular wiring to immobilise the fractured fragments of the bone.

There is almost no indication to open an infant's fracture because the abundance of developing teeth in the bone makes fixation almost impossible without damaging the budding dentition; however, with unfavourable, displaced fractures, ORIF almost becomes an absolute necessity. In such cases, the treatment becomes analogous to that performed in the adults when dentition has erupted and the root formation has matured enough, implying some subperiosteal dissection with the potential to interrupt or limit the osteogenic potential of the periosteum, which is actually not desirable at younger ages.

Bioresorbable plate fixation in paediatric craniofacial surgeries as a means of avoiding the potential and well-documented problems with rigid metal fixations has been recently used with good results. The use of resorbable plates and screws have nearly no side effects on the growing facial skeleton, although there is still the risk of damaging the unerupted teeth during the surgical process.^[7]

Mandibular fractures are the most commonly displaced fractures. A low-damage, open reduction management strategy is, thus, highly desirable. Nevertheless, this method provides established three-dimensional re-enactment, promotes primary healing of the bone and eliminates the call for an early release of IMF. Furthermore, Posnick *et al.* claimed that a decreased dependence on IMF improved post-operative respiratory and nutritional concerns of the patient's wards.

Contrary to this, secondary infections and wound dehiscence are seen less frequently with closed as against open reduction. Furthermore, the propensity for rapid bone healing in children results in shorter IMF periods, even when indicated, compared to the adults, ruling out the possibility of temporomandibular ankylosis due to long-term jaw immobilisations done post-operatively. Closed reduction by means of IMF was essentially used for all paediatric facial fractures till the mid-seventies. In the present context, therefore, while ORIF has become the standard of care for the management of displaced facial fractures, its appropriateness for undisplaced facial fractures, especially, in child patients remains contentious.^[8]

In the present case, a soft oropharyngeal airway tube was adapted according to the mandibular arch. The prefabricated adaptable surgical splint that was fixed to the teeth using self-curing acrylic provided adequate stabilisation of the fractured fragments in the present case that avoided the need for IMF. Furthermore, it was convenient to the patient and provided the patient comfort during feeding. The said splint was removed after 3 weeks, whereas the 6-month follow-up revealed neither a delay in the eruption of the teeth nor any occlusal disharmony or facial disfigurement secondary to growth changes.

CONCLUSION

The clinical outcomes achieved in the present case indicated that prefabricated surgical splints for conservative treatment of paediatric mandibular fractures are more reliable than the open reduction or IMF techniques with regard to cost-effectiveness, ease of application, removal and the post-operative sequel. The

use of semi-rigid material, further, leads to minimal trauma to the adjoining anatomic structures and comfort for the patients, especially younger patients. The important point to be considered in such cases is the follow-up which is required for an early detection of the possible growth disturbances, so that the required measures can be taken before an irreversible change sets-in as a permanent sequel of trauma.

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Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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