



APPLICATION OF BIODEGRADABLE PLATE AND SCREWS IN MANAGEMENT OF PEDIATRIC MANDIBULAR FRACTURES: CASE REPORT AND REVIEW OF LITERATURE

Surgery

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ABSTRACT

Pediatric mandibular fractures are highly common maxillofacial injuries which present a number of challenges in the management. Classically, they have been treated conservatively but with the advent of newer plating systems and technologies, more and more of these fractures are now being actively managed with open reduction and fixation. The popular titanium systems though quite effective in adult population, suffer from certain drawbacks in pediatric patients. To overcome these, resorbable plates and screws have been recently introduced. We present one of the first such case reports from the Indian subcontinent of a 3 year old patient who was successfully managed with this new system. We also discuss the available literature and its implications.

KEYWORDS

Bioresorbable plate and screws, pediatric mandible fracture

INTRODUCTION

One of the most common types of pediatric maxillofacial trauma comprises of mandibular fractures^{1,2}. Many of these fractures are incomplete due to relatively softer and more elastic mandibular bone in children. The treatment of mandibular fractures in children is often conservative due to presence of unerupted permanent tooth buds and overall difficulty associated with children as surgical patients^{3,4}. However, the proportion of children with mandibular fractures treated with open reduction and internal fixation (ORIF) has increased gradually over the years, mostly because of the progress made in bone-repair materials and the improvement of bone-repair technology,

Titanium plates and screws are the standard for craniomaxillofacial rigid internal fixation, but these are subject to disadvantages such as palpability, visibility, temperature sensitivity, interference with radiographic imaging, and excessive stress shielding. Furthermore, metal fixation is thought to be associated with possible growth retardation and might require a second operation for removal². Biodegradable plates on the other hand get assimilated into the body over a period of time and offer considerable advantages in the management of mandibular fractures in children. However, there are some disadvantages too. First, the duration of the operation is longer as the plate bending requires a heat source, and resorbable screw placement requires screw-thread pretapping before screw insertion. Second, due to insufficient strength of the fixed material, the plates may break and displacement and nonunion might occur after surgery. Third, foreign body reaction and complications may occur during the biodegradation and absorption of the plate and screws⁵⁻⁹. These plates and screws are also considerably more expensive than the titanium ones.

In this paper, we present a case of pediatric mandibular body fracture managed with resorbable plating system. This report to the best of our knowledge is the first such report from the Indian subcontinent.

CASE REPORT

A 3 year old male child reported to the unit of Oral and Maxillofacial surgery, Oral Health Sciences Centre, PGIMER Chandigarh with a history of road side accident around two days back. There was no history signifying any neurosurgical injury and except for maxillofacial injuries, no other regions were seemingly involved. On clinical examination, there was swelling on right lower side of face which was tender to touch. Overlying skin had a fine laceration. Intraorally, the occlusion was deranged and gross step defect was visible in mandible right body region (Fig. 1). Orthopantomographic evaluation revealed fracture of mandibular body on the right side. Multiple unerupted tooth buds were also seen.



Fig. 1 Deranged occlusion and step defect due to fracture of right mandibular body

Decision was made to perform open reduction and fixation with bioresorbable plate and screws. Under general anesthesia, access was gained extraorally through the pre existing laceration and fracture ends were mobilized and reduced to anatomical position. An assistant maintained a good occlusal relationship, and intraoperative maxillomandibular fixation (MMF) was not required. A 4-hole resorbable plate was prepared in a hot water bath. It was held along the inferior border of the mandible and adapted to the bone surface, with 2 screw holes on each side of the fracture. The screw holes were drilled with prescribed drillbit and the screws were inserted with slight apical pressure (Fig. 2). Fixation was rechecked and layerwise closure was done. Post operative sequelae were uneventful and the child returned to normal function in less than four weeks. Follow ups revealed no fresh problems and optimum occlusion (fig.3).

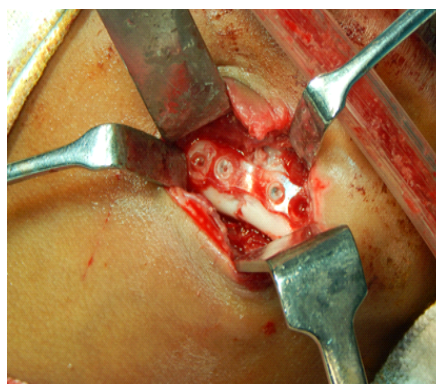


Fig. 2 Plate adaptation and fixation



Fig.3 Excellent occlusion at six months follow up

DISCUSSION

When treating pediatric maxillofacial fractures, factors such as age and anatomical site and complexity of the fracture should be considered¹⁰. In general, treatment of patients with undisplaced or incomplete mandibular fracture should include liquid diet, close observation, and regular follow-up. For displaced and mobile mandibular fractures, monomandibular fixation can be performed using an arch bar or acrylic splint; an alternative method is intermaxillary fixation. As the contour of the primary dentition is lower, ligating the arch bar to the dentition is difficult; the situation is the same situation in mixed dentition, and circummandibular wires and some form of skeletal suspension are often required¹¹. In children, especially younger children, monomandibular fixation (MMF) cannot reduce fractures anatomically, and does not facilitate early recovery of mandibular function. Furthermore, as children generally find it difficult to cooperate with the treatment conditions, conservative treatment is relatively difficult.

ORIF reduces fractures anatomically, and children can resume a normal diet as soon as possible, which ensures the nutrition required for fracture repair and bone growth¹⁰. It can also reduce the duration of mandibular immobilization, which is conducive to the recovery of joint function¹¹. ORIF is the standard treatment for displaced mandibular fractures in children^{2,3}, but issues regarding the application of titanium fixation may arise, such as allergies, stress shielding, corrosion, limitation of bone growth, and plate migration, necessitating a second operation to remove the titanium plates.

After 30 years of development, an increasing number of clinicians have gradually accepted the use of biodegradable fixation for maxillofacial fractures. In the field of craniomaxillofacial surgery, biodegradable fixation is mainly used for oral and maxillofacial trauma, orthognathic surgery, and cranial vault modeling. In addition to the titanium plating system, biodegradable fixation is another option for maxillofacial skeletal fixation. The biodegradable plating systems commonly used are mainly composed of polyglycolic acid (PGA), poly(L-lactic acid) (PLLA), and their copolymers¹². Generally, plate bending requires a heating device to cause the polymer chains to bend and not break, and placement of the resorbable screws requires pre-tapping of the screw threads before screw insertion; consequently, the operation is more complicated and more time-consuming compared with that for similar metal fixation systems¹³. In addition, it has been reported that mandibular fractures have been treated with ultrasonic-aided fixation of biodegradable implants¹⁴. As the fractures heal, the absorbable materials are absorbed, which is a clear advantage when treating displaced and mobile pediatric mandibular fractures¹⁵.

We placed a biodegradable plate along the lower margin of the mandible, which would effectively avoid injuring the permanent tooth germs. Where temporary intermaxillary fixation could not be performed during the operation, an assistant held and pushed up the mandible to maintain normal occlusion prior to plate fixation. Eppeley¹¹ believed that this free-hand technique is fairly effective for maintaining good centric occlusion before fixation of isolated pediatric mandibular fractures.

The complications of biodegradable fixation are mucosal dehiscence, plate dehiscence, nonunion, malunion^{7,8,14,16,17} and foreign body reaction^{5,6,7,9}. Foreign body reactions include local swelling, fistula formation, sterile abscess, and osteolysis^{5,6,7,9}. The most common foreign body reaction is aseptic abscess⁵. At a 6-month followup, Landes et al⁷ reported radiographically apparent local osteolysis 2

months after curettage subsided. Kallela et al⁶ reported on 11 cases of anterior mandibular fracture in adult patients fixed with self-reinforced PLLA lag screws; one patient had osteolysis 6 weeks after surgery, which disappeared 6 months later.

In the literature, osteolysis is rare when resorbable plates and screws were used in the oral and maxillofacial regions. This might be because osteolysis is extremely rare in itself. Another reason might be that the radiographic examinations at follow-up often involved plain films, such as panoramic radiographs, and CT scans were relatively rare¹¹. Panoramic radiographs only disclose the change in screw hole density, but cannot reveal changes in the bone around the resorbable plates.

In many patients, the drill holes for screw insertion are visible on radiographs as persistent radiolucent areas^{7,12,16,17}. Some researchers believe that the screw holes may serve as a measure of degradation time in that once the screw hole is no longer visible, it can be assumed that the material has been resorbed^{12,16}. Landes et al. observed that the screw holes of 85:15 PLGA resorbed 24 months later, and those of 70:30 P (L/DL) LA resorbed 36 months later. Ferretti¹⁷ believed that screw hole reossification was subject to site-dependent variability, generally being more rapid at the mandibular angle and body as compared with the symphysis.

Conclusion

Resorbable systems hold a growing space and a promising future, especially for pediatric facial fractures.

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