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SHORT COMMUNICATION

Maxillofacial Injuries in the Pediatric Patient: An Overview

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ABSTRACT

Children are uniquely susceptible to craniofacial trauma because of their greater cranial mass-to-body ratio. The pediatric population sustains 1 to 14.7% of all facial fractures. The majority of these injuries are encountered by boys (53.7-80%) who are involved in motor vehicle accidents (up to 80.2%). The incidence of other systemic injury concomitant to facial trauma is significant (10.4-88%). The management of the pediatric patient with maxillofacial injury should take into consideration, the differences in anatomy and physiology between children and adults, the presence of concomitant injury, the particular stage in growth and development (anatomic, physiologic and psychological), and the specific injuries and anatomic sites that the injuries affect. The greatest concern when treating the pediatric patient is the effect of the injury or treatment on growth and development. This is both anatomically and psychologically important and may have various effects on management for the different stages of psychological development.

Keywords: Pediatric trauma, Soft tissue injuries, Maxillofacial injuries, Management.

MAXILLOFACIAL INJURIES IN THE PEDIATRIC PATIENT

Maxillofacial fractures in the pediatric age group are not so common, yet they are not less important.[1] This article aims at eliciting a few common pediatric fractures and their managements. The incidence of pediatric facial fractures ranges between 1 and 14% for victims under the age of 16 years and 0.87 to 1% for those younger than 5 years. The incidence of pediatric facial fractures among Indians is 5.5%.[2] Most frequently boys are involved (53.7-80%). The cause is most often a motor vehicle accident (5-80.2%), violence (3.7-61.1%), falls (7.8-48%), bicycle accidents (7.4-48%), play (10-42%), and others (Table 1).[3]

The pediatric patient may be categorized according to various stages of growth and development. The infant includes the newborn to 1 year of life. Preschool is the childhood period between 2 and 6 years of age, whereas the child is defined as 11 to 13 years and younger. School-age is that period between 6 and 10 to 12 years.[4,5] We are considering children from birth to 13 years of age as our target group.

Table 1: Etiology of pediatric facial fractures

MVA	5.0-80.2%
Violence	3.7-61.1%
Falls	7.8-48.0%
Bicycle	7.4-48.0%
Play	10.0-42.0%
Sports	1.2-33.0%
Pedestrian	10.0-25.0%
Other	4.5-23.0%
Object	1.0-23.0%
Crush	10.0%
Birth	0.1-4.0%

GROWTH AND DEVELOPMENT

Maxillofacial injuries are much less common in younger children than in adolescents and adults. This lower incidence of facial trauma in infants and young children is a result of socio-environmental, general physical and craniomaxillofacial anatomic factors. Fracture sites tend to shift from the upper to the lower aspect of the face with the increasing age of the patient.

One must appreciate facial development in order to understand the difference between pediatric and adult facial fractures. Around 80% of the cranial growth occurs in the first two years of life and is completed by the age of seven. The craniofacial ratio at birth is 8:1, while this ratio at adulthood varies from two to two and half to one.

By the end of the first year of life, the two mandibular halves have joined in the midline. At age 2, complete symphysis fusion from the inferior border to the alveolus and most of the transverse maxillary growth is complete (followed by vertical and then anteroposterior). The sixth year marks the mixed dentition phase, the antrum are present and well developed. Palatal, premaxillary and midline maxillary sutural growth are complete with suture obliteration by ages 8 to 12. The adult dentition is present by ages 12 to 13.

The mandible and maxilla continue to grow throughout childhood, maintaining a high cancellous-to-cortical bone ratio and resulting in greater elasticity of the jaws. As a result, incidence of greenstick fracture and nondisplaced fracture is more in pediatric age group.[6]

ANATOMIC DIFFERENCES BETWEEN CHILDREN AND ADULTS

The general management of children after trauma requires special attention independent of the presence of maxillofacial injuries. They are different from adult fractures in many respects. The child, for example, is more difficult to examine both clinically and radiologically as they tend to be more uncooperative due to fear. Their answers when trying to elicit clinical signs or answers to questions may not be always completely reliable. Furthermore, it is more difficult to make use of the teeth in children for fixation, because deciduous teeth may be either insufficient in number or their roots may be resorbed and permanent teeth may be incompletely erupted. The shape of the deciduous crown is also not favorable for retention of wires and splints, being bell-shaped with little undercut area. Elasticity of the bone in children, the relatively small size of the face and the growth process in the young bone are also among the factors that influence the pattern of fracture, its management and the postoperative period of fixation. Ankylosis of the temporomandibular joint causing impairment of function is more common in children and damage to the condylar growth center can result in facial deformity.[6,7]

SOFT TISSUE INJURIES

Pediatric soft tissue injuries are frequently overlooked when discussing pediatric trauma. Yet they occur in association with facial fractures 29 to 56% of the time. Although, immature collagen in the child's soft tissues provide very good cosmetic results, the vast majority of the time hypertrophic scars and keloids may form in this patient population. To avoid this, use of synthetic collagen (kollagen) dressing over the wound is known to cause desired healing in case of laceration, abrasion, etc. However, specialized structures, such as the facial nerve and salivary ducts, may require microvascular repair.[8]

Kollagen is to be placed after a thorough debridement and cleaning of the wound, which facilitates growth and also prevents exposure of raw wound to external environment, thereby reducing chances of infection. The healing is uneventful with the placement being atraumatic. The dressing falls off after the healing is complete and the skin texture and color match is esthetic as shown in Figures 1A to C.

Although isolated abrasions, lacerations and contusions may occur with motor vehicle accidents, falls and sports, the most extensive and devastating pediatric soft tissue injuries occur from animal (especially dog) bites. Prophylactic measures for tetanus and rabies must be considered alongwith antimicrobial skin preparations while treating animal bite cases.[9] Antibiotic therapy must also be given. Psychosocial counseling may be required for patients and families sustaining these forms of injury not only because of trauma but also because of the deforming nature of the soft tissue injury in the child[8] (Figs 2A to F).

Figs 1A to C: The different changes that can be seen postgrafting and the excellent esthetic color that is retuned

Figs 2A to C: The management of animal bite and the reason why psychiatric counseling is necessary

Figs 2D to F: Management of facial laceration and need to avoid facial skin sutures and the use of steri-strips to fasten wound edges

FIXATION CONSIDERATIONS

When formulating a plan of treatment for pediatric patients with facial trauma, a number of elements must be considered. These include the age of the patient (to maximize growth and development), the anatomic site (to optimize form and function), the complexity of the injury (displacement, comminution and the number of sites), the time elapsed since injury (ideal to treat within 4 days), concomitant injury (fitness for anesthesia and duration of surgery) and the surgical approach (closed versus open). The fixation preference will be dictated by the age, anatomic site, complexity and approach.[10]

No Fixation

Many authors have suggested that for nondisplaced or greenstick fractures in the pediatric population, observation alone is adequate[11] (Fig. 3).

Fixation of mandibular fracture can be done by:

Monomandibular Fixation

In the edentulous newborn with a mandibular body or symphysis fracture, monomandibular fixation by means of an arch bar, acrylic splint (or stent) or thermoplastic material, may be the only acceptable alternative. This technique is particularly helpful

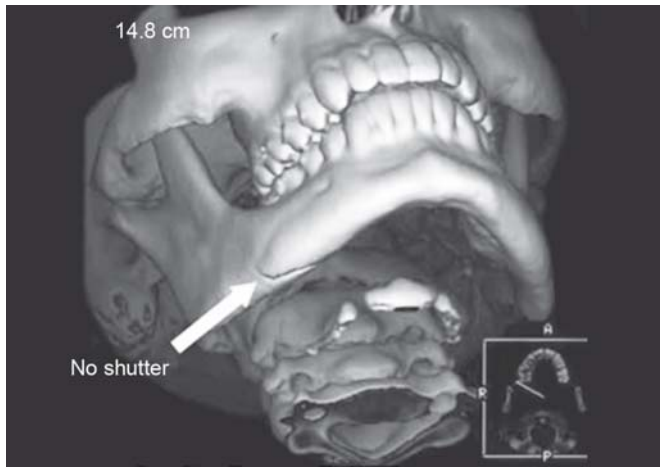
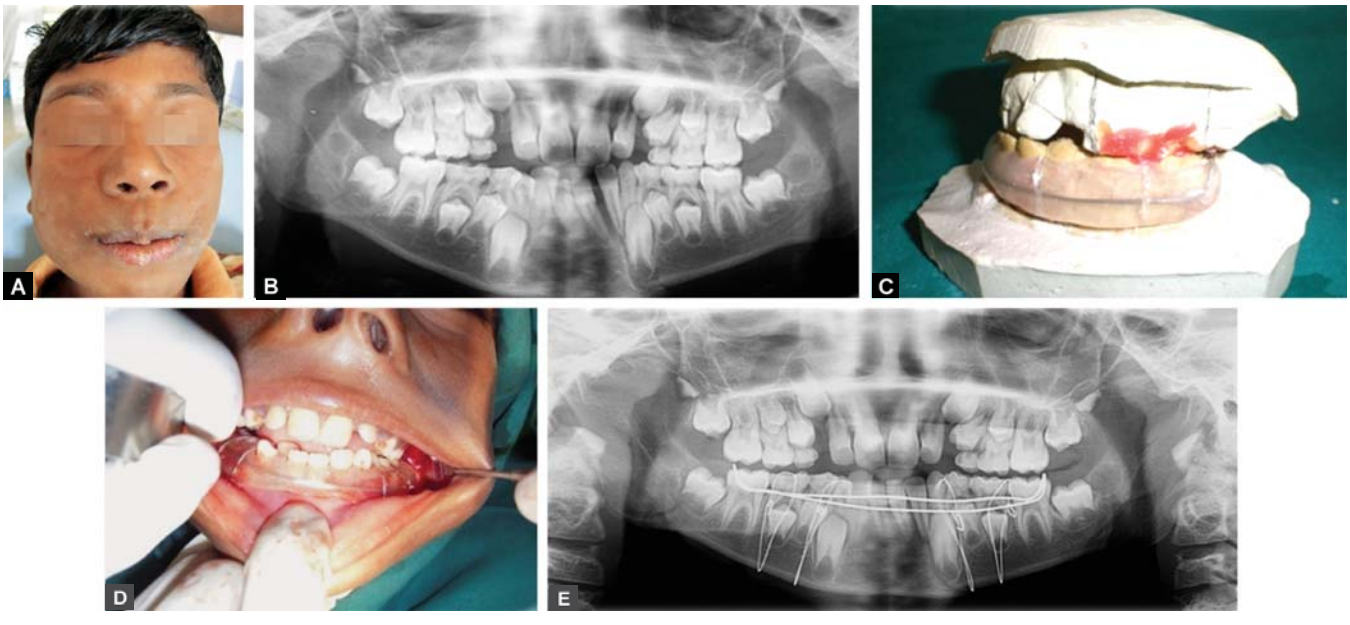


Fig. 3: A typical undisplaced fracture which most of the times can be treated by conservative means

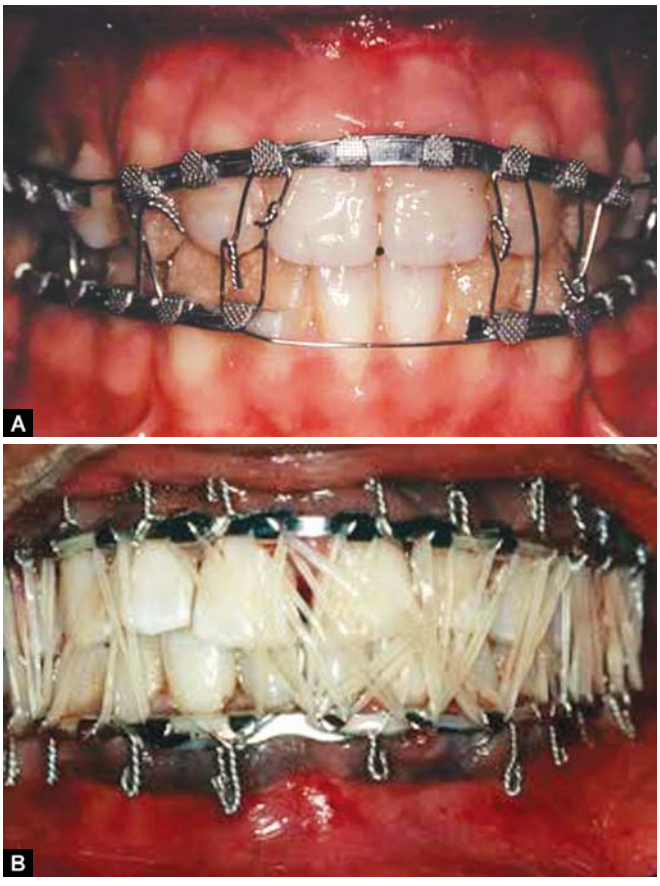
for greenstick or minimally displaced fractures when the patient is partially edentulous (ages 5-12). This fixation has the disadvantage of limiting anatomic reduction and restricting full function (Figs 4A to E).[12]

Maxillomandibular Fixation

Thinner wire (28 or 30 gauge) is suggested for ligating the arch bar to the dentition. Before age 2 and after age 6, missing or



Figs 4A to E: The fabrication of a circummandibular splint and the procedure to do circummandiblar wiring



Figs 5A and B: Use of arch bar for maxillomandibular fixation, the same can also be used in a single arch to stabilize dentoalveolar fractures

resorbed teeth limit this technique. Maxillomandibular fixation (MMF) with closed reduction may not permit anatomic reduction even after 3 to 4 weeks of MMF (Figs 5A and B).[12]

Internal Fixation

This technique when used in children may interrupt or limit the osteogenic potential of the periosteum or create scars that may further restrict growth, or both. Absolute anatomic reduction can be achieved, nutrition is improved by permitting a rapid return to a normal diet, tolerance and compliance are not a major issue (Fig. 6).[13]

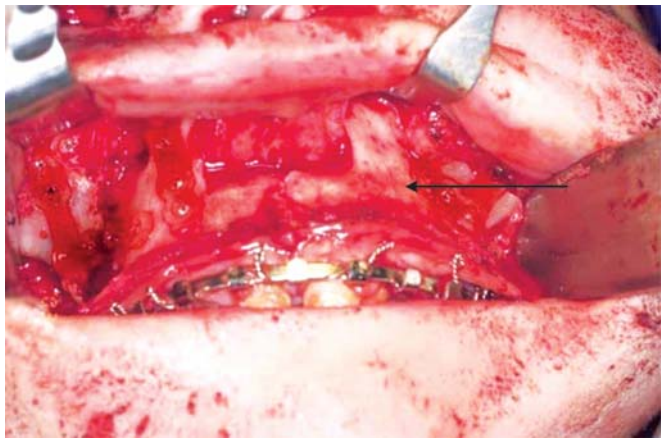


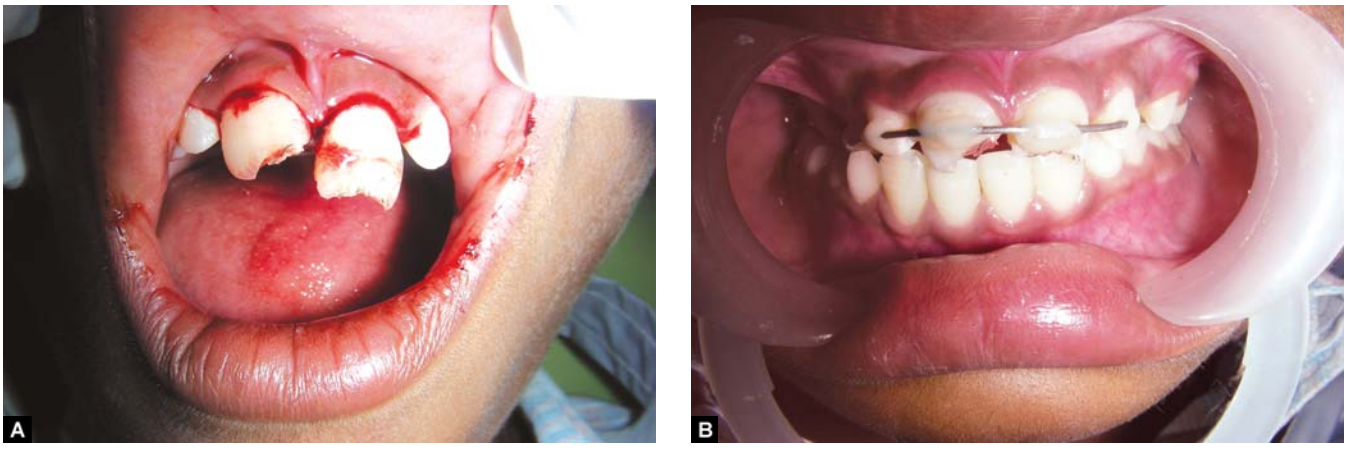
Fig. 6: Use of resorbable plates in the fixation of a fractured maxilla

DENTAL AND DENTOALVEOLAR INJURY

The other most common injuries in pediatric age group are dentoalveolar injuries. Dentoalveolar injuries may be quite dramatic, causing parents to panic and the child to cry uncontrollably. Wire, acrylic splint and arch bars offer satisfactory methods of stabilization. Avulsed primary teeth should not be replaced, whereas avulsed adult teeth should be reimplanted within 2 hours (preferably 30 minutes) and stabilized for 4 weeks. The prognosis of an avulsed tooth is largely dependent on the status of the cells of the periodontal ligament at the time of reimplantation. Alveolar fractures should be anatomically reduced and stabilized for 4 weeks (Figs 7A and B).[14]

MANDIBULAR CONDYLE

The condylar fracture, though are seen in most of pediatric injuries, is a matter that invites great controversies, and a definite protocol for treatment is to be discussed in greater detail to arrive at a possible deformity free survival, and hence very common injury is not discussed in this article. It must suffice to say at this point that all children presentation with laceration on the chin must be put on a long-term follow-up to recognize the earliest sigs of TMJ ankylosis.



Figs 7A and B: The technique of splinting an avulsed teeth by bringing it back to the arch and occlusion, and using composites to splint it

MAXILLARY INJURY

The maxilla is the least frequently injured pediatric facial bone (1.2-20%). Closed reduction with maxilla-mandibular fixation for 2 to 3 weeks is effective to re-establish the occlusion in minimally displaced fractures. If an open reduction with semirigid internal fixation is chosen, the approach should be made through a circumvestibular incision.[15,16]

The other traumatic injuries though very uncommon like naso-orbital, ethmoidal fracture, zygomatic fracture, nasal fracture are beyond the scope of this article.

CONCLUSION

The pattern of craniomaxillofacial fractures seen in children varies with their evolving craniofacial anatomy, and for this reason requires different treatment strategies from those in adults. Facial fractures in children may go unrecognized as a result of incomplete communication with the patient, inadequate radiographic examination in the restless child or late presentation of the patient by the family. A methodical system of surveillance must be applied in every trauma patient to effect favorable outcome, the hard tissue trauma need immediate attention of the involved mandible and in case of dentoalveolar injuries.

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