ORIGINAL RESEARCH PAPER
Volume - 10 | Issue - 09 | September - 2021 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

PEDIATRIC FACIAL FRACTURES: ARE KIDS IMPLICITLY A MINIATURE VERSION OF ADULTS?

Dental Science

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ABSTRACT

During the past decades, there have been enormous advances in the management of pediatric facial fractures. Trauma regarded as the sole reason for the cause of morbidity and mortality in children. Diagnosis is more difficult in children than the adults and fractures are easily overlooked. CT imaging is the gold standard for the diagnostic purposes. Operative management must be done while keeping in mind the child's skeletal and dental age.

KEYWORDS

Pediatric Facial Trauma, Resorbable Plating System

INTRODUCTION

Trauma has been considered as the leading cause of morbidity and mortality in children. Unlike adults the facial skeletal fractures in children are less likely to occur and are minimally displaced.[1] This is due to the relative smaller size of the facial skeleton, the nature of elasticity of bones,[2] shortness of condyles and non-prominent chin region.[3] Facial fractures in young adults comprise less than 15% of all the facial fractures. They are seen rarely below the age of 5 years, having a male dominating predilection, seen as a constant incidence over the years.

ETIOLOGY, GENDER

The major causes of facial fracture in children incorporates falls, sports injury and RTA. The rate of occurrence solely depends upon the age factor of the child and the types of fractures included (young children may sustain injury from low-velocity forces like falls, while the older once require higher velocity forces such as RTA, sports-related injury). The preponderance of boys over girls can be explained because of frequent involvement in sports related activities, dangerous behavior and activities.[4]

DISTINCT FEATURES OF THE PEDIATRIC PATIENT

At birth the cranial volume and facial volume ratio is approximately 8:1, which after the growth completion becomes 2.5:1.[5] As a matter of fact, the prominent frontal bone (with the protecting skull) and the retruded facial skeleton is likely to be the cause of higher incidence of cranial injuries in children less than 5 years of age.[6] Facial fractures in children are less likely to occur than adults with minimal displacement, due to the fact that the elastic bones of a child is covered with a thicker layer of adipose tissue with flexible suture lines. The presence of tooth buds and lack of pneumatization increases the stability of the fractured bone.[7]

Furthermore, the growth potential of the condyle may come in handy to compensate post condylar fracture, while a spontaneous occlusal readjustment during the mixed dentition stage can be accomplished.[8]

DIAGNOSIS OF FACIAL FRACTURE IN CHILDREN

CT Scan being the gold standard in diagnostic aid is helpful in pediatric patients, especially in midfacial fracture, comprising of underdeveloped sinuses and tooth buds obscuring the skeletal bones. Plain radiographs may not prove to be useful as in the case of adults.[7]

RIGID INTERNAL FIXATION AS AN OPTION IN CHILDREN

It comes with a package of advantages over the closed reduction technique, such as it promotes primary healing, lesser treatment period, early removal of MMF enhancing postoperative oral hygiene, nutritional intake and respiratory care,[7] However, there are controversies concerning the use of rigid internal fixation in growing children, comprising of the high cost, potential artifacts on CT/MRI, visibility of plates through the child's thin skin, pain, early/late infection, trauma to the tooth buds and erupting teeth, risk of dural penetration of plates and screws (potential risk of secondary headacks/seizure focus),[9] cerebrospinal fluid leak, meningitis, brain injury, disturbed growth pattern.[83] Mini plates and screws are known to possess the capacity to migrate in bone and other tissues such as cartilage.[10] Device loosening, skin irritation and device exposure are the causes of potential need for secondary removal surgery.[9]

It is suggested to remove the plate and screws as early as possible (within 2-3 months). Furthermore, the plates and screws must not traverse suture lines or the midline of the mandible. With the introduction of absorbable plates and screws these complications will be further minimized.[10]

RESORBABLE PLATING SYSTEM

With the introduction of resorbable material the need for additional surgery for the removal of hardware is eliminated. Adding to its advantages such as lesser hospital spending, the use of large mesh panels helps to contain the cost with resorbable systems (by placing several small pieces in cost-effective fashion) from a single large panel. Improving patients quality of life. Various authors in their respective studies demonstrated that the larger resorbable plate fixation in the tooth bearing regions can be troublesome in a way that the developing tooth buds and the roots of erupting teeth may be damaged, making them a selective choice of treatment in mixed dentition phase. They are also presumed to have lower biomechanical strength.[4] The development and use of bioresorbable material such as polylactic (PLA), polyglycolic (PGA) and polydioxanone acid plates has transformed the way and view point of pediatric fracture treatment, as they are biocompatible in nature with complete degradation within 12-14 months after the completion of bone healing through hydrolysis.

MANDIBULAR FRACTURES

The management of mandibular fractures in young children offers numerous remarkable challenges for the oral surgeon. The fractures are likely along the line of unerupted teeth, frequently irregular, long and oblique fracture line.[11]

Treatment of mandibular fracture depends on the fracture site and the stage of skeletal and mental development. Mostly condylar fractures are treated with supportive care (observation, soft diet, physiotherapy, long span of postoperative follow up). A short period of MMF (<2 weeks) with guiding elastics (<8 weeks) after MMF release is suggested in case of malocclusion. Postoperative physiotherapy (passive jaw exercise) is advised for an extended period of time.[8,9] Furthermore, open reduction avoids MMF, improving the functional outcome. Fractures associated with alveolar process may be treated by open or closed reduction followed by immobilization for 2-3 weeks (via splints and arch bar), rarely indicated for 2 months preventing malocclusion. Displaced mandibular fractures can be alternatively immobilized using splint fixed to teeth, to the mandible with circum-mandibular wiring (Gunning splint), or a splint with MMF.[8]

ZYGOMATIC COMPLEX FRACTURES

The zygomatic complex fracture has the occurrence incidence of 7%-

41% in pediatric patients. Undisplaced fracture without any functional deficits (diplopia, sensory defects) and greenstick fracture may be treated by observation.[37] For displaced fracture, comminuted fracture, in cases of esthetic and functional impairment open reduction and internal fixation is indicated.[8] Various complications encountered are enophthalmos, facial asymmetry, paresthesia (in the distribution of the infraorbital nerve), orbital floor defects with entrapment of orbital soft tissues with or without limitation of eye movement.[5] Fracture lines in children can be accessed via the lateral upper eyelid incision (for frontozygomatic suture), lower eyelid, infra-ciliary or trans-conjunctival incision (for infraorbital rim, orbital floor), trans-oral buccal sulcus approach (for zygomatic buttress). Intraoral and Giles temporal approach are effective for the displaced zygomatic arch fracture. Zygomatic arch fractures are commonly stable without fixation. It is approached via coronal approach in Le Fort 3 fractures. Concerns regarding growth disturbances subsequent to zygomatic fracture are fewer in literature. One point fixation at the frontozygomatic suture is sufficient, due to the shorter lever arm forces from the frontozygomatic suture to the infraorbital rim.[8]

ORBITAL FRACTURES, FRONTAL BONE FRACTURES AND FRONTO-NASO-ETHMOIDAL FRACTURES

Fronto-orbital injuries have a varying degree of incidence (2.9% - 35%). Isolated orbital injury has an incidence of about 10-13%, with the involvement of floor fracture (25-58%), roof fracture (18-35%), medial wall (5-28%). Although, the site of injury is age specific. Orbital roof fracture occurs below age 7 (due to the underdeveloped sinuses), whereas the involvement of roof, floor, medial and lateral walls can be seen above age 7 in conjunction with frontal sinus fracture. Undisplaced or minimally displaced orbital roof fracture, without impairment of extraocular movement are observed (for neurosurgical consultation). ORIF is indicated in case of displaced fracture with hindrance of extraocular movements/ intracranial injury, indicating bitemporal flap.[12]

NASO-ORBITAL-ETHMOIDAL FRACTURES

They are rare in children (1-8%). Although considered difficult to treat in children, it is possibly most deforming in the growing patient. Resorbable fixation is acceptable in a case of naso-orbital-ethmoidal fracture to avoid second surgical procedure, preventing its migration and growth restriction.[12] Migration of the hardware has been reported in the growing patients. In case of traumatic telecanthus, anatomic repositioning and careful handling of soft tissue is important because canthopexy may cause abnormal child appearance. The canthal ligament should be reattached in a more posterior and superior position. The treatment is acceptable to begin in 4 days.[12]

LE FORT FRACTURES

Open reduction and internal fixation is a choice for the treatment of displaced midface fractures, using plates and screws (when the damage to the tooth buds and erupting teeth can be prevented).[7] Various incisions can be incorporated for the needful, comprising of coronal, infra-ciliary, trans-conjunctival, intraoral incisions. It is recommended to stabilize the fractured fragment via inter-maxillary fixation and suspension from zygomatic arches or from piriform aperture for 2-3 weeks.

NASAL FRACTURES

Young children encounters nasal fractures (1%-45%). Nasal fractures are diagnosed over the two factors such as physical examination and the history. It can be difficult to diagnose a nasal fracture in children due to difficulty in physical examination (intranasal diagnosis with a speculum), edema may mask deviation of the nasal dorsum.[8] Careful anatomic reduction of nasal bones, lateral nasal cartilages, osseous and cartilaginous septum are to be attended strictly. Reduction of the displaced fracture segment to its anatomical form must be done in 7 days.[8]

CONCLUSION

It is anticipated that the pediatric growth is a complex, integrated process consisting of multiple morphologic forces, with simultaneous interaction of displacement and remodeling displaying bone as a liquid medium. This medium permits the placement of rigid fixation with minimal consequences. Though, placement of fixed, non-resorbable plating system in the immature and growing craniomaxillofacial skeleton of children has sparkled much of a debate. Despite its limitations of use in mandibular fracture cases, it has favorable outcomes when open reduction and internal fixation is the treatment of choice.

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