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What are the Differences in Pediatric Mandible Fractures?

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Introduction

Although lower jaw fractures in the pediatric population are uncommon relatively to the adult age range, mandibular fractures are the most frequently seen in pediatric maxillofacial trauma [1]. The rare occurrence of jaw-area fractures in children is due to the anatomical advantages such as mandibular flexibility, shortness of condyls and non-prominent jaw tip. Besides, children especially younger than 5 years are more protected from trauma by their family. Over the age of five, there is an increase in the frequency of mandibular fractures. School start period and participation in social activities are the main reasons of this rise [2].

The mechanisms of injury vary from series to series, such as motor vehicle accidents, falls, and sports-related injuries contributing significantly [3]. The pediatric mandibular condyle fractures are the most frequently encountered with the rate of 55% in terms of localization. This is followed by the parasymphysis, corpus, and angular fractures, respectively [4]. Considering the histological parameters such as the calcium-water ratio and the medullary-cortical bone ratio in the bone structure of the child, we can say that the mandibula is more resistant to trauma than the adult population in terms of elasticity and stability. Whereas, investigation of other traumas such as the cranial, vertebrae, etc. accompanying to mandibular fracture should not be neglected in the pediatric population because of the possibility of high- energy trauma as pointed below.

Diagnosis: The diagnosis of mandibular fractures in children can be difficult compared to adult patients due to lack of coordination. For this reason, anamnesis and physical examination are very important during the approach to the fractured mandible. Firstly, complete anamnesis taken from relatives of the patient, and if possible, from the patient, can guide an examiner in terms of accompanying pathologies, life-threatening conditions and treatment management.

Significant asymmetry during the examination, swelling and ecchymoses in the preauricular region can give hints about a location of the fracture and the diagnosis. A deviation, malocclusion and limited mobility may be seen when opening and closing the mouth in the jaw examination. Muscle spasm and pain resulting from mandibular fracture may be encountered with trismus. Following maxillofacial sensory and motor examination, exophthalmia, rhinorrhea, otorea possibly caused by intracranial pathologies and other bone damage findings such as diplopia, infraorbital rim step sign, periorbital ecchymosis and edema should be evaluated without omission. Although X-ray is the first applied examination among the radiological imaging techniques to support the diagnosis, computerized tomography is more valuable in terms of reflecting a localization of the fracture, presence of the displaced fracture and relation of the fracture with other anatomical contiguities in three dimensions. As the most common fracture localization in pediatric patients, the disruption in the 'golf club' appearance of the condyle in computerized tomography imaging is highly diagnostic [5-7].

Treatment: It is crucial to determine the urgency situations and provide appropriate interventions, if necessary, before the primary treatment of maxillofacial trauma. Especially, after the bilateral corpus and parasymphysis fractures of the mandible, airway obstruction can be encountered due to backward dislocation of broken bone segment. Therefore, providing airway safety by applying endotracheal intubation or tracheostomy procedures is a priority in possible airway obstruction conditions. Although the treatment of pediatric mandibular fractures is different from adults due to anatomic factors such as facial and dental development, restoration of mandibular functions with minimal morbidity is the main goal in both age groups by providing anatomic reduction and stabilization of the fractured bone segments.

Closed reduction techniques such as interdental wiring, application of arch bars and intermaxillary fixation and open reduction with internal fixation are the methods of fixation [8,9]. Rigid internal fixation following the anatomic reduction of adult mandibular fractures is almost always expected while fractures in children can be healed without functional loss by conservative methods such as close observation, soft diet, analgesics, and activity precautions [10,11].

Closed reduction: The indications for closed reduction include 1) no displaced favorable fractures, 2) conditions where open reduction is best avoided due to the risk of injuring tooth buds, 3) condyle fractures, except in cases of

bilateral condyle fractures, where closed treatment alone can result in loss of mandibular height [12,13].

Today, as a standard maxillomandibular fixation method, Erich arch bars are applied to the interdental areas with the help of circular dental tether. 12 However, since this method is usually to be tolerated almost over the age of 9 years, closed reduction technique is preferred according to age range and tooth development status. Before age 2 years, an acrylic splint may be useful to help immobilize the fracture with the addition of circummandibular wires. The splint may be fixated through either the piriform aperture or a paramedian palatal drill hole to immobilize the jaw. The use of occlusal splints is a versatile technique that can be used for a wide range of ages [14,15].

During intermaxillary screw fixation, care must be taken not to damage the root of the tooth in pediatric population. This treatment method is usually applied in cases where arch bar cannot be applied and temporary stabilization is required during open reduction surgery.

Open reduction: Indications for formal ORIF for pediatric mandible trauma are rare, and include complex, multipart fractures of the tooth-bearing regions of mandible, fracture-dislocations of condyle with dislocation into middle cranial fossa, and bilateral condylar fractures with an anterior open bite malocclusion that cannot be reduced and immobilized with MMF alone. One of the issues to be considered in this technique is the placement of the plaque and the screw in the region near the lower rim, which is the most reliable region of the mandible, considering the potential of damaging the root of the tooth.

Titanium plaques are generally used in the case of madibula fractures, however using absorbable plaque and screws can be an advantage in pediatric patients. These materials provide temporary rigid fixation for bone healing to occur and degrade over time as the reconstructed bone regains strength. These characteristics prove particularly ideal for the pediatric population, in which bone growth and turnover creates potential problems for nonresorbable, permanent plates. Variable chemical compositions of these plates attempt to balance an expedient degradation process while minimizing local foreign-body inflammatory reactions. Typically their strength holds for 4 to 6 weeks while the complete degradation process may take 1 to 2 years. Titanium miniplates are still widely used despite the possible benefits of resorbable plates. Titanium plates demonstrate good long-term biocompatibility, have favorable physical properties, can be easily manipulated intraoperatively to treat the fracture, and have the benefit of several decades of predictable use in facial fracture fixation [16,17].

Complications: Generally, fewer complications are encountered after treatment of pediatric mandibular fractures than in the adult population. Besides the application of conservative treatment and closed reduction frequently, favourable pediatric wound healing and a treatment response level than adults' are also the reasons of minimal complication ratio in pediatric patients.

The main complications in the postoperative period are; infection, malunion, nonunion, malocclusion, facial asymmetry, mandibular growth disturbance, permanent tooth loss, temporomandibuler joint dysfunction/ankylosis [18].

Removal of fragmented bone fragments and foreign bodies and debridement of non-vascularized tissues during operation will reduce the occurrence of infection. Furthermore, it is important to remove the totally damaged teeth after trauma, especially in children to prevent an abscess formation. In addition, obtaining broad spectrum antibiotics should not be neglected in these patients.

Patients who exhibit persistent malocclusion after unilateral or bilateral condylar fractures that have been treated with MMF can often further be treated nonsurgically; however, some type of functional therapy is recommended to address the abnormal occlusal relationship. This functional therapy can be as simple as elastics in conjunction with orthodontic appliances or occlusal splints, or it may require a formal functional appliance, which are placed by orthodontists. In growing children, over a period of time, a functional appliance can correct a malocclusion caused by a condylar fracture and help correct abnormal mandibular function.

Complications such as malunion and nonunion usually occur due to factors such as inadequate reduction during surgery, failure to achieve stabilization, or failure to apply a healthy fixation. In case of significant maloclusion or nonunion, open reduction and internal fixation should be performed by secondary surgical operation.

Abnormal growth results in facial asymmetry and deviation of the chin, and may not become apparent for several years. The cause of the actual growth disturbances remains unclear, as different outcomes occur with similar fractures. It is possible that certain children may have lost growth stimuli or suffers from decreased regional vascularity, resulting in growth restriction. Maintaining appropriate range of motion at the TMJ is important in maintaining proper mandibular growth, as well as avoiding ankylosis and TMJ dysfunction. In all cases, restoring facial symmetry is a very difficult challenge in these patients, and may require additional interventions that may range from fat grafting, to orthodontics, to combined orthodontic-orthognathic surgery approaches.

Conclusion

As a result, mandibular fractures in pediatric patients are relatively common; however the incidence is much lower than in the adult population. In the approach to pediatric mandibular fractures, conventional treatment and closed reduction techniques are held in the frontal plane. In case of need open reduction can be performed and it is important to consider the patient's age, tooth and jaw development and anatomical structure.

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