

MacLennan splint as a treatment modality in pediatric mandibular fractures - A case report

Indu M. Varkey^{1,*}, Pooja Kurup², Kiran Ghule³, Uma Dixit⁴

¹Lecturer, ²PG Student, ⁴Professor & HOD, Dept. of Pedodontics & Preventive Medicine, DY Patil University, Nerul, Navi Mumbai

***Corresponding Author:**

Email: indu.varkey@dypatil.edu

Abstract

Mandibular fractures are amongst one of the most common facial fractures in children. Growth centers in the mandible along with the smaller size of jaws and numerous tooth buds present in them can complicate treatment in pediatric patients. Thus a conservative management protocol of closed reduction with functional therapies is the treatment of choice for most undisplaced pediatric mandibular fractures. This article discusses the management of symphysis fracture along with right condylar head and left subcondylar fracture in a 5 year old child. The reduction of fracture, construction and fixation of MacLennan splint with circum mandibular wiring was done under general anesthesia. This splint limited the discomfort and morbidity and served the purpose of reduction of fracture.

Keywords: MacLennan splint, Mandibular fracture, Trauma

Introduction

Facial trauma can leave an everlasting impact on the esthetics, and therefore psychological well being of the child. Most common etiological factors for facial trauma are fall from height (64%), road traffic accidents (22%) and sports related accidents (9%).⁽¹⁾ Children are more susceptible to craniofacial trauma because of their higher cranial mass to body ratio. Cranial volume: Facial volume changes from 8:1 to 2.5:11, from birth till completion of growth. Thus the frequency of facial fractures in children is less than 15% of those in the adult population. This can also be attributed to the presence of thicker layer of adipose tissue covering the elastic bones, more flexibility at the suture lines, presence of tooth buds and the scarcity of sinus pneumatization.⁽²⁾

Mandibular fractures are amongst the most common facial fractures in children with incidence ranging from 0.6% to 1.2%.⁽¹⁾ Based on age, less than 1% fractures occur below the age of 5 and upto 8% in children younger than 12 years. The angle, condyle and subcondylar region comprise 80% of mandibular fractures in pediatric patients, the remaining 15-20% are symphysis and parasymphysis fractures.⁽²⁾

Active bone growth centers present in the mandible are important for a lifetime maintenance of form and function. These growth centers along with the smaller size of jaws and numerous tooth buds present in them can complicate treatment in pediatric patients.⁽³⁾ Thus on-time management of the injury is mandatory for a successful outcome. Closed reduction with functional therapies is the treatment of choice for most undisplaced pediatric mandibular fractures.

The purpose of this article is to showcase the management of symphysis fracture along with right condylar head and left subcondylar fracture in a 5 year old child using a MacLennan splint with circum

mandibular wiring to restore function with minimum complications.

Case Report

A 5 year old female patient reported to the Department of Pedodontics and Preventive Dentistry, D.Y. Patil University - School of Dentistry, Nerul, Navi Mumbai, 24 hours after an injury to the oral and perioral region after a fall from the first floor. Parents reported bleeding from the nose and chin immediately after injury. Patient was taken to a local dentist, who placed sutures on the chin. There was no history of loss of consciousness, vomiting or convulsions. At the time of reporting to the department, the patient complained of spontaneous pain in the chin region with difficulty in speech and mastication.

On extra oral examination, abrasions were noticed on the forehead and nose with sutures in the chin region.(Fig. 1) A facial edema was appreciated in the lower part of the face. The temporomandibular joint was bilaterally tender on palpation.



Fig. 1

On intra oral inspection, a complete primary dentition with avulsion of the maxillary central incisors and left lateral incisor was observed. The contralateral lateral incisor had a grade 3 mobility.(Fig. 2) A step defect was seen between the mandibular central incisors with derangement of occlusion, mobility of fractured segments and restricted mouth opening. Tenderness could be elicited along the lower border of the mandible in the anterior region.



Fig. 2

Haematological parameters such as blood count, bleeding and clotting time were normal at the time of examination. An orthopantomograph and computed tomographic findings (Fig. 3) revealed symphysis fracture along with right condylar head and left subcondylar fracture. Informed consent was obtained from the parents prior to the start of treatment. An attempt was made to obtain impressions of the maxillary and mandibular arches, but failed as the patient was highly uncooperative. Hence a definitive treatment was planned under general anesthesia to reduce the mandibular symphysis fracture.

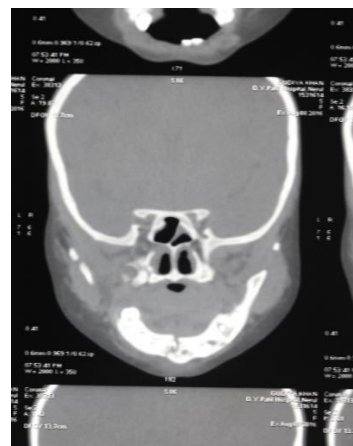


Fig. 3

After required pre anesthetic consent, a nasotracheal intubation was performed followed by extra and intraoral preparation with povidine iodine. Impressions of both maxilla and mandible were made using fast setting vinyl polysiloxane impression material. Working models were poured using fast setting stone. Fracture site was marked on the mandibular cast which was then split into two segments using a saw along the fracture line. After mock surgery, the fragments were held in their reduced positions using wax and checked against the maxillary arch for proper occlusion. A Mac Lennan splint was fabricated with cold cure acrylic on the altered and sealed mandibular cast. The splint was checked for an appropriate fit and proper occlusion intraorally, after which it was finished, polished and kept in an antibacterial solution.(Fig. 4)





Fig. 4

Digital pressure was used to reduce the fracture. Mandible was then stabilized with the Mac Lennan splint and circummandibular wiring. Stab incisions were made distal to the mandibular canines bilaterally. A mandibular bone awl was passed through the incision, guided along the lower border of the mandible and taken out lingually. Next the wire was tied in, guided along the lower border of the mandible and passed into the buccal sulcus. Wire was held around the mandible and splint to stabilize the reduced fracture segments.(Fig. 5)



Fig. 5

Post-insertion, the patient was advised to avoid physical activity, to be on a soft diet along with antibiotic and analgesic medications. Patient was also advised supervised brushing, rinsing after every meal and oral irrigation using chlorhexidine. The splint was removed after 4 weeks. Healing and function were favorable at follow up expect for an ulcer in the lower anterior region for which an anesthetic gel was prescribed.

Discussion

Pediatric maxillofacial fractures are uncommon. In young children (less than 5 years), cranial injuries are more common than midface and mandibular fractures because the face is in a more retruded position as compared to the protective skull.⁽⁴⁾ Incidence of pediatric facial fractures amongst Indians was 5.5% in 1988 which increased to 11% in 2007.⁽⁵⁾ Elasticity of bones and short condylar neck are contributory factors to resist fracture, but higher tooth to bone ratio in a developing mandible can predispose it to fracture.⁽⁶⁾

Various factors need to be taken into consideration when treating a pediatric patient including age,

compliance, anatomy of the fracture site, stage of growth and development and its potential to change, complexity of the injury, any associated complications, time elapsed since injury and treatment approach being contemplated.^(7,8,9) However, pediatric patients have an advantage of faster ability to heal in lesser time with minimal complications because of the increased vascularity of the facial tissues. Also growth potential and increased adaptability favor repair of damaged orofacial tissues and restore the same to function. But the presence of multiple tooth buds in the mandibular body and growth centers at the mandibular condyle are a concern when treating pediatric patients.⁽²⁾ A loose anchorage system due to attrition of deciduous teeth with physiological resorption of roots, unstable partially erupted secondary teeth and precarious dental stability in the mixed dentition stage further complicate treatment in a pediatric patient.⁽⁴⁾

Thus, our aim was to restore the underlying bony structure to its pre-injury position as non-invasively as possible with minimal impairment. Clinical features of a fractured mandible in a child and adult are similar: pain, swelling, trismus, derangement of occlusion, sublingual ecchymosis, step deformity, midline shift, bleeding, TMJ problems, loss of sensation and movement restriction.⁽¹⁰⁾ It must also be noted that a pediatric patient with craniofacial trauma is more difficult to examine as they are uncooperative due to fear.

Imaging techniques are of much value in children. A panoramic radiograph may not be sufficiently conclusive due to poorly developed sinuses, presence of tooth buds and an underdeveloped cortex obscuring fracture lines. A computed tomography (CT) scan can be considered as gold standard as it improves diagnostic accuracy.⁽¹¹⁾

In pediatric patients, depending on the type of fracture and stage of skeletal and dental development, the treatment modalities range from conservative, non invasive through closed reduction and immobilization to open reduction with internal fixation.

Mandibular fractures without displacement are supervised by close observation, soft diet, medication and avoidance of physical activity. Displaced mandibular fractures are to be reduced and immobilized.⁽¹²⁾

Monomandibular fixation for symphysis injury is the treatment of choice in young patients. Thus a cap

splint (MacLennan splint) was used to treat our patient. A cap splint was preferred for the following reasons: it covers both buccal and lingual cortical plates and holds them securely, occlusion is open, function is unimpaired, functional stresses increase remodeling, ease of application and removal, ease of fabrication, ease of checking occlusion after reduction and cost effectiveness.^(2,8,11) The height of contour in primary dentition is lower as compared to the permanent dentition which implies that the vertical height of the mandible is shorter.⁽⁷⁾ This warrants circummandibular wiring for acrylic support which was followed in our case. Increased elasticity of bone, thin and less dense mandibular cortex and the presence of tooth buds further sustain the use of circummandibular wiring.⁽¹³⁾ Care was taken to reduce the fracture to as close as possible to original position and the splint was removed in 4 weeks. A high metabolic rate and high osteogenic potential of the periosteum speeds up the reparative process resulting in early union of fractured segments. Slight occlusal discrepancies resolve spontaneously with bone remodeling and as succedaneous teeth erupt.^(2,7)

Highly vascularized pediatric condyle and its thin neck are poorly resistant to the impact of forces during a fall. Thus the chances of a condylar fracture are higher and the possibility of adverse growth defects following a condylar injury should be considered when planning treatment.⁽¹²⁾ Interincisal opening, dental age, occlusion and pain must be assessed rather than location and degree of displacement of condylar fractures.⁽¹⁴⁾ Most fractures of the condyle are treated with observation or closed reduction.⁽¹²⁾ Same protocol was followed in this case.

Complications in pediatric patients are highly unlikely due to higher osteogenic potential and faster healing rate. Damage to permanent tooth bud,⁽⁴⁾ and non-union of fracture segments due to metabolic disturbances, poor patient compliance and generalized disease state can occur occasionally.⁽¹³⁾

A long term follow up is needed to ensure that teeth in the line of fracture are not deformed or damaged, developing follicle is intact and absence of infection in the fracture site to protect the odontogenic cells in the dental follicle.⁽⁴⁾

Conclusion

Fractures in children are less common than in adult patients. The causes and presentation of fractures vary with age. Thus a thorough knowledge of the manifestations is a key for a good outcome. A systematic method of investigation and age appropriate treatment protocol are mandatory. Majority of pediatric facial fractures can be managed conservatively and this should be the goal considering the anatomical complexity of the developing mandible.

References

1. Agarwal RM, Yeluri R, Singh C, Chaudhry K, Munshi AK. Management of Pediatric Mandibular fracture: A case series. *Compend Contin Educ Dent* 2014;35(8):578-582.
2. Patankar AP, Patankar AS, Suman G, Singh V, Bhosale A. Lateral Compression Open Cap Splint (Mac Lennan) A treatment Modality for Pediatric Mandibular Parasymphysis Fracture Case Report. *Journal of Oral Medicine, Oral Surgery, Oral Pathology and Oral Radiology* 2016;2(2):102-104.
3. Binahmed A, Sansalone C, Garbedian J, Sandor GK. The lingual splint: an often forgotten method for fixating pediatric mandibular fractures. *Journal of Canadian Dental Association* 2007;73:521-524.
4. John B, Reena R., Stalin A., Elango I. Management of mandibular body fractures in pediatric patients: A case report with review of Literature. *Contemp Clin Dent* 2010;1(4):291-296.
5. Chirag S., Macwan, Anshula N. Unfolding the hidden facts of Pediatric Maxillofacial Trauma. *J Clin Diagn Res* 2014;8(11):ZE01-ZE02.
6. Rowe NL, Williams JL. *Maxillofacial Injuries*. New York(NY): Longman (Churchill Livingstone):1985.
7. Adlakha V, Bansal V, Chandna P, Agarwal A. Mandibular fracture in an 18 month old child. *Indian Journal of Dental Research* 2011;22(5):723-725.
8. Jain P, Yeluri R, Gupta S, Lumbini P. Management of Pediatric Mandibular Parasymphyeal fracture with acrylic closed cap splint: A case Report. *Annals of Dental Specialty* 2015;3(1):45-47.
9. Mittal HC, Pathak C, Yadav S. Management of mandibular body fracture in a young child. *Journal of Pediatric Dentistry* 2016;4(1):29-32.
10. Balakrishnan R., Ebenezer V. Management of Mandibular Body Fractures in Pediatric Patients. *Biomedical & Pharmacology Journal* 2015;8:369-373.
11. Khairwa A, Bhat M, Sharma A, Sharma R. Management of Symphysis and Parasymphysis Mandibular fractures in children treated with MacLennan splint: Stability and Early results. *International Journal of Clinical Pediatric Dentistry* 2015;8(2):127-132.
12. Zimmermann C.E, Troulis M.J, Kaban L.B. Pediatric facial fractures: recent advances in prevention, diagnosis and management. *Int J. Oral Maxillofac. Surg.* 2006;35:2-13.
13. Agnihotri A, Agnihotri D, Dwivedi D, Dwivedi V. Management of Pediatric Mandibular Fracture using acrylic cap splint & Cap splint & circummandibular wiring-A report of 12 cases. *International Journal of Orthopaedics, Traumatology and Surgical Sciences* 2015;1(1):16-19.
14. Sharma S et al. Pediatric Mandibular fractures: A Review 2009;2(2):1-5.