European Journal of Molecular & Clinical Medicine

ISSN 2515-8260 Volume 07, Issue 11, 2020

ROLE OF CAP SPLINTS IN THE MANAGEMENT OF PAEDIATRIC MANDIBULAR FRACTURES- A CASE SERIES

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ABSTRACT:
Introduction- ***Management of paediatric maxillofacial injuries is different and mainly depends upon the psychological, physiological, developmental, and anatomical characteristics of children. Mandibular fractures in children have variable etiologies and there are various treatment modalities to treat symphysis/parasymphysis fractures, which have their own complications and limitations.***
Method- These case series describe open cap splint with circum mandibular wiring as treatment modality intreating 20 paediatric parasymphysis/symphysis mandibular fractures .
Results- The splints were removed after 3 weeks. The patients had no complaints, and radiographsrevealed healed fractures.
Conclusion- The clinical outcomes in the following case seriesrecommends the management of mandibular fractures in paediatric patients using acrylic cap splints with circummandibular wiring.
Key words:Cap splints,healed fractures

INTRODUCTION

Little thought to consequences, an impulsive nature, hyperactivity, assaults, abuses, falls and road traffic accidents make children the most unfortunate victims of facial bone fractures. Incidence of paediatric facial fractures range from 1-14%for children under the age of 16 years and .8 to 1% for those younger than 5 years**(1,2).** Incidence of facial fractures among

indian children is 5.5%. Mandibular fractures are the most common facial skeletal injury in paediatric trauma patients (56%), the dento alveolar fractures being the most frequent (60%)**(3,4)**Symphysis and parasymphysis fractures in children account for 15 to 20% and body fractures are rare**(5).** Predilection for trauma is twice in males as compared to females, because of the male gender being more aggressive**(6).** Also the patterns of fractures change with increasing age. According to Mc Graw and Cole, the trauma shifted from upper to lower part of the face**(7)**

Most paediatric mandibular fractures are undisplaced because of the resiliency of the mandible and the presence of tooth buds that act as small anchors to keep the unit together**(8).** The approach to treatment of paediatric fractures differ from the fracture treatment of the adult mandible, in that a conservative management is advocated for most cases. Techniques for treatment have to be modified to cater to the stage of anatomy, physiology and psychology of the child at the time of trauma**(9).** Therefore the treatment of choice is closed reduction unless the fracture segments are in severely displaced condition**(10)**. Although a lot of techniques have been proposed in treating the fractured paediatric mandible like staples, modified orthodontic brackets, tape muzzles, the use of occlusal cap splints has been a preferred and a versatile technique. The following case series reviews the evaluation, triage and treatment of symphysis or parasymphysis fractures in paediatric mandible. It stresses upon the role of acrylic cap splints stabilised with circum mandibular wiring in the management of these fractures.

CASE HISTORIES

20 patients between the age of 5 to 12 years reported to the department of paediatric dentistry from the year 2017 to 2020**(Figure 1).**These children presented with fractures of mandible at symphysis, parasymphysis or body region. Out of 20 cases that reported . 11 were displaced and other 9 were undisplaced fractures. In 5 patients sedation was employed and the remaining were operated under general anaesthesia depending upon the level of co-operation of the child and extent of the injury. Clinical and radiographic examination with detailed case histories and haematological investigations were performed for every patient**(Figure 2 through Figure 7)**. Clinical examination included extra oral examination which revealed the presence of swelling on the fracture site, pain, trismus in undisplaced fracture and step deformity and malocclusion in case of displaced fracture. Intra oral exam was also performed to check for loose teeth, lacerations or embedded bony fragments. Radiographic exam included screening with orthopantomogram. Additional labs included CT scans for displaced fractures and chest x rays to rule out disease before intubation under general anesthesia. After complete evaluation, the diagnosis of the type of fracture was achieved and plan of treatment was formulated for each patient.

CONSTRUCTION OF THE SPLINT

Before the surgery, upper and lower alginate impressions were taken for all cases after administration of local anaesthesia. For cases of undisplaced fractures, after the stone casts were poured, an acrylic splint was constructed on it with cold cure acrylic and secured with a 19 guage wire on the distal surface of the last erupted molar to achieve retention. Occlusal surfaces were left open and lingual and buccal flanges were prepared on the cast**(Figure 8a and Figure 9)**

In case of displaced fractures, wherein there was a step deformity seen in the mandible and in the stone cast **(Figure 8b),** the cast was split with a disc at the fracture site**.** After the mock surgery, the segments of the cast were brought in normal alignment and the pre injury occlusion was established with the inlay wax. An open cap splint was then fabricated on the

new formed cast as opposed to the cap splint construction on the undisplaced cast, where no repositioning of the fractured segments was required.

PROCEDURE UNDER GENERAL ANAESTHESIA

All the patients were treated with circum mandibular wiring under GA**(11).** Local anaesthetic solution (2% lignocaine with 1:80,000 adrenaline) was administered in the submandibular regions extra orally at the point where the bone awl was to be inserted. The bone awl was then guided along the body of the mandible and entered lingually piercing the mucosa. Once the awl tip was seen, a 26 guage wire was secured to its head. It was then withdrawn till its tip reached the inferior border of the mandible and then passed along the buccal side into the sulcus. Same procedure was repeated on the other side of the mandible and wires held in position**(Figure 10, 11 and 12)**

In case of displaced fractures, the mandibular arch was first reduced manually with bi digital pressure, taking occlusion as guidance. Circum mandibular wiring was then performed for these cases in the standardised way described above. Cap splints were secured intra orally and wires wound over it to secure it over the mandibular arch.Howeverfor displaced fracture cases, an improvisation was done of splitting the cap splint over the fracture site. A hole was drilled in either side of the split flange with wires passed through these holes. The wires from the holes were wound with each other to achieve additional reduction and stabilisation of displaced segments**(Figure13, 14 and 15)**

An OPG was then taken post operatively for all patients to ascertain the position of the wires and to check the reduction of fracture in case of displaced fractures**(Figure16, 17).**Post operative instructions included avoiding physical activity, a soft diet and antibacterial mouthwashes in children above 6 years of age. Antibiotic treatment was instituted for five days. Patients were recalled every week for post operative monitoring and on the fourth week, the circum mandibular wires and the splint were removed. An OPG taken thereafter showed a good healing of the fracture site. There was no mobility present and a satisfactory occlusion was achieved.

DISCUSSION

The incidence of face fractures is low in children than in adults and represents 1-14% of the fractures of face in general population**(12).** The low incidence of fractures in children as compared to adults is attributed to small volume of face relative to cranium, resiliency of paediatric bones and higher cancellous to cortical bone ratio**(13).**Approximately 40% of the paediatric fractures involve the mandible. Fractures in children are most common in condylar regions (55%), followed by angle (27%) and body regions (8%).

The management of mandibular fractures in children is different from that in adults because of anatomical considerations, accelerated healing, level of co operation and the growth potential**(11).** Bone fragments can unite, as early as 4 days in children and it is difficult to reduce fractures by the 7^{th} day. So it becomes imperative to reduce fractures in children as early as possible and also for shorter duration of time. Excellent bone remodelling occurs even if bone surfaces are in imperfect apposition and fibrous union or non union rarely occurs in children**(14).**However, immobilisation time should be minimised else there are chances for hampering the condyle growth and causing ankylosis.

Most paediatric fractures are green stick or non displaced, observation alone or conservative closed reduction is the commonly recommended management**(15)**. Intermaxillary fixation with arch bars is also a method for closed reduction for mandibular fractures**(13)** . However it is not a feasible treatment because primary teeth present with a loose anchorage system of resorbed roots and attrited teeth. Questionable dental stability is the characteristic of mixed dentition period.**(16)** . The conical shape of the primary teeth challenges the placement of

IMF devices predisposing them to avulsion**(17).** Another significant drawback of IMF is that it restricts the normal dietary intake which results in weightloss and reduced tidal volumes, and there is risk of aspiration of gastric contents,should the patient vomit. The wires can cause soft tissue as well as periodontal injury**(18)**

When the mandibular fractures are substantially displaced, open reduction and internal fixation with miniplates is the preferred treatment. This technique provides three dimensional stability and primary bone healing. However , this technique remains controversial due to therapy related risks in paediatrc population. This treatment can damage the developing tooth germs which may disturb the normal growth and development of the mandible in a growing child. It may create artifacts on CT or MRI scans or show through the thin skin of the child or cause late infection. Therefore the decision to employ IMF should be taken only if reduction and fixation is not attainable with other methods**(1)** .

Newer development of resorbable osteosynthesis plates with open reduction and fixation are being used because they provide sufficient stability for an accelerated healing. Also as they are radiolucent, they do not interfere with the diagnostic techniques. They will eventually degrade and resorb from the body and thus do not require secondary operates to remove the implant**(19)**. Howeverthis procedure is not cost effective and there have been reports of resorption of bone adjacent to the plate**(20)**

CONCLUSION

The anatomical complexity of the developing paediatric mandible and teeth and the concerns regarding the biocompatibility of the implanted hardware mandates the use of techniques which are different from those used in adults.This technique is the most conservative and effective management for treating paediatric mandibular fracturesat our centre, the advantages being its cost effectiveness, reduced operation time, ease of application and removal, minimal trauma for the growing mandible and the developing tooth buds of the permanent successorsas well as a potential healing. However periodic follow up is essential for mandibular trauma in paediatric population for the early determination of possible growth disturbances.

ISSN 2515-8260 Volume 07, Issue 11, 2020

Cases	Age/Sex	OPD No	Type of Fracture	Cause	Displaced/ Nondisplaced	Treatment Performed
Case 1	5/M	66869	Para symphysis	Fall	Nondisplaced	Splint (CW)
Case 2	6/M	65384	Para symphysis	Road traffic Accident	Displaced	Splint (CW)
Case 3	7/M	56257	Para symphysis	Road Traffic Accident	Nondisplaced	Splint (CW)
Case 4	5/F	50354	Para symphysis	Assault/Abuse	Nondisplaced	Splint (CW)
Case 5	11/M	29823	Body	Assault/Abuse	Displaced	Splint (CW)
Case 6	9/F	61005	Symphysis	Fall	Nondisplaced	Splint (CW)
Case 7	7/F	38965	Condylar Para symphysis	Sports injury	Displaced	Splint (CW)
Case 8	8/F	89226	Symphysis	Fall	Displaced	Splint (CW)
Case 9	6/M	67819	Symphysis	Fall	Nondisplaced	Splint (CW)
Case 10	7/F	51089	Body	Assault/Abuse	Displaced	Splint (CW)
Case 11	9/M	41218	Para symphysis	Sports Injury	Nondisplaced	Splint (CW)
Case 12	11/M	10325	Condylar Para symphysis	Fall	Displaced	Splint (CW)
Case 13	8/M	22263	Body	Road traffic accident	Displaced	Splint (CW)
Case 14	7/M	35009	Symphysis	Fall	Nondisplaced	Splint (CW)
Case 15	9/M	60192	Body	Sports injury	Displaced	Splint (CW)
Case 16	10/F	63295	Para symphysis	Fall	Nondisplaced	Splint (CW)
Case 17	6/F	41217	Symphysis	Fall	Displaced	Splint (CW)
Case 18	9/M	75310	Para symphysis	Sports injury	Displaced	Splint (CW)
Case 19	12/M	75409	Body	Assault /Abuse	Nondisplaced	Splint (CW)
Case 20	9/F	58605	Body	Sports Injury	Displaced	Splint (CW)

Figure 1- Detailed description of cases

Figure 2- Preoperative photographs of one of the patients in the case series who suffered undisplaced fracture of the mandible in the parasymphysis region

Figure 3-Preoperative photographs of one of the patients in the case series who suffered a displaced fracture of the mandible in the parasymphysis region.

Figure 4- Intra oral view of the patient in the case series, with undisplaced fracture segments and a luxated primary tooth

Figure 5- Intra oral view of the patient in the case series with displaced fracture segments of the mandible.

Figure 6- Preoperative orthopantomogram showing a non displaced fracture of the parasymphysis of the mandible (Case 1)

Figure 7- Preoperative orthopantomogram showing a displaced fracture of the parasymphysis of the mandible (Case 2)

Figure 8a, 8b- Example of preoperative casts showing a non displaced arch and a displaced arch

Figure 9- Fabrication of the open cap acrylic splint

Figure 10 through Figure 15- Procedure of circum mandibular wiring under general anaesthesia

Figure 10

Figure 11

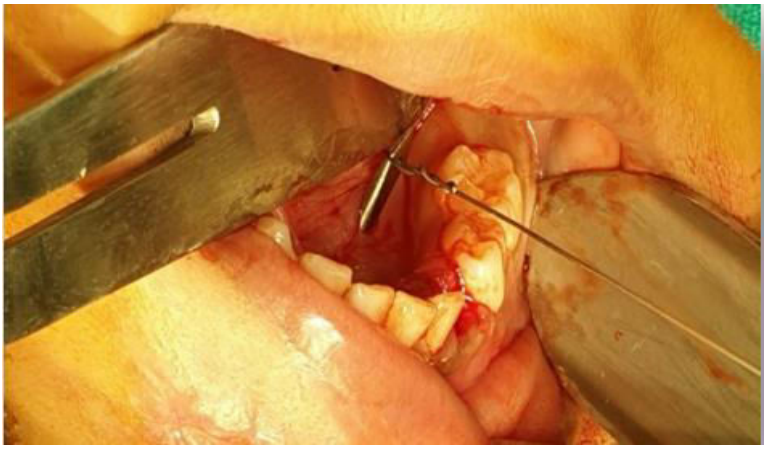

Figure 12

Figure 13-A hole was drilled in either side of the split flange

ISSN 2515-8260 Volume 07, Issue 11, 2020

Figure 14- Wires from the holes wound with each other to achieve additional reduction and stabilisation of displaced segments

Figure 15- Cap splint secured in place

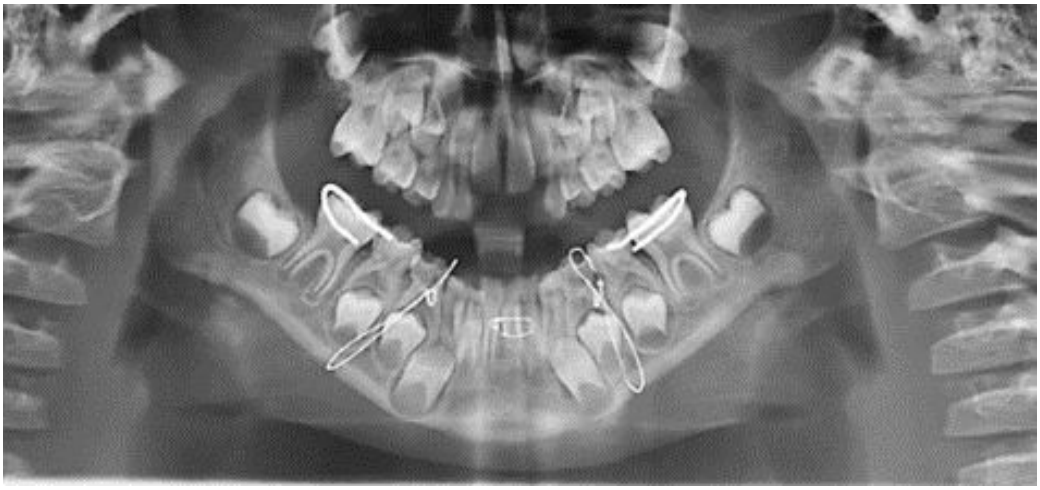

Figure 16- Post operative OPG for case 1- Undispaced fracture

Figure 17- Post operative OPG for case 2- displaced fracture

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