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VACUUM FORMED SPLINTS: EASING THE MANAGEMENT OF DENTO-ALVEOLAR FRACTURES

Dental Science

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ABSTRACT

Dento-alveolar injuries in children include an array of entities that range from severe injuries to the tooth and supporting structures to fracture of the entire bone. This article presents two case reports of parasymphyseal fracture in a 5 and 8 year old patients with a review on the various available treatment modalities.

KEYWORDS

Dento-alveolar injuries, Vaccum formed closed cap splint.

Introduction

Dento-facial injuries grow conjointly with the development of children due to the inclination of children to explore new ideas and indulge in various physical activities. Facial injuries are said to be less common in children before 5 years of age but have an alarming rate thereafter[1]. Common factors considered responsible for such fractures are falls (64%), traffic (22%) and sports related accidents (9%)[2].Of all the fractures mandible is considered more prone to maxilla[3]. Treatment for such traumatic injuries requires orientation towards the difference in adult and pediatric morphology.

The management of mandibular fractures in mixed dentition period is made strenuous by the presence of tooth buds however the nested tooth buds are also known to cohesively hold the two fragments together[4]. The treatment modalities must be cautiously undertaken as it may severely affect the growth and development of mandible. Thus the aim of the treatment is to restore the lost architecture to the pre-injury position which is greatly puzzled as the growth of the mandible is dynamic and constantly changing with growth and development.

Various treatment modalities available for the treatment of these dentoalveolar injuries. Broadly they can be categorised as open and closed reduction. Closed reduction is generally preffered in children as it gives commendable results due to the high osteogenic potential of the developing bone[5].

Thus the present article emphasizes on the preponderance of conservative management in children and presents two case reports of a parasymphyseal fracture treated by a vaccum formed closed cap splint.

Case Report 1

A 5 year old boy (Figure 1a) reported to the department of Pedodontics and Preventive Dentistry with a history of fall while playing due to which he sustained injury to his lower jaw. The patient was conscious, well oriented and had no history of convulsions or vomiting. He presented with diffused swelling and erythema on the left side of face. Step deformity could be elicited in the left para-symphyseal region corresponding to the canine region intraorally.

Intra oral examination revealed restricted mouth opening with a severely lacerated wound between the left primary lateral incisor and canine associated with bleeding and mobility of the fractured segments (Figure1b). The primary left lateral incisor was completely luxated with the derangement of occlusion. Orthopantomogram revealed a uniform linear radiolucency running from the alveolus upto the inferior border of mandible involving the tooth bud of the permanent canine (Figure 1c).

Fig 1 a- Swelling and erythema on the left side of chin, 1b- Intra-oral lacerated wound with gaping and step deformity, 1c- Pre-treatment OPG

Management

Under local anaesthesia upper and lower alginate impressions were made and stone casts poured. The casts were then occluded to check for the occlusal discrepancy. The fractured site was marked on the mandibular cast and it was split into two segments using an electric saw(Figure 2a). The two segments were then stabilized using sticky wax into proper occlusion[6] (Figure 2b). A vacuum formed closed cap splint was then fabricated from thermoplastic clear foil 1.5mm thick and 125mm in diameter[6]. The material was heated according to the manufacturer's specifications for 50 sec at 220^{0}C at a pressure of 6.2 bar using the biostar vacuum forming machine (Scheu-Dental , Postfach 7562 58613 Iserlohn, germany) . The cervical undercut was enhanced on the cast to aid in the retention of the cap splint. It was then appropriately trimmed and cemented into the patient's mouth using type 1 GIC (Figure 2c). The approximation of the fractured segments and restoration of the contour of the lower border of mandible was confirmed by orthopantamogram. (Figure 3a).

The patient was administered Tetanus Toxoid and was put on analgesics and antibiotics for 5 days. He was advised to take soft diet and was followed up weekly for 4 weeks.

The splint was removed by the end of 4 weeks. On clinical examination occlusion was stable (Figure 3b), no mobility of the fractured segments was elicited and also the luxated lateral incisor was secured and steady in its position. Orthopantamogram confirmed the healing of fracture site, stable occlusion and continuity of lower border of mandible (Figure 3c).

Fig 2 a- Pre-treatment cast split into two segments as per the fracture line; 2b- Segments re-arranged in proper occlusion; 2c- Fabricated splint in situ

Fig 3 a- Immediate post-operative OPG; 3b- 4 weeks post-operative OPG; 3c- Stable occlusion after 4 weeks

Case Report 2

A 8 year old boy (Figure 4a) reported to the department of Pedodontics and Preventive Dentistry with a history of fall into the well while playing due to which he sustained injury to his lower jaw. The patient was conscious, well oriented and had no history of convulsions or vomiting. He presented with diffused swelling and erythema on both the left and right side of face. Step deformity could be elicited in the para-symphyseal region corresponding to the canine region intraorally.

Intra oral examination revealed restricted mouth opening with a laceration and step deformity between the permanent lateral incisor and primary canine on the left side and in the region of the primary canine on the right side associated with bleeding and mobility of the fractured segments (Figure4b).The permanent left canine that was erupting lingually was in the line of fracture and was completely luxated. Orthopantomogram revealed a uniform linear radiolucency running from the alveolus upto the inferior border of mandible on both the right and the left side. (Figure 4c).

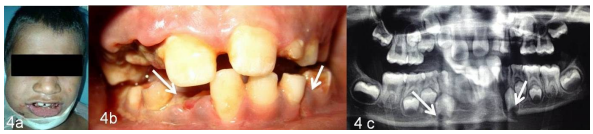

Fig 4 a- Swelling and erythema on the left and right side of chin; 4b- Intra-oral lacerated wound with gaping and step deformity; 4c- Pre-treatment OPG

Management

The procedure was accomplished as described previously. Under local anaesthesia upper and lower alginate impressions were made and stone casts poured. The casts were then occluded to check for the occlusal discrepancy. The fractured sites were marked on the mandibular cast and it was split into three segments using an electric saw(Figure 5a). The three segments were then stabilized using sticky wax into proper occlusion[6] (Figure 5b). A vacuum formed closed cap splint was then fabricated as described previously. It was then appropriately trimmed and cemented into the patient's mouth using type 1 GIC (Figure 5c). The approximation of the fractured segments and restoration of the contour of the lower border of mandible was confirmed by orthopantamogram. (Figure 6a).

The patient was administered Tetanus Toxoid and was put on analgesics and antibiotics for 5 days. He was advised to take soft diet and was followed up weekly for 4 weeks.

The splint was removed by the end of 4 weeks. On clinical examination occlusion was stable (Figure 6b), no mobility of the fractured segments was elicited and also the luxated canine was secured and steady in its position. Orthopantamogram confirmed the healing of fracture site, stable occlusion and continuity of lower border of mandible (Figure 6c).

Further endodontic and orthodontic interventions could not be performed for the patient as the parents were not willing for it.

Fig 5 a- Pre-treatment cast split into three segments as per the fracture line; 5b- Segments re-arranged in proper occlusion; 5c- Fabricated splint in situ

Fig 6 a- Immediate post-operative OPG; 6b- 4 weeks post-operative OPG; 6c- Stable occlusion after 4 weeks

Discussion

Dento-alveolar injuries have always proven to be a great challenge to the clinicians. Apart from causing physical damage such type of injuries have a great impact on the psychological well being of the child and so should be dealt with great care.

There are various school of thoughts regarding the incidence of facial fractures in children. According to some authors the incidence is high due to greater cranial mass to body ratio[7]. However according to some authors the low incidence is attributed to high cancellous to cortical bone ratio, lack of full pneumatisation of sinuses, small volume of facial mass relative to the calvarium, resiliency of the pediatric skeleton and the relatively protected environment in which children live[6]. All these factors combined with limited ability of the clinicians may lead to certain treatment decisions which are entirely different from that in adults and a bit complicated.

The treatment options generally recommended for pediatric fractures include[8] Tape muzzels, circumferential wiring, acrylic splints, open reduction, percutaneous skeletal fixation, resorbable plates, orthodontic resin[9], nickel titanium stapels[10], modified orthodontic brackets, rubber elastics in combination with orthodontic brackets[9] and now recently vaccum formed splints are also being used to overcome the disadvantages of the acrylic splints. Now there are various factors that influence the type of treatment that should be undertaken in children. Generally, surgical intervention is recommended for treatment of jaw fractures but in case of children as ossification of jaws is not complete and there are underlying erupting teeth open reduction may lead to failure of eruption of teeth[9] also anatomical variations like smaller crown size, bulbous shape with a marked cervical constriction make fixation procedures quite complicated[11]. The alveolar bone in case of children is quite pliable due to higher medullary content and hence susceptible to green stick type of fracture.[4] This ensures stability in case of undisplaced fractures as well as at the time of reduction. Non union or fibrous union is also unlikely[4]. On the contrary remodelling is said to occur under the influence of masticatory forces. Hence,closed reduction like simple splinting methods hold relevance in case of children. It is recommended that anatomic reduction in children should be done at the earliest and immobilisation time should be shorter due to greater osteogenic potential and faster healing rates[12].

Vacuum formed splints were used for the reduction of fracture in one case and severe extrusive type of luxation in the other. Favourable results were achieved in both as compared to the cumbersome procedures like fixation of arch bars which do not hold in case of primary dentition and are also not feasible to use after the patient has already gone through such severe trauma. Closed cap vacuum formed splints exactly simulate the occlusal morphology[13] and thus aid in maintaining occlusion along with the stabilisation of the fractured segments which was the main concern while using acrylic type of splints and silver cap splints which only have a historical evidence. The vacuum formed splint comparative to the acrylic splint covers the entire occlusal surface uniformly and to a great extent does not make chewing difficult for the patient. Patient can thus chew semi-solid food too and not just liquids. Moreover the esthetic quotient[14] it carries makes it readily acceptable to young children and their parents. As seen in the present case one of the most important advantage of using vacuum formed splint in case of luxation injuries is that on account of its flexibility, vacuum formed splints allow physiologic tooth mobility that promotes periodontal healing of the luxated tooth[15]. Retention was achieved by mechanical means like closely contoured plastic splints and enhancement of the cervical undercut on the cast. Additional retention was achieved by the chemical bonding of glass ionomer cement. It is said to provide a strength of 1.23 megapascals (MPa) which is greater than zinc phosphates and polycarboxylate cement which was investigated by Wood et al (1996)[13] as the force required to deband first molar orthodontic bands. Other benefits of preferring glass ionomer cement over other cements were its fluoride releasing property.No additional re-enforcement was required like cicum-mandibular wiring or any type of intermaxillary fixation. Thus eliminating extra chair side time involved in the invasive wiring procedure and all the chances of causing any injury to the permanent tooth buds.

Parasymphyseal fracture of the mandible is the case reported in the present study. Inspite of the various factors favouring faster healing in children certain anatomic variations for example absence of stabilizing factors that are provided to the posterior mandible like splinting effects of masseter and medial pterygoid muscles and the inter-digitation of bicuspids and molar teeth greatly affect the treatment outcome[1].

According to the present guidelines on management of Acute Dental Trauma rigid splinting can be used for alveolar fractures for example parasymphyseal fracture for 4 weeks.[16]

CONCLUSION:

Thus the clinical success achieved in the present case of parasymphyseal fracture using vacuum formed closed cap splints signifies that it is an effective and a steady technique. The added advantages of ease of fabrication, less chair side time, compatibility with the surrounding tissues, maintenance of oral hygiene and enhanced patient compliance make it strongly recommendable for the treatment of dento-alveolar injuries in children.

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