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Fabrication of a Surgical Splint in an Emergency Situation: A Clinical Report

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Keywords
Surgical splint; pediatric mandibular fracture; impression; closed reduction.

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The authors deny any conflicts of interest.

Accepted July 1, 2012

doi: 10.1111/j.1532-849X.2012.00939.x

Abstract

Fractures involving pediatric jaws most often require a splint to prevent the fragments from being displaced; however, impression making presents a challenge. This article describes the fabrication of a surgical splint over an ideal cast, which is subsequently refitted with a tissue conditioner onto the patient's jaw. The highlight of this technique is the elimination of an impression procedure, thereby reducing clinical and laboratory time and easing pain in the child.

Fracture of the facial skeleton is uncommon in childhood, as compared to its incidence in adults. This is thought to be due to the relatively smaller size of the face and the elasticity of the bones in a child.[1] Nasal bone fracture is the most common pediatric facial fracture but usually goes underreported, as it is often managed in an outpatient setting.[2] In contrast, mandibular injuries are the most common, accounting for 15% to 80% of all pediatric maxillofacial injuries requiring hospitalization.[3]

It is always a challenge for the prosthodontist to make an impression when there are severe facial injuries, especially when the patient is a child. Many techniques[4] have been described for fabrication of various splints to restore function as well as the anatomic form of the fractured arch. This article describes a novel splint fabrication technique that eliminates the impression making procedure.

Clinical report

A 6-year-old child reported to the Department of Oral and Maxillofacial Surgery, Manipal College of Dental Sciences, Manipal, India, after a fall, down the stairs. On examination, the patient was medically fit and conscious but highly uncooperative.

Clinical evaluation revealed a vertical fracture with an associated medially dislocated mandibular dentoalveolar structure. No other fractures either on face or body were perceived.

Fabrication of splint

The uncooperative behavior of the child negated the making of an impression. To eliminate the impression procedure, an ideal typodont (Frasaco Franz Sachs & Co. Gmbh, Tettnang, Germany) pediatric base corresponding to the 6 to 7 year age group was selected with 6 teeth, including A-E and first permanent molars, fitted on either side of the lower base.

An impression of the lower typodont base was made with alginate (Zelgan Plus Irreversible Hydrocolloid, Dentsply India, Delhi, India), and the cast was poured with die stone (Kalrock Diestone Class IV, Kalabhai, Mumbai, India). A 2-mm-thick wax spacer was applied over the cast, over which a 0.6-mm stainless steel wire (SS Wire, Dentaurum, Ispringen, Germany) was positioned for stabilization and strengthening of the autopolymerizing resin (RR Autopolymerizing Resin, Dentsply India), which was the material chosen for the fabrication of the splint. A splint was then fabricated by molding the resin over the wax spacer (Fig 1). Grooves were made in the canine and molar region of the splint to prevent slippage during

Figure 1 Typodont model and splint before relining.

Figure 2 Prefabricated surgical splint with occlusal details seated in position on mandibular arch for closed reduction.

circumandibular wiring. The finished and polished splint was subsequently disinfected in 2% gluteraldehyde before the child was taken in for surgery.

Surgical procedure

The dislodged segments were repositioned by digital pressure in proper occlusion under general anesthesia. The preformed splint was relined with permanent tissue conditioner (Ufi Gel P, Voco, Cuxhaven, Germany), and the occlusal details of the lower teeth were recorded in the stabilized position of the fractured mandible. The relined splint was then removed from the mouth for trimming of excess material. After final adjustments, the splint was seated in the mouth as a guiding splint for the fractured segment. Circumandibular wiring was carried out around the splint for stabilization of the fractured segments of the mandible (Fig 2). The patient was advised to use 0.2% chlorhexidine gluconate mouthwash regularly to prevent the growth of microorganisms due to the presence of the tissue conditioner. The splint and circumferential wiring were removed after 4 weeks. A clinical and radiographic evaluation after 2 months showed excellent occlusion and healing of the fractured site.

Discussion

Fractures of facial bones are rather uncommon in children aged $\leq$10 years, representing only 2.8% to 14% of all patients with maxillofacial fractures.[5] Falls are a common cause of fractures in children under 11 years of age, while sporting activities are a common cause in children older than 11.

Formulating a treatment plan for pediatric patients with facial trauma necessitates the consideration of various elements, including age of the patient to maximize growth and development, the anatomic site to optimize form and function, complexity of the injury, time elapsed since injury (ideal to treat within 4 days), concomitant injury (fitness for anesthesia and duration of surgery), and the surgical approach (closed vs. open). Most pediatric fractures are nondisplaced or greenstick fractures and observation alone would be adequate.[3] There is almost no indication to open a child's fracture site, as the abundance of developing teeth in the bone makes fixation almost impossible without causing untoward damage to these structures.[6]

Conservative treatment with closed reduction is mainly applied in cases of condylar fractures, which use intermaxillary fixation; fractures of the dentoalveolar process, which are treated with manipulation followed by replacement and immobilization of luxated permanent teeth, whenever needed; and single nasal fractures, which are treated with manipulations and external splinting.[1] Displaced mandibular fractures, however, need to be reduced and immobilized. When tooth buds within the mandible do not allow internal fixation with plates and screws, this could be achieved by circumandibular wiring with a mandibular splint fixed to the teeth or a splint with maxillomandibular fixation.[7]

Bioresorbable plate fixation in pediatric craniofacial surgery, as a means of avoiding the potential and well-documented problems with rigid metal fixation, has been used recently with good results.[8] The use of absorbable plates and screws has nearly no side effects on the growing facial skeleton, but there is still a risk of damaging unerupted teeth during the drilling process.[9]

Monomandibular fixation, by means of an arch bar, acrylic splint, or thermoplastic material, may be the only acceptable alternative in situations such as the edentulous newborn with a mandibular body or symphysis fracture. This technique is particularly helpful for greenstick or minimally displaced fractures when the patient is partially edentulous in the 5- to 12-year age group.

The technique in this article negates the most challenging step of impression making, with or without the use of conscious sedation in pediatric patients. Ideal casts can be used in other age groups by extending the splint to the distal-most teeth bilaterally.

Tissue conditioners were used in this technique, as they helped in filling the space inside the splint, thereby further stabilizing it. They aided in healing with no leakage of irritant such as methylmethacrylate into the oral cavity and less generation of heat. Because of tissue conditioner's viscoelastic properties, it could be easily used in interdental areas or other areas of undercut.[10] This technique also had an added advantage in that it consumed very little laboratory or operating time.

Conclusion

This technique indicates the use of an innovative approach in the fabrication of a surgical splint on ideal casts as a less time-consuming, practical alternative in the treatment of pediatric mandibular fractures. Methods like open reduction or intermaxillary fixation could get in the way of growing permanent tooth buds or could have an adverse effect on the growing temporomandibular joint of a child. The described technique is cost-effective with an ease in application and removal, reduced operating time, maximum stability during the healing period, minimal trauma to adjacent anatomic structures, and comfort for child patients. Long-term follow-up is, however, required for early detection or prevention of any possible growth disturbances in pediatric patients.

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