Case Report

The conservative treatment of pediatric mandibular fracture with prefabricated surgical splint: a case report

Kocabay C, Atac MS, Öner B, Güngör N. The conservative treatment of pediatric mandibular fracture with prefabricated surgical splint: a case report.

Abstract – The use of rigid fixation in children is controversial and may cause growth retardation along cranial suture lines. Intermaxillary fixation for mandibular fractures should be used cautiously as bony ankylosis in the temporomandibular joint (TMJ) and trismus may develop. The high osteogenic potential of the pediatric mandible allows non-surgical management to be successful in younger patients with conservative approaches. In this case, successful conservative treatment of mandibular fracture of a 3-year-old patient is presented.

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Pediatric maxillofacial fractures are not common and they can require different clinical treatment strategies compared with fractures in the adult population and are estimated to occur in 5% of all maxillofacial traumas (1, 2). These fractures are particularly uncommon in children younger than 5 years.

Treatment principles of pediatric mandibular fractures differ from treatment of the adult population in that a conservative approach is advocated in most cases (3).

Open reduction and osteosynthesis of the pediatric fracture with titanium plates and screws are thought to have a negative effect on skeletal growth and unerupted teeth and involve two-stage surgery because of the need for plate removal after complete healing (4).

The use of absorbable plates and screws is less likely to disturb facial skeletal growth but is still associated with the risk of damaging unerupted teeth even when using monocortical screws (5, 6). Because of these obvious risks, closed reduction is advocated in some cases and knowledge of methods to accomplish this is necessary (3).

Growth and development of the maxillofacial structures should be considered to avoid malunion and subsequent deformities (7).

Although preparation and fixation techniques of surgical splints for pediatric maxillofacial fractures help to reduce the operation time in the operating room as well as bringing many surgical advantages for young patients, there is not much knowledge about them in the literature. The purpose of this paper is to present the advantages of a prefabricated surgical splint, which was chosen as a practical and effective conservative treatment approach in a 3-year-old girl with a mandibular dentoalveolar fracture.

Case report

A 3-year-old girl was referred to the department of oral and maxillofacial surgery with a history of falling on the sharp corner of a table 3 days ago. The patient was medically fit and conscious but she was non-cooperative when referred to our clinic. The patient could not be correctly placed in the focal trough of the panoramic X-ray machine

because of the dislocation of the fractured mandibular segments; therefore, the image of the fracture site was distorted. Clinical and radiological examination showed a vertical fracture line between lower incisors associated with medially dislocated left mandibular dentoalveolar structure. No sign of fractured segments on the inferior border of the mandible was seen. There were no other fracture lines on the temporomandibular joint or other bony structures (Fig. 1a,b). Because of the age of the patient a conservative treatment approach was preferred.

Under mild sedation, impressions of both jaws were taken with silicone impression material. The surgical model setup of the mandible was prepared to obtain an accurate occlusal plan for the dislocated dentoalveolar segment (Fig. 2). According to the final occlusal plan, a 0.6 mm orthodontic round wire was prepared around the vestibule and lingual surfaces of the mandibular teeth. Self-curing acrylic was placed to increase the strength of the wire (Fig. 3). The next day, under general anesthesia via nasal intubation, the dislocated segment was replaced by bi-digital pressure with the guidance of the surgical splint (Fig. 4). The fixation of the splint to the dentoalveolar structure was achieved by self-curing acrylic (Fig. 5). After curing, the sharp edges of the acrylic were rounded using drills to avoid soft tissue irritations. The patient was discharged without intermaxillary fixation. The antibiotic treatment was sultamisilin oral suspension

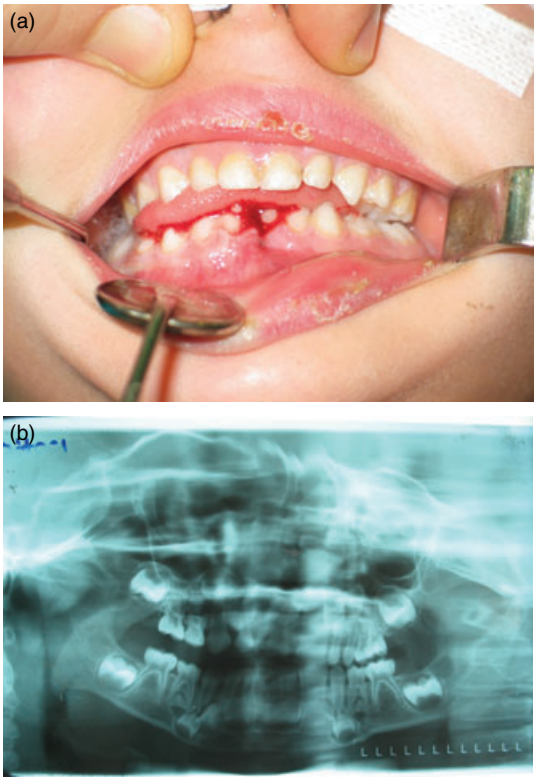

Fig. 1. (a) Preoperative intra-oral appearance of the fracture. (b) Preoperative panoramic X-ray of the patient. Note that there is primary occlusal contact at the left mandibular posterior site as a result of medially dislocated left mandibular dento-alveolar structure.

Fig. 2. Preoperative and surgical model set-up models.

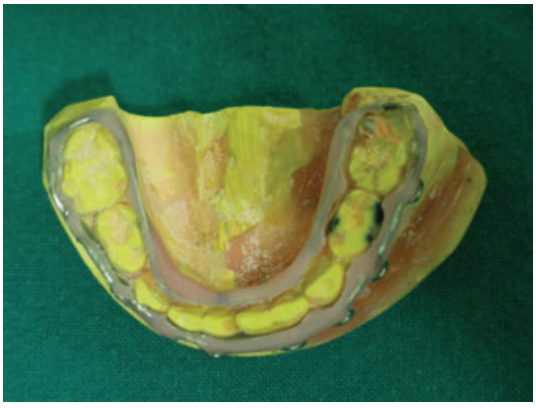

Fig. 3. Prefabricated surgical splint on the model.

Fig. 4. Intraoperative reduction of the segments.

Fig. 5. Intraoperative splint stabilization by self curing acrylic.

(three times a day, 25 mg/kg) (Duocid, Pfizer) and analgesic acetaminophen suspension (three times a day, 250 mg) (Calpol, Glaxo-Wellcome) for 2 weeks. The patient was treated as an out-patient. On postoperative day 17, the splint was removed. No signs of complications were observed during the healing period. The clinical and radiological evaluation after 6 months showed that both centric occlusion and healing at the fracture site were excellent (Fig. 6a,b).

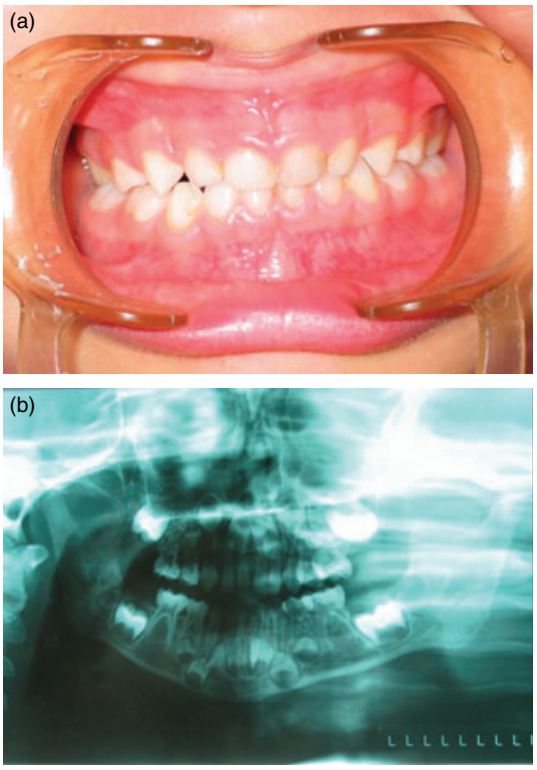

Fig. 6. (a) Occlusal relation of the jaws in postoperative 6 months follow-up. (b) Postoperative sixth month panoramic X-ray of the patient shows the symmetric occlusal relation on both sides of the jaws.

Discussion

The incidence of facial fractures is lower in the pediatric population than in the adult population and represents 1–14.7% of the facial fractures in the general population. The reasons cited for this low incidence include the small volume of facial mass relative to the calvarium, the relative resilience of the pediatric skeleton, and the protected environment in which children live, leading to less exposure to the typical mechanisms of injury (8, 9–13).

Many pediatric fractures are non-displaced or greenstick-type fractures, and observation alone is adequate (8, 10–13). There is almost no indication to open an infant's fracture because the abundance of developing teeth in the bone makes fixation almost impossible without damaging these structures (8, 10, 11, 13). However, with unstable fractures that cannot be secured with closed reduction techniques, open reduction and internal fixation become necessary after the age of 12 years, when dentition has erupted and root formation has matured enough and at which time treatment becomes similar to that performed in the adult population. This implies some subperiosteal dissection, with the potential to interrupt or limit the osteogenic potential of the periosteum (8, 10). Some authors recommend the removal of the hardware in the growing patient once fracture healing is complete (14).

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 (15). The use of absorbable plates and screws have nearly no side effect on growing facial skeleton but there is still the risk of damaging unerupted teeth during the drilling process (3).

The available bone area for inserting screw and plate fixation between vital structures offers a great challenge associated with risk and a conservative approach is therefore of great value when treating pediatric jaw fractures (9). A conservative approach (observation or closed reduction) is the best approach to consider first for mandible fractures. The fractures heal rapidly, and the children function normally (8, 10, 11).

Despite there being a large number of references regarding the etiology and epidemiology of fractures in children, only a few of these studies are focused on the treatment modalities of the fractured components for different cases in childhood.

Surgeons from other disciplines (e.g. ENT or plastic surgeons) usually have limited knowledge about dental materials, so they prefer to use rigid fixation techniques in pediatric patients instead of

prefabricating surgical splints for the mandibular fractures. Growth disturbances of the facial bones and injuries to the unerupted teeth germs and adjacent anatomic structures during drilling process may occur. If intermaxillary fixation technique is preferred, the risk of ankylosis of TMJ and inadequate stability of the bars and wires because of the morphologic structures of the primary teeth should always be considered.

The prefabricated acrylic splint that was fixed to the teeth using self-curing acrylic provided adequate stabilization for the fractured segments that avoided intermaxillar fixation. The application of the splint took only 10 min in the operating room. The patient's comfort during feeding was at the highest level and there was no risk of TMJ ankylosis. The propensity for rapid bone healing in children results in shorter fixation periods compared to adults. In our case, the surgical splint was removed on postoperative day 17 and the final stability of the segments was excellent. The 6 month follow-up showed neither delayed eruption of the teeth nor occlusal disharmony and no sign of TMJ problems.

These clinical outcomes indicate that prefabricated surgical splints for conservative treatment of pediatric mandibular fractures are more reliable than open reduction or intermaxillary fixation techniques with regard to cost-effectiveness, ease of application and removal, reduced operation time, maximum stability during healing period, minimal trauma for adjacent anatomic structures and comfort for young patients. It should be always considered that periodical long-term follow-up is essential in pediatric facial trauma cases for early determination of possible growth disturbances.

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