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OPEN

Three-Dimensional-Printed Splint for Use in Pediatric Mandibular Fracture

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Abstract: Mandibular fractures are the most common type, accounting for about 71% of facial fractures in children. The man-

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dible is the only movable bone in the craniomaxillofacial region. The injury of the mandible has a serious impact on the functions of children's mouth opening, chewing, pronunciation, and occlusion. Therefore, the treatment of children's mandibular fractures is particularly important. Because of the characteristics of children with permanent tooth germ blocking and strong skeletal development, the treatment methods of adults cannot simply be used in children with mandibular fractures. Here, we demonstrate the simple, reliable method using 3-dimensional-printing splint for stability of the fracture segments in pediatric patients.

Key Words: pediatric mandibular fracture; three-dimensional printing, virtual surgical planning

TECHNIQUE

Preoperative Data Acquisition

The younger patients who were diagnosed with symphysis/parasymphysis fracture of mandible were scheduled to undergo computed tomographic (CT) scanning.^{1–4} Preoperative CT scan was acquired with a slice thickness of 1.25 mm using a hospital-based spiral CT scanner.

Virtual Surgical Planning

Preoperative virtual planning and simulation were performed in our clinical group using ProPlan CMF 1.4 software (Materialise, Leuven, Belgium), the surgeon could simulate and reposition the fracture segments anatomically and create a virtual reconstructed mandible model.

Design and Fabrication of Occlusal Splint

After the surgical simulation was finalized, the stereolithography data for the reconstructed mandible model were imported into Geomagic Studio 6.0 software (Raindrop Geomagic, Research Triangle Park, NC). Then, this software was used to design occlusal splint based on the stereolithography file of lower dentition and the occlusal splint was fabricated (Figure 1A) using a 3-dimensional (3D) printer (3D System ProJet3510s, 3D Systems, Rock Hill, SC).

Surgical Procedure

The procedure was performed under general anesthesia. After the nasotracheal intubation, the intraoral vestibular incision was made to expose the fracture line and occlusal splint was fixed on the lower dentition to assist reducing the displaced fractured mandible. Then, the circum mandibular wirings were used to fix the splint in bilateral canine and first molar area (Figure 1B).

DISCUSSION

The virtual surgical planning and 3D-printing technique are gradually in popularity in craniomaxillofacial surgery.^{5,6} This study introduces the 3D-printing splint for use in pediatric mandibular fracture. Our technique has the following key points. First, it is suitable for the patients with a complete primary dentition. Second, the fracture segments should be reduced accurately during virtual surgical simulation. Third, grinding 4 grooves on the splint to retain the wire and prevent slipping. The advantages of our technique can be summarized as follows. First, the preoperative 3D design of the 3D-printing splint can guide the surgical fracture reduction and improve the accuracy of the operation. Second, due to the splint is 3D printed according to the individual dentition of the child, it is more stable than the tradi-

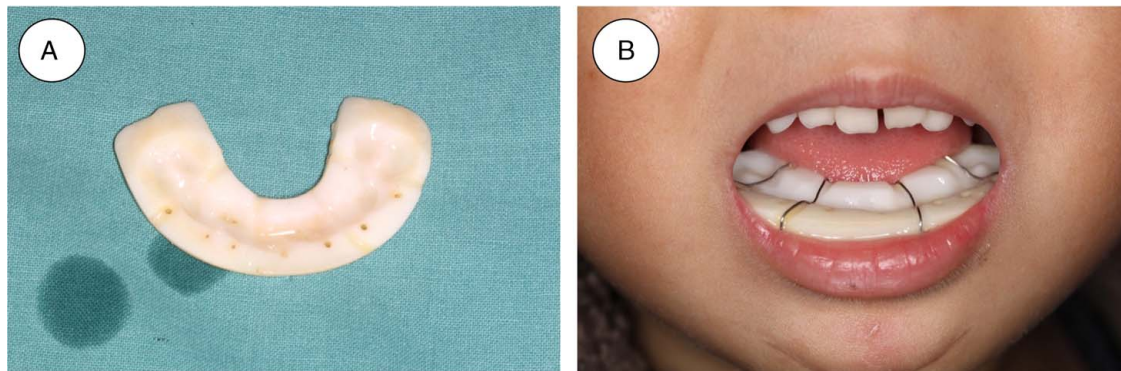


FIGURE 1. (A) The 3D-printing splint; (B) The splint with 4 grooves were fixed on the lower dentition. 3D indicates 3-dimensional.

tional dental arch splint ligation. Moreover, compared with intraoperative impression taking and fabrication of occlusal pads/retainers, it avoids the contamination of the operation area and helps shorten the operation’s time spent, and improves the safety and efficiency of the operation.

In summary, the use of 3D-printing splint assists fracture reduction accurately, avoids contamination of the operation area and reduces the time spent on the operation. This modified technique is safe, efficient, and accurate. Therefore, it is recommended for use in pediatric mandibular fracture.

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Supratentorial Acute Subdural Hematoma During Fully Endoscopic Microvascular Decompression Surgery for Hemifacial Spasm

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Abstract: The endoscope has been widely used in microvascular decompression (MVD), which is the best curative treatment for hemifacial spasm. Supratentorial subdural hematoma (SDH) is rarely happened in MVD. The authors report 2 cases of SDH during full endoscopic MVD. The origin of bleeding is not confirmed during the operation. Rapid and excessive drainage of cerebrospinal fluid and the operation position may result the rupture of bridging veins, which result in the occurrence of SDH. However, there is no clear evidence to explain the clinical symptoms.

Key Words: endoscopy, hemifacial spasm, microvascular decompression, supratentorial acute subdural hematoma

CLINICAL REPORT

We retrospectively reviewed consecutive cases that under fully endoscopic microvascular decompression (E-MVD) for hemifacial spasm (HFS) in our department from December 2019 to April 2021. There were 48 HFS, including 20 male and 28 female patients aged 23 to 66 years (mean age at operation is 47.85 ± 10.63 y).

Auxiliary examination: All patients underwent preoperative magnetic resonance imaging (MRI) scan, including 3-dimensional time of flight (3D-TOF) and fast imaging employing

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