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Craniofacial/Pediatric

Simplified Fabrication of a Lingual Splint for Management of Mandibular Fractures

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Summary: Lingual splints have been used to treat mandibular fractures, particularly in cases of complicated mandibular fractures, and serve as a noninvasive adjunctive procedure for reduction and fixation. Furthermore, when used in conjunction with open reduction and internal fixation, the lingual splint provides feasible external fixation against displacing forces exerted by the robust musculature of the mandible. However, the conventional method for lingual splint fabrication is performed preoperatively, and the procedure is time-consuming. This technical note describes a simplified and efficient technique for the intraoperative manufacture of a lingual splint for mandibular fractures using a thermoplastic material, polycaprolactone. Our results demonstrated satisfactory fixation outcomes, reduced lingual splint fabrication time, and superior cost-effectiveness, offering an alternative option for adjunctive external fixation of mandibular fractures. *(Plast Reconstr Surg Glob Open 2024; 12:e5919; doi: 10.1097/GOX.0000000000005919; Published online 19 June 2024.)*

INTRODUCTION

Lingual splints are commonly used in managing pediatric mandibular fractures to assist in closed reduction and external fixation, thereby obviating the requirement for internal fixation hardware.[1,2] Additionally, in adults, lingual splints serve as a valuable adjunctive procedure for complex mandibular fractures, ensuring stability and occlusion after internal fixation.[2,3]

However, conventional methods for manufacturing lingual splints involve multiple time-consuming steps,[3,4] typically beginning with a preoperative dental impression, followed by the creation and realignment of the mandibular cast, fabrication of the lingual splint, and subsequent mounting onto the mandibular cast. Finally, the lingual splint is intraoperatively affixed using circumdental or circummandibular wires.[3,5]

In this study, we introduced an alternative approach using thermoplastic resin to simplify and streamline the intraoperative manufacturing of lingual splints. This method reduces manufacturing time and facilitates an efficient one-team approach, eliminating the need for preoperative dental impressions, and ensures stable dental occlusions.

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METHODS

Patient Selection

This retrospective case study, conducted between January 2018 and May 2020, was approved by the institutional review board and ethics committee of Kaohsiung Medical University Hospital (KMUHIRB-E-(I)-202300181). The inclusion criteria were (1) major trauma with an injury severity score of 16 or more points, (2) mandibular fractures definitively confirmed by computed tomography scans, and (3) a simplified lingual splint fabrication technique for treating mandibular fractures.

Technique Procedure

Patients with mandibular fractures underwent open reduction and internal fixation (ORIF) under general anesthesia. After reduction, internal fixation was accomplished using titanium plates and screws to ensure optimal dental occlusion. Fabrication of thermoplastic lingual splints commenced after this stage. About 20 g

Disclosure statements are at the end of this article, following the correspondence information.

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of polycaprolactone (PCL) particles were prepared by soaking in water at temperatures ranging from 70°C to 80°C until they became softened and translucent (Fig. 1A and B). The softened PCL was then manually applied to conform to the lingual surfaces of the mandibular teeth under manual pressure (Fig. 1C). To avoid mucosal pressure injury, caution should be taken to ensure that the lingual splint is secured to the lingual surface of the teeth rather than to the oral mucosa. Eight holes were created on a splint using an electric drill (Fig. 1D). The splint was immersed in a Cidex orthophthalaldehyde solution for 10 minutes for sterilization, followed by rinsing with distilled water. Subsequently, the splint was securely affixed to the mandible with four 25-gauge wires that passed through the splint holes from the lingual to the buccal aspect. (**See figure, Supplemental Digital Content 1,** which shows a lingual splint placement. **http://links.lww.com/PRSGO/D308**.) These wires were tightened buccally to verify the approximation of the lingual splint to the mandibular lingual surface. The procedure is illustrated in Video. [**See Video (online)**, which demonstrates the thermoplastic lingual splint.]

Takeaways

Question: The conventional lingual splint fabrication for treating mandible fractures is time-intensive and cannot be executed during surgery after the precise realignment of the fracture.

Findings: We introduce an efficient intraoperative technique using thermoplastic polycaprolactone to create lingual splints, which reduces fabrication time and cost, providing a feasible alternative for external fixation in mandible fractures.

Meaning: Intraoperative fabrication of lingual splints by using thermoplastic polycaprolactone is a reliable and efficient adjunctive fixation for mandible fractures.

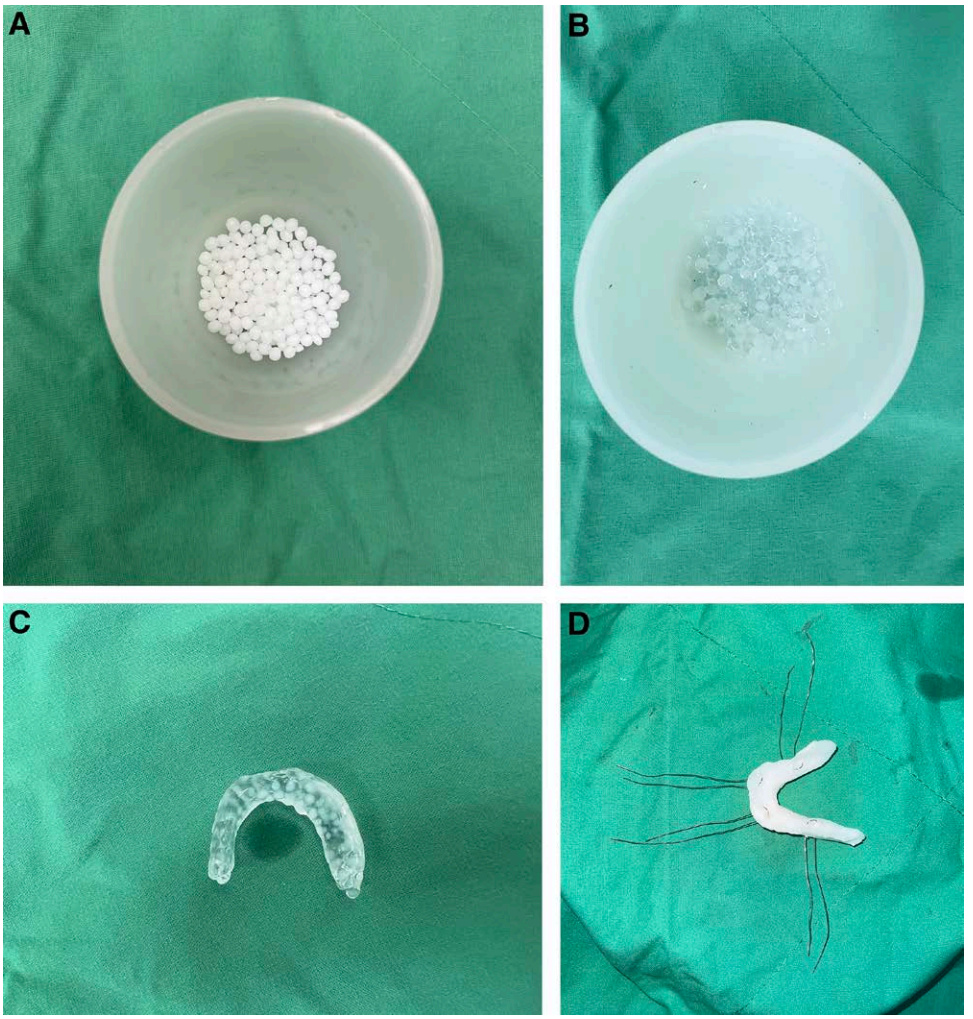

Fig. 1. Fabrication of a lingual splint. A and B, Twenty grams of PCL particles were soaked in water (70–80°C) until they softened and became translucent, ready for molding (B). C, Heated PCL material was intraoperatively applied to the lingual surfaces of the patient's mandibular teeth and mucosa. D, Eight holes were created by an electric drill and with four 24-gauge stainless steel wires for circumdental fixation.

Outcome Evaluation

A single surgeon conducted postoperative assessments during outpatient visits, including physical examinations for wound healing and evaluation of dental occlusions. Panoramic radiographs were taken 1 month after the operation and before lingual splint removal, which occurred 4–6 weeks postoperatively under local anesthesia.

RESULTS

Patient Profiles and Outcomes

Three patients with mandibular fractures treated with adjunctive lingual splints were included in this study. (**See table, Supplemental Digital Content 2**, which shows patient profile and outcomes. **http://links.lww.com/PRSGO/D309**.) All three patients were male, with an average age of 23 years (range, 18–30 y). These patients experienced major trauma, with an average injury severity score of 25 points (range, 19–30 points). The mean operation time was 4 hours and 16 minutes, encompassing mandibular ORIF, lingual splint application, and other associated facial bone reconstructions. The mean follow-up period was 24 months (range, 12–48 mo). During the follow-up period, stable dental occlusion was observed in all cases, with no complications, such as lingual splint-associated mucosal pressure injuries, refractures, or malunion.

DISCUSSION

The use of lingual splints in the treatment of mandibular fractures has declined owing to the widespread adoption of ORIF. Conventional acrylic lingual splint fabrication, which involves impression-taking and splint trimming,[3] is time consuming and limits practicality. However, lingual splints remain vital in pediatric cases.[2,6] They also serve as crucial adjuncts in managing complex mandibular fractures, particularly in patients with major trauma or concurrent severe facial bone fractures. Our simplified technique for lingual splint fabrication reinforces the equilibrium between buccal (via ORIF and/or arch bar) and lingual (via a lingual splint) fixation. This technique prevents mandibular widening caused by masticatory forces during the healing process.[7] Furthermore, it reduces the manufacturing time compared with conventional acrylic lingual splints. This improvement is particularly advantageous for patients with major trauma because it potentially decreases the overall operation duration.

In our cohort of three patients with mandibular fractures, we found that the lingual splint provided adjunctive external fixation for various types of mandibular fractures. It also produces re-enforced fixation in reoperative cases to prevent displacement. Additionally, this method can be applied to adult and teenage patients without significant complications. These results suggest that the simplified thermoplastic lingual splint is a reliable adjunctive fixation for mandibular fractures.

Regarding safety, acrylic resins may release potentially toxic monomers that decrease the viability of human gingival fibroblasts in vitro.[8] In contrast, PCL is inert and biocompatible with the human periodontal tissues.[9] Another drawback of the conventional approach is the limited availability of the requisite material, acrylic resins, which are ubiquitous in prosthetics and orthodontics but less common in stocks for plastic and reconstruction surgery and local hospitals. Thus, achieving optimal results with lingual splint application in patients with mandibular fractures necessitates robust communication and collaboration between dental and craniofacial reconstruction surgeons.

The primary limitation of our technique is the challenge of fixing the thermoplastic lingual splint in edentulous patients, which poses a risk of pressure injury to the oral mucosa.[3] However, no pressure injury was observed in our cohort because the lingual splint was secured on the lingual side of the teeth rather than on the oral mucosa. To verify the effectiveness of thermoplastic lingual splints, inclusion of a broader range of mandibular fracture cases and use of higher-level study designs is essential. In conclusion, the thermoplastic lingual splint is an easy, hands-on, cost-effective, and labor-saving procedure that provides safe and durable external fixation for patients with mandibular fractures.

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DISCLOSURES

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PATIENT CONSENT

Informed consent was obtained from all patients for publication of this case series.

ETHICAL APPROVAL

This study was approved by the institutional review board and ethics committee of Kaohsiung Medical University Hospital (KMUHIRB-E(I)-20230181).

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