

# New Method for Fabrication of Gunning Splint in Orthognathic Surgery for Edentulous Patients

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## Abstract

Treatment planning poses difficulties in edentulous patients for orthognathic surgery prediction and fixation.

Treatment of severe class III malocclusion frequently requires orthognathic surgical procedures. For such patients, orthognathic surgery would be the only option before prosthetic rehabilitation.

This clinical report describes step-by-step fabrication of a surgical splint for an edentulous 22-year-old patient with a severe class III malocclusion.

The patient wound up in class I occlusions and stable prosthodontic rehabilitation. Using splints for planning and guiding the surgery in edentulous patients facilitates accurate positioning of the jaws and saves time in the operating room.

**Key Words:** Occlusal Splint; Gunning Splint; Orthognathic Surgery; Edentulous Patient; Class III Malocclusion

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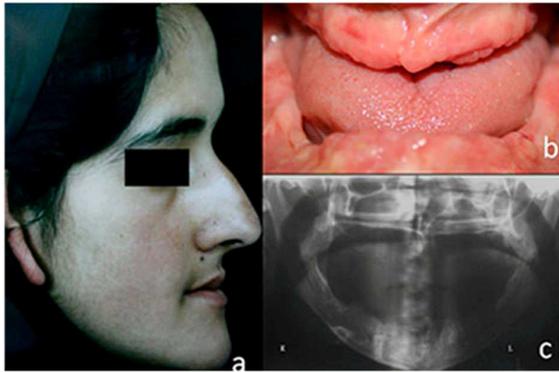
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## INTRODUCTION

There is a group of edentulous and partially edentulous patients in which satisfactory reconstruction cannot be reached by dental rehabilitation alone. To restore function and aesthetic balance, such patients require corrective jaw surgery. Orthognathic surgeries for correction of facial deformities have increased significantly in the recent years [1]. This is in line with the development of many techniques for the correction of increasingly complex congenital and acquired deformities such as Amelo-

genesis Imperfecta [2,3]. This hereditary condition is associated with several dental features including enamel deficiencies, pulpal calcification, taurodontism, root malformations, failed tooth eruption, impaction of permanent teeth, progressive root and crown resorption, congenitally missing teeth and anterior and posterior open bite [4]. If a skeletal problem exists in the maxilla and mandible, surgeons perform combined maxillary (Lefort I) and mandibular ramus surgery during the same operative procedure in a safe and predictable



**Fig 1.** Clinical and radiographic examination of the patient with class III deformity, a. Lateral view of the patient, b. Intraoral frontal view, c. Panoramic view



**Fig 2.** Anterior tooth set-up in class III occlusion

fashion.

This manner is specially indicated in patients with severe class III deformities that have more than 12 mm maxillo-mandibular discrepancy. However, planning for both jaw surgeries requires an increased attention to detail [5,6].

The stability in multiple segmental surgery of the maxilla or mandible is provided by surgical stabilizing splints, such as transverse stability in case the maxilla and/or mandible are expanded or narrowed and occlusal support in case key teeth are missing.

The splints are usually made for patients with several remaining teeth and could be made over the maxillary and/or mandibular arch. If one jaw surgery is planned, only one definitive positioning splint is necessary.

This splint can be fixed to the jaw by means of skeletal fixation screws and left in place for 6 weeks.

In case of rigid fixation, the splint is used only to hold the jaw in its corrected position while the rigid fixation is being applied.

In two-jaw surgeries, there are generally a series of splints that could be used.

This includes an interim splint to set the operated maxilla to the unoperated mandible, and the definitive splint to set the operated mandible to the maxilla in its corrected position [1,5].

However, orthognathic surgeries in edentulous

patients and making surgical splints for them is a challenging procedure. This is because these patients do not have any teeth for preserving vertical dimension. In other words, teeth are essential determinants of the occlusal plane that can be used for prediction and for maxillomandibular fixation during and after surgery [1].

This clinical report presents an edentulous patient affected by AI with class III jaw discrepancy who underwent orthognathic surgery with a precise surgical stent.

## CASE REPORT

An edentulous 22-year-old female was referred from the Oral and Maxillofacial Surgery Department to the Prosthodontics Department at Tehran University of Medical Sciences. The chief complaint was extreme dissatisfaction with appearance, mastication and speech. A detailed medical, dental and social history was obtained.

The medical history and general physical condition were unremarkable. Dental history showed that the patient had hypodontia with some impacted teeth because of Amelogenesis Imperfecta (AI).

All the impacted teeth apart from the mandibular first right premolars due to proximity to the inferior border of the mandible and the consequent fracture risk were surgically removed in the oral and maxillofacial surgery department.



**Fig 3.** The cephalometric radiography with bariumsulfate-coated anterior acrylic teeth

Although clinical and radiographic examination of the patient revealed pseudo long face, malar deficiency, maxillary deficiency, mandibular prognathism, class III deformity and a wide gonial angle (Figure 1). Preliminary impressions were made using irreversible hydrocolloid impression material (Alginoplast, HeraeusKulzer, South Bend, IN) and final impressions were made with zinc oxide eugenol paste (Luralite, Kerr). Maxillary cast was mounted using an arbitrary facebow (Dentatus, Dentatus Ltd., NY) on a semi-adjustable articulator (Dentatus ARH, Dentatus Ltd., NY).

The mandibular cast was connected to the maxilla using a centric relation record. Anterior tooth set-up (Vivotac/Orthotak, Ivoclar Vivadent, Schaan, Liechtenstein) was accomplished on the mounted casts in class III occlusion (Figure 2).

The anterior acrylic teeth were coated with barium sulfate. This made the teeth opaque so that the occlusal plane could be detected in the cephalogram for Epker prediction procedure [7] (Figure 3). After presurgical analysis, the patient was diagnosed as having skeletal man-

dibular prognathism, maxillary retrognathism and an excessive vertical growth pattern. Therefore, to achieve improvement in both form and function, sagittal split ramus osteotomy (SSRO) and Lefort I osteotomy were the selected surgical procedures. Epker prediction procedure was carried out for predicting hard and soft tissue movement and the patient's final profile.

Based on the results of this prediction and some clinical considerations (e.g., zygomatic regions, paranasal area, nasolabial and gonial angles, and SNA, SNB and ANB angles), the surgeon decided to reposition the maxilla about 2.0 mm superiorly and an advancement of about 5.0 mm and to setback the mandible 7.0 mm.

These repositionings were applied on the casts to model surgery.

Then, the posterior teeth were arranged and the dentures were fabricated in new articulation and were remounted for occlusal adjustment. This denture plays the role of a definitive splint for the edentulous patient.

Mandibular cast with dentures were set approximately 7.0 mm forward compared to its original position. So an intermediate splint (IMS) was made with self cure acrylic resin (Meliodent Cold, HeraeusKulzer, Ltd, Newbury, UK) at this position (Figure 4).

Subsequently, the complete denture was finished and polished as the final splint.

Arch bars were bonded to the appliance with multiple holes drilled into the denture bases to accommodate circummandibular wires or palatal screws that would be used to fix these appliances to their respective jaws.

In the surgical procedure, after dissection and maxillary Lefort I osteotomy, the final splint was used and fixed to the jaws (Figure 5). The IMS was put between the final splint and was fixed with wire between arch bars.

Then the maxilla was fixed with screws and miniplates (Synthes, SynthesGmbh, Switzerland).



**Fig 4.** Intermediate splint was made with self cure acrylic resin in the articulator



**Fig 5.** Fixing final splints with screws in the maxilla (a) and circummandibular wiring in the mandible (b)



**Fig 6.** Fixing the final splint with an arch bar for stabilizing the maxilla and the mandible after surgery. An intermediate splint was sited between the two jaws

The surgeon opened the arch bar and performed mandibular sagittal split osteotomy. The final splint was fixed by arch bar (Figure 6) then mandibular fixation was performed in that position by screws. The deficient alveolar ridge in the premaxilla and mandible was augmented by autogenous iliac bone graft harvested during the orthognathic surgery.

## RESULT

The patient reached class I occlusion and a stable prosthodontic rehabilitation. Post surgical cephalometric analysis and clinical evaluation showed improvement in her facial appearance.

## DISCUSSION

There are multiple factors involved in denture stability. For instance, the anteroposterior relationship of the maxilla and mandible affects the stability of denture.

The stability of class I maxillo-mandibular relationship is generally more than those of class II or III. These adverse relationships can be improved by orthognathic surgery [1]. In planning orthognathic surgery for edentulous patients, prosthetic restoration is often a compromise between the ideal restoration for stability and function on one hand and aesthetic and appearance on the other hand. Eventually, the clinicians should trust their evaluation of facial proportions and prediction of postprosthetic rehabilitation.

The appropriate positioning of the maxilla requires clinical evaluation of the zygomatic regions, paranasal area and nasolabial angle. Final determination of the appropriate position of the maxilla and mandible follows the overall examination of the facial profile by the surgeon [1, 8]. Gunning-type splints are a superb fixation device and relatively quick and easy to apply for edentulous patients [1].

Defining the occlusal plane by coating the anterior teeth with barium sulfate made accurate Epker prediction easier on the lateral cephalometric radiograph.

Therefore, the surgeon could determine the amount of movement of each jaw accurately during the surgery and prevent over or under correction or jaw movement during surgery. Consequently, with all these evaluating and preparing phases, esthetic and functional results were more satisfactory, though it was relatively time consuming.

**CONCLUSION**

This clinical report describes the use of surgical splint for orthognathic surgery of an edentulous patient with class III deformity. This article presents the cooperation between prosthodontists and surgeons in all steps of the procedure.

This cooperation plays an important role in achieving ideal results.

Using splints for planning and guiding the surgery in edentulous patients provides accurate positioning of the jaws and saves time in the operating room.

**REFERENCES**

- 1-Fonseca RJ. Oral and Maxillofacial Surgery. Philadelphia: Saunders; 2000.p. 463-82.
- 2- Walker F, Ayoub AF, Moos KF, Barbanel J. Face bow and articulator for planning orthognathic surgery: 1 face bow. Br J Oral Maxillofac Surg. 2008 Oct;46(7):567-72.
- 3-Sharifi A, Jones R, Ayoub A, Moos K, Walker F, Khambay B et al. How accurate is model planning for orthognathic surgery? Int J Oral Maxillofac Surg. 2008 Dec;37(12):1089-93.
- 4- Williams WP, Becker LH. Amelogenesis-imperfecta: functional and esthetic restoration of a severely compromised dentition. Quintessence Int. 2000 Jan;31(6):397-403.
- 5-Nattestad A, Vedtofte P. Pitfalls in orthognathic model surgery. Int J Oral Maxillofac Surg. 1994 Feb;23(1):11-5.
- 6-Koh CH, Chew MT. Predictability of soft tissue profile changes following bimaxillary surgery in skeletal class III Chinese patients. J Oral Maxillofac Surg. 2004 Dec;62(12):1505-9.
- 7-Epker BN, Stella JP, Fish LC. Dentofacial deformities, integrated orthodontic and surgical correction. 2nd ed. St Louis: Mosby; 1995. p. 574-699.
- 8-Liaw YC, Kuang SH, Chen YW, Hung KF, Tsai HC, Kao SY et al. Multimodality treatment for rehabilitation of adult orthodontic patient with complicated dental condition and jaw relation. J Chin Med Assoc.2008 Nov;71(11):594-600.