

CLINICAL REPORT

Restoring masticatory function in a patient with severe microstomia using rapid prototyped mesh and a custom-made hinge and swing-lock prosthesis



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Microstomia is characterized by an abnormally small mouth opening that may severely compromise the patient's appearance, function, and

quality of life.<sup>1</sup> The multiple etiological factors for microstomia may be categorized as diseases, syndromes, surgical, and/or radiotherapy treatments, direct physical trauma to the masticatory muscles or temporomandibular joint, and chemical or electrical burns.<sup>2,3</sup>

In patients with a limited oral opening resulting from trauma, chemical, or electrical burns, postburn contracture causes the tissue around the site to tighten, thus restricting the functional movement of the tissue.<sup>4</sup> The most common cause of the burn is scalding in second-degree facial burns, while electrical burns predominated in patients with third-degree burns.<sup>4</sup> A tar burn may be classified as a prolonged scalding injury because tar sticks to the area and causes burning until it is removed or cooled.

Prosthodontic treatment for patients with microstomia may pertain either to minimizing scarring and stiffening of the tissues or providing a modified prosthesis to accommodate the restricted mouth opening.<sup>5</sup> Early intervention with splinting and prosthesis delivery decreases the need for eventual surgical intervention.<sup>5-7</sup>

ABSTRACT

This clinical report describes the use of rapid prototyped mesh in a complete swing-lock prosthesis to restore masticatory function in an edentulous patient with severe microstomia and perioral scar tissue after an industrial hot tar accident. (J Prosthet Dent 2018;119:887-92)

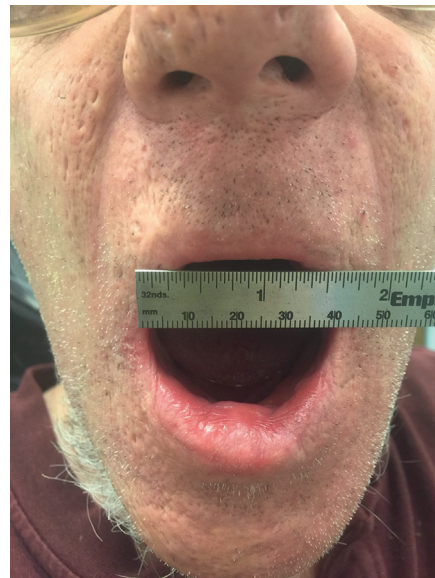


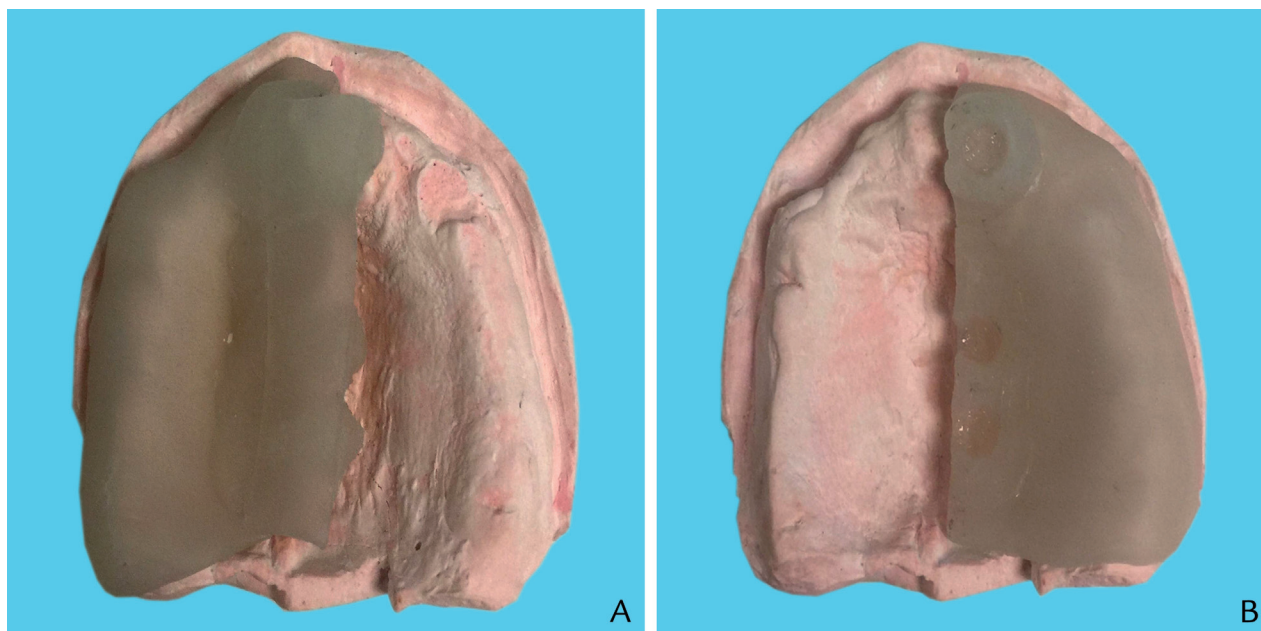
Figure 1. Patient with horizontally and vertically restricted openings.

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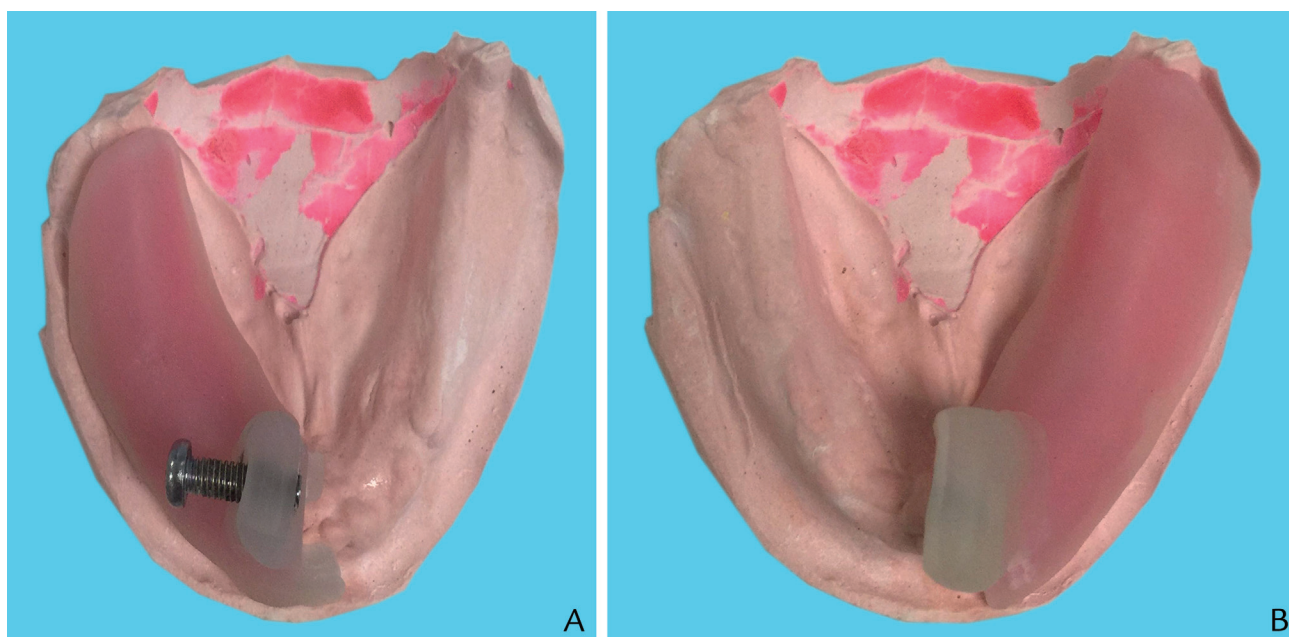
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**Figure 2.** A, Maxillary right sectional impression tray. B, Maxillary left sectional impression tray.

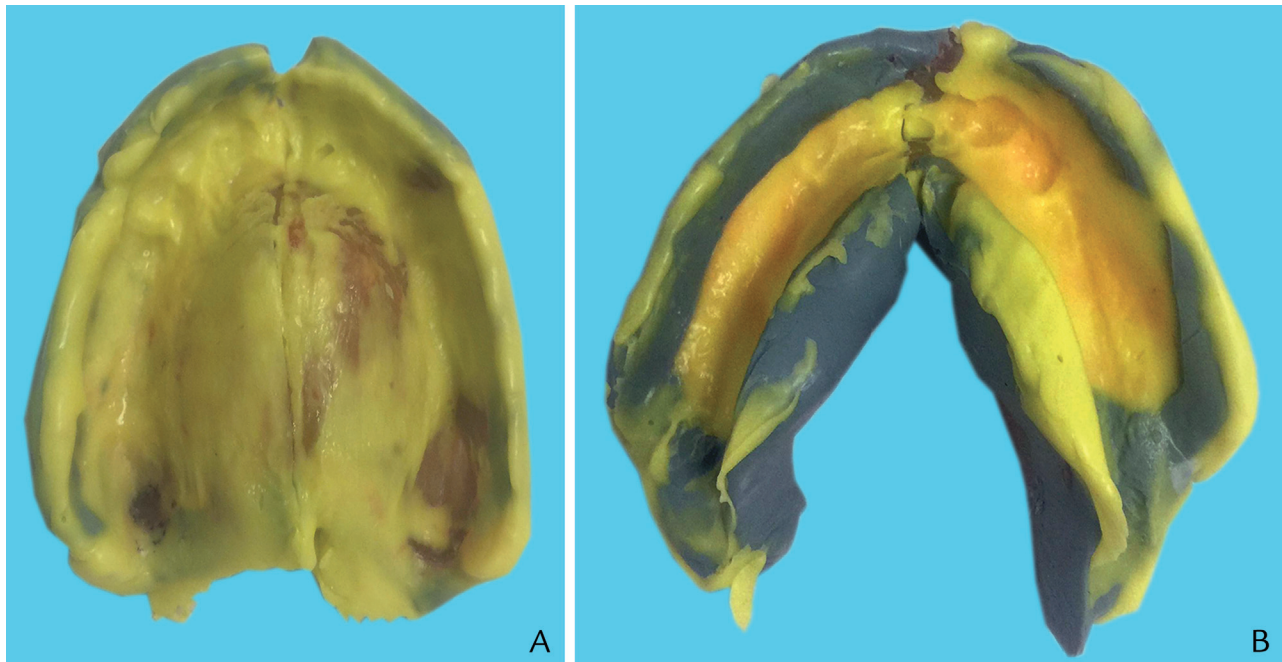


**Figure 3.** A, Mandibular right sectional impression tray. B, Mandibular left sectional impression tray.

Limited mouth opening implies difficulty in accessing the teeth for daily oral health maintenance procedures, which frequently predisposes the individual to caries and ultimately edentulism; it is also an important challenge in the fabrication and use of removable dentures.<sup>2,8-10</sup> The average maximum mouth opening in a normal patient is between 40 and 50 mm between the incisal edges.<sup>11,12</sup> Different techniques of fabricating removable prostheses

for patients with microstomia have focused on sectional impression trays, foldable prostheses, cast magnetic attachment complete dentures, and sectional complete dentures.<sup>13-19</sup> However, these techniques are not straightforward or suitable for a predoctoral student clinic.

This clinical report describes a straightforward technique used to fabricate a mandibular hinged swing-lock



**Figure 4.** Definitive impressions. A, Maxillary. B, Mandibular.

complete prosthesis in a dental school setting. The patient had suffered a hot tar burn during his teenage years.

#### CLINICAL REPORT

A 58-year-old man without contributory medical conditions presented for complete maxillary and mandibular dentures. He had been involved in a hot tar chemical accident in 1976 at the age of 18. The hot tar covered his perioral tissues including his nose and his hands with extensive scarring, severely limiting their elasticity. His oral opening measured 30×37 mm (Fig. 1).

Diagnostic maxillary and mandibular casts were obtained by using pediatric impression trays (Redi-Lok impression tray; Masel) with alginate impression material (Jeltrate Alginate; Dentsply Sirona). Sectional impression trays were fabricated from a light-polymerizing tray material (Triad TruTray Custom Tray Material; Dentsply Sirona) with reference pivots in the maxillary tray and a reference screw in the mandibular sectional tray (Figs. 2, 3). After border molding with heavy-body polyvinyl siloxane material (Imprint 3 Heavy Body; 3M Dental), each section was loaded with light-body polyvinyl siloxane material (Imprint 3 Light Body; 3M Dental) and inserted consecutively after the polymerization of the material in the first increment (Fig. 4). The definitive impressions were beaded and boxed, and a dental stone cast was poured (Microstone; Whip Mix Corp). A mandibular record base with a custom hinge (Fig. 5) and a conventional maxillary record base were made (Triad Denture Base Material; Dentsply Sirona) for intermaxillary relationship records. After the definitive

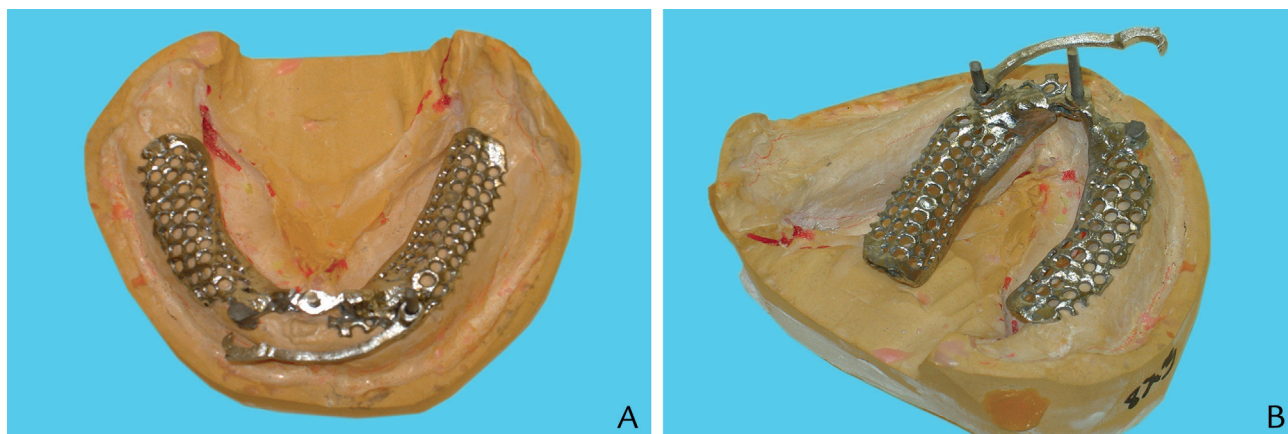


**Figure 5.** Mandibular hinged record base.

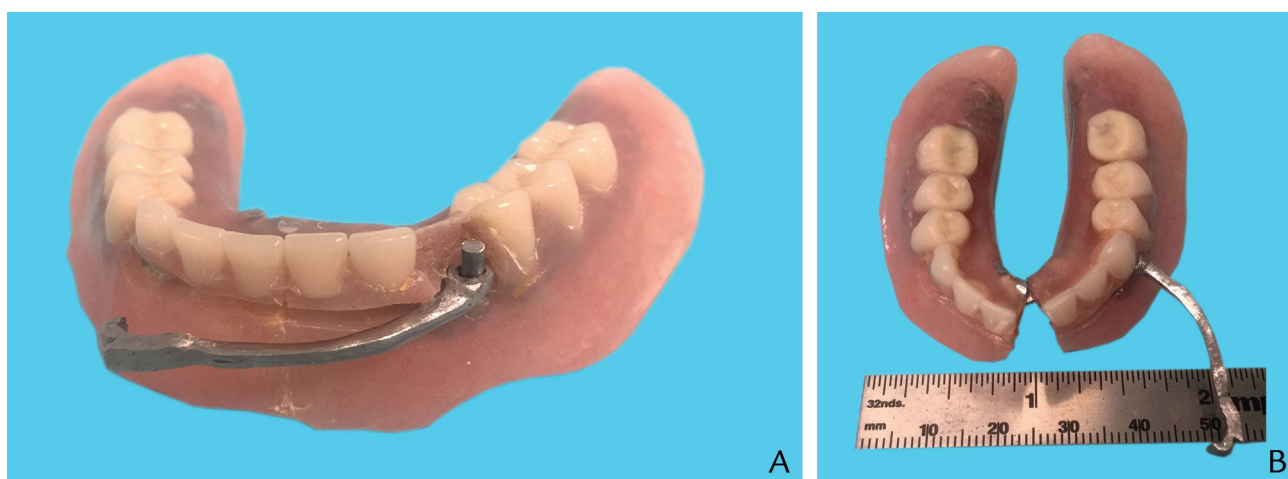
tooth arrangement was clinically evaluated, a polyvinyl siloxane putty index (VP Mix Putty; Henry Schein) was prepared on the tooth arrangement to record the positioning of the artificial teeth on the definitive prosthesis.

A plastic resin pattern of the retentive mesh for the mandibular cast metal framework was fabricated on the scanned and digitized model by using a computer-aided design and computer-aided manufacturing (CAD-CAM)





**Figure 6.** A, Framework after laboratory processing. B, Hinge activated.



**Figure 7.** A, Definitive denture before canine placement. B, Definitive denture after canine placement.

system (Trios 3D; 3Shape). A custom-made pattern of the hinge, swinging arm, and lock was prepared from wax and replaced with pattern resin (Pattern Resin LS; GC America).

The putty mold was then sectioned slightly lingual of the incisal edge to assess the design of the framework. After the best locations of the swinging arm and hinge were determined, the resin prototype of the retentive mesh, the hinge, and the swinging arm were attached with pattern resin (Pattern Resin LS; GC America) and by using a surveyor to provide parallelism between the axes of the hinge and the swinging arm. The framework was then sent to the dental laboratory for casting.

After the cast framework was returned from the laboratory (Fig. 6), the same putty silicone tooth arrangement index was used to arrange the teeth. The denture bases were processed, and the swinging arm and mandibular left canine were replaced (Fig. 7) with auto-polymerizing acrylic resin (Perm Reline and Repair Resin;

Coltène). The interarch relationship and occlusion were verified, and the dentures were delivered.

The patient was recalled at 24 hours, at 1 week, and at 3 months for minor adjustments made to the intaglio surface (Fig. 8).

## DISCUSSION

The threshold between microstomia and a normal mouth opening is defined as an interlabial measurement less than 45 mm and/or an interincisal distance less than 40 mm.<sup>20</sup> Zweifel et al<sup>6</sup> further refined that statement by defining the average vertical mouth opening as 40 to 50 mm, a functional opening as 25 to 35 mm, and a severely limited opening as 10 to 24 mm. However, no definitive description has been presented of the width of mouth opening that should prompt the use of a foldable or sectional denture.

Mouth opening exercises have been described for patients with scleroderma but not for those with facial



**Figure 8.** Patient 3 months after placement. A, Frontal view. B, Lateral view.

burns.<sup>20-22</sup> Clinical research on the efficiency of types of exercises and appliances used long after facial burns is scarce, but exercises may be of value in the treatment of these patients.<sup>20-24</sup>

The use of sectional trays and record bases may be essential to obtaining accurate impressions of a patient with microstomia. An accurate tray and record base is required to consistently obtain the position of the tray and record base related to the reference anatomic structures.<sup>19,25</sup>

While maxillary bone resorbs toward the center of the maxilla, mandibular bone resorbs laterally in posterior areas and lingually in the anterior region. This may allow the fabrication of maxillary dentures with a smaller width. To provide support, however, the buccal flanges of mandibular complete dentures should overlay the bone horizontally at the buccal shelf region, which may extend buccally 10 mm or more from the residual ridge top. These factors explain the presence of several mandibular collapsible or foldable dentures in the literature versus few articles describing techniques for maxillary sectional dentures. The use of implants may allow less extension of the borders, providing comfort and ease of use for patients with microstomia.<sup>26</sup>

## SUMMARY

This report presents an option for treating patients with microstomia requiring a removable prosthesis by a predoctoral clinician (M.H.L.) with the help of an experienced prosthodontist (I.T.). Every part of the prosthesis, including the hinges, swiveling arm, pins, and nut was custom made. The meshwork prototype was fabricated using a rapid prototyping system. The current software

system used has no library of premade forms for hinges, nuts, or locks. Such a library would expand the capabilities of the software system. In the future, all components may be fabricated through rapid prototyping and casting or by using CAD-CAM based on additive manufacturing techniques such as selective laser melting.

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## Noteworthy Abstracts of the Current Literature

### Factors affecting the decision to use cemented or screw-retained fixed implant-supported prostheses: A critical review

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Gómez-Polo M, Ortega R, Gómez-Polo C, Celemin A, Del Rio Highsmith J

**Purpose.** This review aimed to compile and enumerate all the factors described in the literature that may affect the decision to use either cemented or screw-retained restorations and to determine the relative weights of each factor by type of retention and prosthesis.

**Material and methods.** The literature was reviewed, and the factors were classified as either determining (present in a clinical situation in which one of the retention mechanisms was clearly more suitable than the other) or conditioning (present in clinical situations in which one type of restoration was not clearly more advantageous than the other).

**Results.** Three determining factors (esthetic outcome, retention, and biologic risk) and five conditioning factors (passive fit, fracture strength, occlusal area, complications, and retrievability) were identified.

**Conclusions.** Although there is not a clearly better alternative for all clinical situations, determining factors in certain scenarios can render one of the two approaches more recommendable. For esthetic reasons, when the implant angle cannot be corrected to conceal the access hole, cementation is more suitable; however, screw retention is the better option when the occlusal space is under 6 mm or margins cannot be located supra- or equigingivally. In the absence of determining factors, the decision should be based on conditioning factors, which carry different weights depending on the type of prosthesis.

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