

Lightweight Opened Hollow Bulb Obturator Using a Precise Positioning Method of Metal Framework in Patients with Partial Maxillectomy: a Case Report

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Abstract

Successes of using an obturator in rehabilitation for a maxillectomy patient depend on size and location of defect. Large maxillary defects with a few remaining abutments located in a relatively straight line lead to a decrease in support, stability, and retention of prostheses due to unfavorable leverage. To minimize this leverage, weight reduction of a prosthesis should be considered. In this clinical report, a patient with a large hemimaxillectomy defect was rehabilitated with a one-piece opened hollow bulb obturator using a cast metal framework. A special tray with opening access was used for making a functional impression of the defect site to obtain a precise working cast. Afterwards, the cast was modified at the defect site to simulate the contour of normal ridge using a mixture of plaster and pumice in order to properly position the meshwork. These procedures, including the predetermined reduction of acrylic thickness, resulted in a lightweight obturator with improvement of stability, retention, and function.

Keywords: Maxillofacial rehabilitation/ Maxillectomy/ Obturator/ Partial denture

Introduction

Maxillectomy can refer to either partial or total resections of maxilla in patients with benign or malignant neoplasms.¹ A partial maxillectomy, particularly, is bony resection that involves removal of a maxillary portion due to abnormalities or assisting surgeries without crossing a midline. After maxillectomy, surgical reconstruction and prosthetic rehabilitation can offer significant esthetic, functional and psychological improvements to patients.

The selection of either surgery or prosthetics for reconstruction of resected structures depends on numerous factors such as etiology, site, size, and severity of defects.² Although there has recently been an advancement in surgical reconstruction, it may be contraindicated in certain cases due to age, general health conditions, and history of radiotherapy. A prosthetic approach, therefore, is generally used for reconstruction in patients with maxillectomy.

Maxillary defects are commonly restored with an obturator, especially large defects, because of the ease of fabrication and maintenance.⁴ The functions of the obturator prostheses are to preserve remaining oral tissue and enhance esthetics, as well as to help mastication, deglutition, and speech by separating the oral cavity from the oronasal communication.^{3,5} An obturator is larger and heavier than a normal denture, since the weight of nasal extension exerts dislodging and rotational forces on abutment teeth.⁶ Hence, fabrication of an obturator with minimal weight and adequate superiolateral extension to a lateral wall of a defect are the main objectives of prosthetic rehabilitation.⁷ Furthermore, to minimize the leverage on the supporting tissue, a decrease in the weight of prosthesis is also the most important factor.⁸⁻¹⁰

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The aim of this article is to present a case of prosthetic rehabilitation using an opened hollow bulb obturator with a precise positioning method of metal framework in a patient who received partial maxillectomy.

Case report

Patient history

A 74-year-old male patient presented to the Maxillofacial Prosthetic Clinic, Faculty of Dentistry, Mahidol University (Bangkok, Thailand) for a follow-up of a previous obturator, which was delivered five years ago. The patient's chief complaints were difficulty in chewing and watery leakage into the nasal cavity, secondary to loose and unstable denture. Fourteen years ago the patient was diagnosed with adenocarcinoma of the right maxillary sinus, and a right unilateral maxillectomy was performed followed by external beam postoperative radiotherapy with a total dose of 60 Gy in 30 daily fractions. After the surgery and radiotherapy, the patient had also experienced fibrosis and scar contraction.³

Clinical examination

Extraoral examination showed a scar contracture at the right midface (Figure 1). According to intraoral examination, the patient presented with an Aramany Class I right maxillary defect¹¹ – a midline resection with a long edentulous span on the non-defect side and remaining teeth 26 and 27. The mandibular arch was a partially edentulous Kennedy Class I, modification I with missing teeth 37, 44, and 47. Occlusal attrition on the mesiopalatal cusp of tooth 26 and full metal crown on tooth 36 were the only occlusal contact at MIP (Maximum intercuspation position). The vertical dimension of occlusion (VDO) with an old obturator was lack leading to a small interocclusal space (Figure 2).



Figure 1 Case with a right hemimaxillectomy



Figure 2 Intraoral photos (A) Maxillary occlusal (B) Frontal. (C) Left view

Treatment plan

Treatment plan included a new full metal crown on tooth 36, followed by a definitive hollow bulb obturator with metal framework replacing teeth from 16 to 25, and a lower removable partial denture (RPD) with metal framework replacing teeth 37 and 44. The obturator framework was designed with double embrasure clasp on abutment teeth 26 and 27. The retention was obtained from retentive clasp arms on buccal surfaces of abutments and extension of the obturator bulb on the lateral wall of the defect. Full metal crown on tooth 36

was replaced by a new one with an increased height compared to the previous one, according to the predetermined new VDO in order to have enough space for setting up artificial tooth 37 occluded to teeth 26 and 27 at that increased VDO.

Treatment procedure

Primary impression of upper arch was made, and the special tray was fabricated with light curing resin (Lightplast-platten; Dreve-Dentamid GmbH). The height of the special tray was extended superiorly into the maxillary defect as precisely as obtained in the primary impression. Rest preparations on teeth 26, 27, 33, 34, 43, 45, and 46 were performed. The defect and edentulous span were border molded with dental impression compound (Kerr Grey Stick; Kerr Corp). Afterwards, the final impression of the defect was made with a tissue conditioner material (COE-COMFORT™ Tissue conditioner; GC America Inc, Ill) whilst taking an impression of the remaining maxillary arch with regular body of polysulfide impression material (Regular bodied Permlastic; Kerr Corp) (Figure 3).¹² A lower alginate impression (Jeltrate Fast Set, Dentsply Intl) was also made for metal framework fabrication.

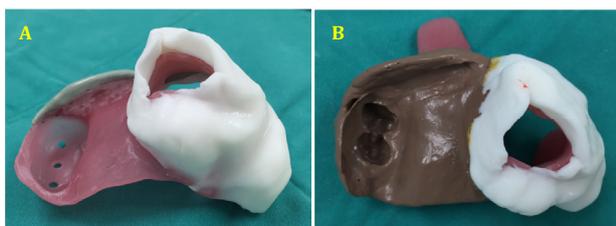


Figure 3 Border molding and functional impression (A) with Coe-comfort (B) with Polysulfide

On the maxillary master cast, the defect area was filled with a mixture of plaster and pumice powder at a 1:1 ratio and built-up to achieve an alveolar-like shape as a normally edentulous arch (Figure 4). The tissue undercuts on the upper were modified and a lower master casts were blocked out. Wax patterns of

frameworks were constructed on refractory casts, and then cast in a cobalt-chromium (Vitallium; Dentsply Intl) for RPD frameworks.

After the upper and lower metal frameworks were tried in the patient, a lower master cast was fabricated using altered cast technique for the left edentulous area. A centric relation was recorded and the artificial teeth were set up. In the next visit, teeth arrangement was tried in the patient to evaluate the interocclusal relationship of both arches. Before flasking, a 2 mm uniform thickness of the plaster and pumice mixture was removed from the periphery of the defect area on the upper master cast, to form an open-hollow bulb of predetermined thickness. The prostheses were then trimmed and polished; occlusal interferences were adjusted chair-side prior to delivery (Figure 5 and 6). In a six-month follow-up visit, the patient reported that dentures had improved retention, function, and esthetics (Figure 7).



Figure 4 Maxillary master cast built up with mixture of pumice and plaster (1:1)



Figure 5 Final seating (A) Occlusal (B) Frontal (C) Left (D) Right view

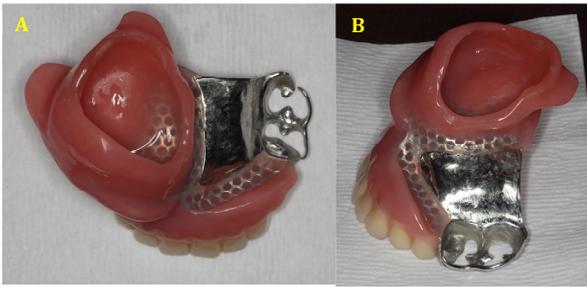


Figure 6 Completed obturator prosthesis (A) Superior (B) Lateral view



Figure 7 Extraoral view of the patient wearing obturator prosthesis

Discussions

This clinical report presents simple and efficient techniques to fabricate a lightweight, one-piece obturator prosthesis by controlling the acrylic thickness of open-hollow bulb during the initial phase of obturator fabrication. As described in our procedure, the definitive obturator was packed with heat-polymerizing acrylic resin in a single step for both the denture base and bulb part, while precisely maintaining a 2 mm acrylic thickness around the bulb wall. In addition, the final acrylic thickness of the denture base underneath the artificial teeth is reduced at the same time because of the favorable meshwork’s height and contour (Figure 8).

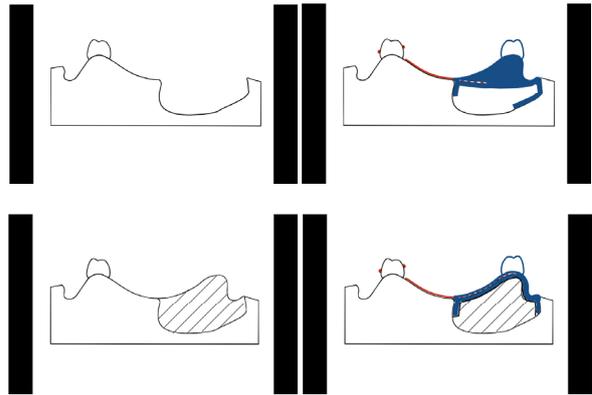


Figure 8 Schematic illustration (A) Without precise positioning. (B) With precise positioning metal meshwork

The design of the maxillary special tray with a palatal opening and superior extension provides access to the defect and allows proper adaptation of the Coe-comfort (or other tissue conditioning materials) with finger pressure to record the configuration, contour and height of the lateral extension for a proposed bulb.¹² Additionally, this special tray provides the support to build up the Coe-comfort to adequate thickness.

As presented in this case, patients with limited number of abutment teeth have compromised retention of obturators. In a linear framework design, abutment teeth may be negatively affected due to the rotation of obturator during function as well as removal and insertion forces.⁶ Retentive sites were located on the facial surfaces of abutment teeth 26 and 27 as well as the lateral wall of the surgical defect via the superolateral extension of the bulb engaging the lateral fibrous band. The purpose of this design was to reduce excessive forces that were exerted on abutment teeth, and to use the lateral wall of the surgical defect as a retentive area together with abutment teeth, referred to as a “tripod” design. An occlusal consideration for this case is considered to be a group function in order to distribute the occlusal load and stabilize an obturator. However, patients with large maxillary resection are recommended to chew only at the non-defect side leaving the occlusion at the defect side as a light contact for esthetic.

Conclusions

The technique of modifying the special tray to obtain an accurate functional impression and contouring the master cast prior to fabrication of the meshwork enhances better communication between the clinician and dental technician team for a proper design of the obturator framework. Therefore, the design and fabrication technique demonstrated herein enables us to obtain a lightweight obturator with improved retention and stability, with a reduction of time required for chair-side adjustment such as relining of the bulb.

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วิธีทำสิ่งปิดเหงาในน้ำหน้าหน้าหนักเบาโดยการกำหนดตำแหน่งที่แน่นอนของโครงโลหะในผู้ป่วยผ่าตัดเหงาปากบางส่วน: รายงานผู้ป่วย

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บทคัดย่อ

ความสำเร็จของการใส่สิ่งปิดเหงาในน้ำหน้าหน้าหนักเบาของผู้ป่วยมะเร็งช่องปากที่ได้รับการผ่าตัดเหงาบางส่วน ขึ้นกับขนาดและตำแหน่งของความพิการ ความพิการของขากรรไกรบนขนาดใหญ่ที่เหลือน้ำหนัก ค่อนข้างน้อยอยู่ในแนวเส้นตรงจะทำให้เสถียรภาพ สิ่งพยุ่ง และการยึดอยู่ของฟันเทียมลดลงเนื่องจาก แรงจذبที่ไม่พึงประสงค์ของส่วนป่อง (bulb) ในฟันเทียม เพื่อแก้ไขปัญหาดังกล่าว การทำให้ส่วนป่องใน ฟันเทียมมีน้ำหนักเบาจึงมีความสำคัญ รายงานผู้ป่วยฉบับนี้ กล่าวถึงการบูรณะผู้ป่วยที่มีเหงาในน้ำหน้าหน้าหนักเบาขนาดใหญ่ด้วยการใส่สิ่งปิดเหงาในน้ำหน้าหน้าหนักเบาแบบเปิดในฟันเทียมชนิดฐานโลหะ ตั้งแต่การทำ ถาดพิมพ์ปากเฉพาะบุคคลที่มีช่องผ่านเข้าไปในส่วนเหงาในน้ำหน้าหน้าหนักเบาเพื่อทำการพิมพ์แบบในส่วนเหงาในน้ำหน้าหน้าหนักเบาเพื่อให้ได้แบบหล่อที่มีความถูกต้อง จากนั้นทำการแต่งแบบหล่อในส่วนของเหงาในน้ำหน้าหน้าหนักเบาให้ดูโปร่งเหมือน สันเหงือกปกติที่ไม่ได้รับการผ่าตัดเหงา โดยใช้ปูนพลาสติกผสมกับผงพิมพ์มิช เพื่อให้ได้ตำแหน่งที่ เหมาะสมของตะแกรงโลหะ รวมไปถึง การวางแผนความหนาของอะคริลิกที่เหมาะสม เพื่อให้ได้ส่วนป่อง ในฟันเทียมที่มีน้ำหนักเบาที่สุดเป็นผลให้สิ่งปิดเหงาในน้ำหน้าหน้าหนักเบาเสถียรภาพ การยึดอยู่ และการใช้งานที่ดีขึ้น

คำชี้แจง: การบูรณะใบหน้าขากรรไกร/ การตัดขากรรไกรบนออก/ สิ่งปิดเหงาในน้ำหน้าหน้าหนักเบา/ ฟันเทียมบางส่วน

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