

Implant-retained feeding aid prosthesis for a patient following total glossectomy and laryngectomy: A clinical report

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This clinical report describes the prosthetic management of a patient following total glossectomy and total laryngectomy that severely compromised his oral function, caused facial disfigurement, and limited the patient's quality of life. A feeding aid prosthesis was designed to address the patient's chief complaint of difficulty in feeding and mastication. The prosthesis was designed as an implant-retained overdenture with a lingual metal plate to facilitate food introduction into the oropharynx. This treatment improved mastication, appearance, and the quality of the patient's social life. (*J Prosthet Dent* 2007;97:261-5.)

Patients with carcinoma of the base of tongue frequently have advanced disease at the time of presentation and, therefore, a combined treatment modality is necessary.¹ Patients may be treated by total glossectomy, occasionally concomitant with laryngectomy, followed by chemoradiotherapy or intraoperative radiotherapy.^{1,2} As a result, patients may suffer from constant pain³ as well as impairment of speech, mastication and deglutition, mandibular deviation in function, and severe facial disfigurement that significantly affects function and quality of life.¹⁻⁴ Patients may also remain at risk for mild or severe aspiration that may be life-threatening.⁴ Various prosthetic approaches have been suggested for the rehabilitation of speech and swallowing following complete glossectomy, including a palatal augmentation prosthesis, tongue replacement prosthesis, or food-guiding prosthesis.⁵⁻¹⁵

The palatal augmentation prosthesis is used to restore impaired speech and swallowing in glossectomy patients by artificially lowering the palatal vault to provide contact between the remaining tongue and the palatal contours.^{8,9} Determining the merit of the palatal augmentation prosthesis for different tongue resections is difficult since the evaluation of tongue defects is not based on a systematic approach that considers residual tongue mobility.⁹ Nevertheless, when the tongue is completely resected along with the muscles of the floor of the mouth, only the esophageal phase of deglutition is preserved and, therefore, there is little functional benefit

with a palatal augmentation prosthesis in these patients. Occasional patient reports describe tongue-replacement prostheses that obdurate the surgical defect and have a raised central portion that resembles the tongue in an elevated position to improve mastication, swallowing, and speech.¹⁰⁻¹⁴ The functional outcome of this type of prostheses is reported to be limited as the artificial bulk of tongue cannot replace the highly dynamic nature of the living tongue.

The food-guiding prosthesis was designed for the complete glossectomy patient as a mandibular denture with a funnel-shaped base that guides food towards the esophagus.¹⁰⁻¹³ This prosthesis renders the nasogastric tube unnecessary.¹¹ Improvement in function has been reported using the food-guiding prosthesis, however, patients need to chop or blend the food or use a special pusher spoon.¹⁰⁻¹⁵ This clinical report describes the prosthetic management of a patient who underwent a total glossectomy and total laryngectomy using an implant-retained feeding aid prosthesis to improve nourishment. The definitive prosthesis was designed as an implant-retained overdenture to facilitate oral hygiene maintenance.¹⁶⁻¹⁹

CLINICAL REPORT

A 66-year-old white man was referred to the maxillofacial prosthetics clinic at the Sheba Medical Center, Ramat-Gan, Israel by his oral and maxillofacial surgeon for prosthetic treatment. He had a history of squamous cell carcinoma of the right base of the tongue that was classified as a tumor stage of T₄ N₂ M₀.⁴ The tumor was initially treated with a combination of chemotherapy and radiotherapy (60 Gy), followed by total glossectomy, total laryngectomy, and ipsilateral radical neck dissection. A permanent tracheotomy was performed to secure the airway with no orotracheal or tracheopharyngeal communication. The patient rejected an electroacoustical speech aid or tracheoesophageal voice device following the laryngectomy. In the same year, the patient underwent hemimandibulectomy on the right side due to local recurrence. The resulting defect was

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immediately reconstructed with an iliac crest microvascular free flap to restore the mandibular continuity. The mandible was then restored with a complete denture with a tongue prosthesis, however, the patient did not use the prosthesis as it was not retentive. Two endosseous cylindrical 3.25-mm implants (Omniloc; Calcitek, Carlsbad, Calif) were placed in the remaining mandible in the canine and second premolar area to improve the retention of a new implant-retained overdenture with a tongue prosthesis fabricated by the authors. However, the patient found this prosthesis unserviceable due to its instability. The patient's chief complaint was difficulty in eating. The patient was also concerned about his facial appearance that limited his social life. The patient's speech was unintelligible even though he could communicate well with his family using sign language and writing.

A clinical examination revealed that the patient breathed through a tracheostomy stoma. The inferior third of the face was reduced in height and the mandible shifted to the resected side (Fig. 1, A). The lower lip inverted into the oral cavity and was entrapped under a maxillary fixed partial denture (FPD) extending from the maxillary right second premolar to the maxillary left second premolar. The resection and free flap reconstruction obliterated the right buccal mandibular vestibule. The reconstructed floor of the mouth was flattened and sloped towards the pharynx (Fig. 1, B). There were 2 unrestored implants in the mandible with healing abutments, 1 of the implants had extensive bone loss and was eventually surgically removed. The patient rejected the use of a gastrostomy tube. The patient used a 60-ml syringe to introduce a liquid or a semiliquid diet directly into the oropharynx. Although he used the syringe for the last 8 years for nourishment, it minimized his food selection, forced him to blend the food, and caused problems for the patient socially. A computed tomography scan of the mandible revealed that additional implants could be placed in the mandible. The planned treatment was fabrication of an implant-retained prosthesis that would assist in directing the food into the oropharynx, support the collapsed lower lip, and guide the mandible into a more favorable interarch relation.

Five endosseous implants 3.75 mm in diameter and 13 mm in length (Spline Twist MTX; Centerpulse, Carlsbad, Calif) were placed, 4 into the free bone graft, and 1 in the area of a previously failed implant in the canine region of the native mandible. Four months later, at the time of the second-stage surgery, a vestibuloplasty was performed to create space for the mandibular prosthesis on the right side to improve the lip support.

Upon healing, an implant-level impression was made with an autopolymerizing acrylic resin (Lucitone 199; Dentsply Intl, York, Pa) open individual tray using vinyl polysiloxane impression material (Express; 3M ESPE,

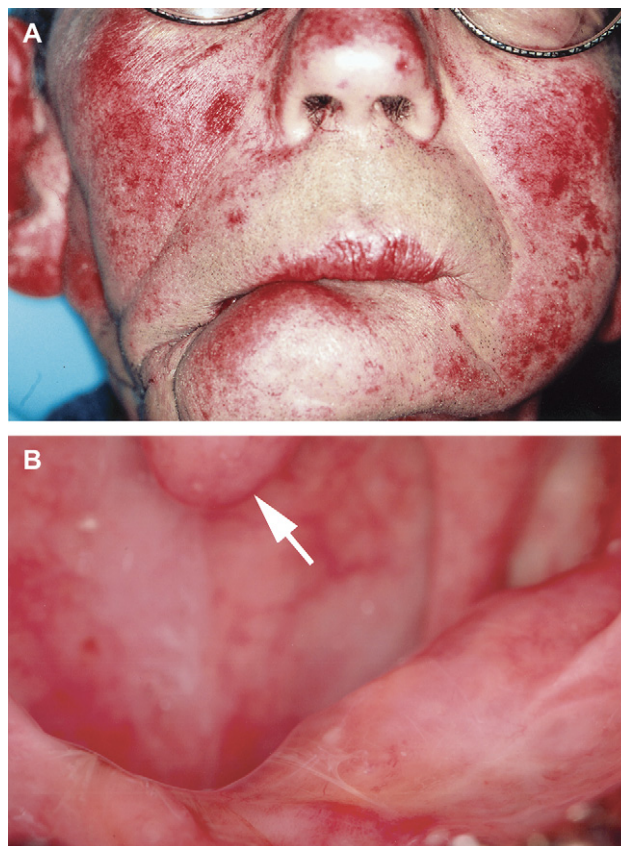


Fig. 1. **A**, Frontal view shows mandibular deviation and collapsed lower lip. **B**, Intraoral view. Note glossectomy and floor of mouth slope (arrow indicates the uvula).

St. Paul, Minn). An autopolymerizing acrylic resin record base was fabricated, and maxillomandibular relation records were made. Semi-anatomic acrylic resin artificial teeth (Trubyte Portrait IPN; Dentsply Intl) were arranged to facilitate lip support (Fig. 2). An implant-supported screw-retained provisional restoration was fabricated with autopolymerizing acrylic resin (Jet Acrylic; Lang Dental Mfg Inc, Wheeling, Ill) using the artificial teeth. The lingual contours of the provisional restoration were shaped to direct food into the oropharynx. A visible light-polymerized (VLP) acrylic resin custom tray material (Triad; Dentsply Intl) was attached to the lingual contour of the acrylic resin provisional restoration and polymerized intraorally with a visible polymerizing light unit (Optilux 501; Kerr Corp, Orange, Calif) at 850 mW/cm^2 for 2 minutes. This impression plastic was functionally border molded with modeling stick impression compound (Green Modeling Stick Impression Compound; Kerr, Romulus, Mich) to determine the shape of the lingual plate. Patient mastication was evaluated chairside with foods of different consistencies, such as bread and peanuts. The provisional restoration guided the mandible towards the left into maximum intercuspation with the maxillary FPD. The



Fig. 2. Tooth arrangement guides mandible and restores occlusal relationship.



Fig. 3. Implant-supported milled bar with attachments serves as infrastructure.



Fig. 4. Definitive mandibular prosthesis. **A.** Polished surface. **B.** Intaglio surface.

patient reported that mastication was improved and was pleased with the esthetic appearance of his provisional prosthesis, however, the patient found the provisional prosthesis difficult to clean.

The definitive prosthesis was, therefore, designed as a removable implant-retained overdenture. The prosthesis required additional stability and retention to guide the food, to direct the mandible into maximum



Fig. 5. Definitive prosthesis intraorally.



Fig. 6. Frontal view 2 years after treatment. Note improved lip support.

intercuspatation, and to resist the destabilizing effect of the lower lip. An ADA type IV noble gold alloy (Minerva 4CF; Elephant Dental B.V., AE Hoorn, The Netherlands) was used to fabricate the infrastructure bar. The bar was fabricated on the definitive cast, milled

to 2-degree taper with milling machine (Schick Dental GmbH, Schemmerhofen, Germany) and 6 castable vertical standard base attachments (Rhein OT Strategy; RHEIN'83, Hoboken, NJ) were added to provide retention for the definitive overdenture prosthesis. These attachments were selected because of their low profile (Fig. 3). Four attachments were placed on the labial aspect of the bar and 2 on the lingual aspect due to the limited interarch space. Two additional attachments (Ceka attachment; Alphadent NV, Antwerpen, Belgium) were cast on the bar bilaterally, 1 on each distal aspect of the bar. The bar was evaluated intraorally for passive fit.

The suprastructure was fabricated directly on the infrastructure bar. A wax pattern (Casting wax; Kerr) was prepared in the shape of a linguoplate major connector with a sloped lingual extension. Retention loops and beads were added to the wax pattern to attach the denture teeth. The suprastructure was cast with the same gold alloy used for the infrastructure. The attachment metal housings were placed on the infrastructure bar and soldered with gold solder (650 Solder; Jensen Industries, North Haven, Conn) to the suprastructure on the definitive cast. The infra- and suprastructure were placed intraorally, the lingual extension of the provisional prosthesis was removed, related to the suprastructure, and connected to the suprastructure with autopolymerizing acrylic resin (Duralay; Reliance Dental Mfg, Worth, Ill.). The lingual plate made of chromium-cobalt alloy (Dentorium Inc, New York, NY) was soldered to the suprastructure to create an inclined slope to direct the food into the oropharynx (Fig. 4). The teeth were arranged on the suprastructure with a plaster index (Yellow Stone; Whip Mix Corp, Louisville, Ky) fabricated from the provisional prosthesis, and the denture was processed in autopolymerizing acrylic resin (Lucitone 199; Dentsply Intl) (Fig. 5). The patient was instructed to follow a strict oral hygiene regimen. At the 1-month follow-up appointment, the patient reported that he was able to masticate a semiliquid diet without using a syringe. He enlarged his food selection. His facial appearance and quality of life were improved (Fig. 6). The patient's motivation, reinforced with appropriate emotional support from family and friends, rendered this treatment successful.

After 2 years of using the prosthesis, the patient reported improved ability to eat solid foods and increased comfort in social settings. The implants were stable. There was no screw-loosening or gingival hyperplasia beneath the bar. However, there was a need to replace the attachment plastic retentive elements.

DISCUSSION

Patients following total glossectomy and total laryngectomy due to advanced carcinoma of the base of the tongue are compromised with poor survival despite

aggressive therapies. This presents a challenge to the maxillofacial prosthodontist since restoration of function to a presurgical level may be impossible.^{4,16} The prosthodontic rehabilitation of the patient presented was primarily limited to improvement in nourishment. The patient had no residual tongue and limited movement of the floor of the mouth. A feeding aid prosthesis to guide food towards the oropharynx was preferred over a palatal augmentation prosthesis or tongue replacement prosthesis. There was no risk of aspiration using the feeding aid prosthesis since there was no possible communication between the oral cavity and the trachea postoperatively. In addition, with the feeding aid prosthesis the occlusal vertical dimension is preserved or may be increased, so facial appearance is improved. However, with a palatal-augmented maxillary prosthesis, a decrease in the occlusal vertical dimension may be needed to create contact with the tongue.

The use of dental implants may resolve a few problems that hamper the prosthodontic rehabilitation of these patients such as: severe change to the neutral zone, impaired function of the tongue, and a poor load-bearing capacity of the remaining soft tissues and mandibular bone.^{18,19} Use of dental implants may improve the biomechanical properties of the prosthesis and assist in regaining some masticatory function. The feeding aid prosthesis described was designed as an implant-retained overdenture to support the lower lip with a flange and to allow access for hygiene maintenance. The suprastructure and infrastructure were fabricated out of the same alloy, while the lingual extension that directed the food into the oropharynx was fabricated from a base-metal alloy to reduce cost. Thus, in situations of complete glossectomy, a food-guiding prosthesis may be considered a valuable treatment option. The disadvantages of the described prosthesis are the more complex laboratory work needed, resulting in increased cost.

SUMMARY

The prosthetic management of an edentulous patient with total glossectomy and total laryngectomy is described. The patient's chief complaints were addressed with the use of an implant-retained overdenture designed with a funnel-shaped lingual metal plate to facilitate food introduction into the oropharynx.

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REFERENCES

1. Malone JP, Stephens JA, Grecula JC, Rhoades CA, Ghaheri BA, Schuller DE. Disease control, survival, and functional outcome after multimodal treatment for advanced-stage tongue base cancer. *Head Neck* 2004;26:561-72.
2. Effron MZ, Johnson JT, Myers EN, Curtin H, Beery Q, Sigler B. Advanced carcinoma of the tongue. Management by total glossectomy without laryngectomy. *Arch Otolaryngol* 1981;107:694-7.

3. Ruhl CM, Gleich LL, Gluckman JL. Survival, function and quality of life after total glossectomy. *Laryngoscope* 1997;107:1316-21.
4. Beumer J, Curtis TA, Marunick MT. Maxillofacial rehabilitation: Prosthodontic and surgical considerations. St. Louis: Medico Dental Media Intl Inc; 1996. p. 113-223.
5. Aramany M, Downs JA, Berry QC, Aslan Y. Prosthodontic rehabilitation for glossectomy patients. *J Prosthet Dent* 1982;48:78-81.
6. Taicher S, Bergen SF. Maxillary polydimethylsiloxane glossal prostheses. *J Prosthet Dent* 1981;46:71-7.
7. Pigno MA, Funk JJ. Prosthetic management of a total glossectomy defect after free flap reconstruction in an edentulous patient: a clinical report. *J Prosthet Dent* 2003;89:119-22.
8. Cantor R, Curtis TA, Shipp T, Beumer J 3rd, Vogel BS. Maxillary speech prostheses for mandibular surgical defects. *J Prosthet Dent* 1969;22:253-60.
9. Marunick M, Tselios N. The efficacy of palatal augmentation prostheses for speech and swallowing in patients undergoing glossectomy: a review of the literature. *J Prosthet Dent* 2004;91:67-74.
10. Moore DJ. Glossectomy rehabilitation by mandibular tongue prosthesis. *J Prosthet Dent* 1972;28:429-33.
11. Lauciello FR, Vergo T, Schaaf NG, Zimmerman R. Prosthodontic and speech rehabilitation after partial and complete glossectomy. *J Prosthet Dent* 1980;43:204-11.
12. Cotert HS, Aras E. Mastication, deglutition and speech considerations in prosthodontic rehabilitation of a total glossectomy patient. *J Oral Rehabil* 1999;26:75-9.
13. Kaplan P. Immediate rehabilitation after total glossectomy: a clinical report. *J Prosthet Dent* 1993;69:462-3.
14. Gillis RE, Leonard RJ. Prosthetic treatment for speech and swallowing in patients with total glossectomy. *J Prosthet Dent* 1983;50:808-14.
15. Ballard JL, Kerner E, Tyson J, Ashford J, Rees R. Adenocarcinoma of the tongue complicated by a hemimandibulectomy: soft tissue support for a tongue prosthesis in an edentulous glossectomy patient. *J Prosthet Dent* 1986;56:470-3.
16. Sadowsky SJ. Mandibular implant-retained overdentures: a literature review. *J Prosthet Dent* 2001;86:468-73.
17. Robertson ML, Gleich LL, Barrett WL, Gluckman JL. Base-of-tongue cancer: survival, function, and quality of life after external-beam irradiation and brachytherapy. *Laryngoscope* 2001;111:1362-5.
18. Schoen PJ, Reintsema H, Raghoobar GM, Vissink A, Roodenburg JL. The use of implant retained mandibular prostheses in the oral rehabilitation of head and neck cancer patients. A review and rationale for treatment planning. *Oral Oncol* 2004;40:862-71.
19. August M, Bast B, Jackson M, Perrott D. Use of the fixed mandibular implant in oral cancer patients: a retrospective study. *J Oral Maxillofac Surg* 1998;56:297-301.

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