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Prosthodontic Rehabilitation for Total Glossectomy with a Magnetic Detachable Mandibular Tongue Prosthesis: A Clinical Report

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Abstract

Total glossectomy can result in significant functional impairments in mastication, swallowing, and speech. In addition to these functional problems, severe psychological problems may follow complete loss of the tongue. Placement of a mandibular tongue prosthesis obturates this large defect, increases the patient's ability to produce intelligible sounds, and assists with a return to a normal diet. Prosthetic rehabilitation can also improve the user's appearance and psychosocial adjustment. This clinical report describes a magnetically attached two-piece tongue prosthesis used to treat a patient who underwent total glossectomy.

The primary functions of the tongue are swallowing and mastication; a secondary function is speech.[1] Twenty-six percent of oral cancers and 0.7% of all carcinomas occur in the tongue,[2] the most common location being the posterior lateral aspect.[3] Surgical treatment of tongue carcinomas may result in partial or total resection. A total glossectomy, besides the obvious functional impairments in mastication, swallowing, and speech, can also cause patients to experience severe psychosocial problems. Treatment for these patients can be nonsurgical or surgical.

The viability of a prosthodontic approach to treatment depends on the type and extent of surgery. In a total glossectomy, a mandibular tongue prosthesis is the treatment of choice. With partial glossectomy or in situations involving an edentulous patient and an irradiated, resorbed mandibular ridge, a palatal maxillary prosthesis should be considered.[4] A primary advantage of treating a glossal defect with a maxillary prosthesis is the stability inherent in a maxillary denture; however, a large maxillary tongue prosthesis in the oral cavity can negatively affect resonance and swallowing.[5]

Several reports have discussed the value of prosthodontic rehabilitation in patients who undergo complete glossectomy.[6-10] This clinical report describes prosthodontic rehabilitation for such a patient without surgical reconstruction. The mandibular tongue prosthesis was created and implanted. The prosthesis consists of two parts: one component helps the patient with swallowing during eating and drinking, and the other component is used during speech. In most similar devices described in earlier studies, the two components are attached to each other with a mushroom-like projection in one component that fits into a similar depression in the other component.[4,7,11] However, due to the projection and depression system used to connect the two components, this design seems to have disadvantages such as patient discomfort and the accumulation of food and debris. Therefore, we designed a prosthodontic device in which the smooth contact surfaces of the two components are attached to each other with magnets. This design reduces the accumulation of food and debris, and the patient's comfort and convenience are enhanced due to the lack of any projecting structure in the mouth when the tongue component is removed during eating and drinking.

Clinical report

A 46-year-old woman with confirmed squamous cell carcinoma of the left base of the tongue was referred to the Department of Prosthodontics, Faculty of Dentistry, Mashhad University of

Figure 1 Intraoral view after total glossectomy.

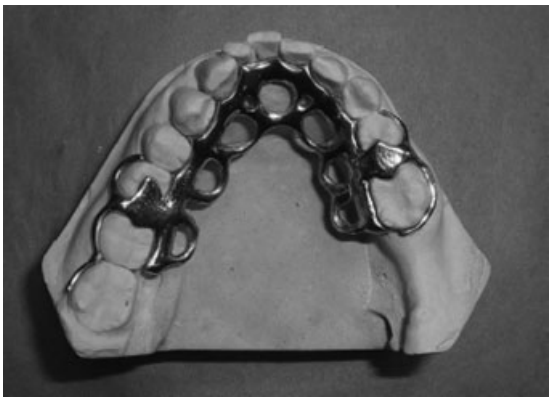

Figure 2 Finished chrome-cobalt framework for mandibular tongue prosthesis.

Figure 3 Wax impression of the floor of the mouth.

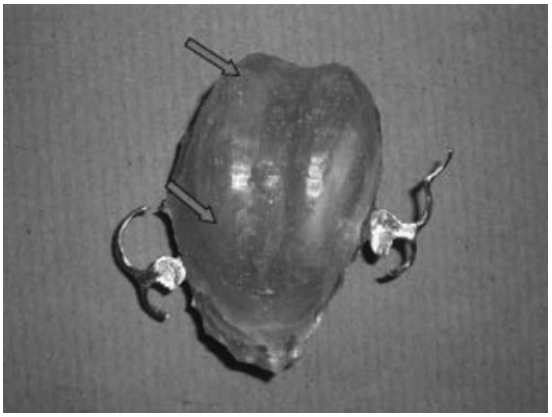

Figure 4 Wax tongue prosthesis. Note the anterior and posterior elevations.

Figure 5 Magnets in the acrylic resin base and silicone tongue.

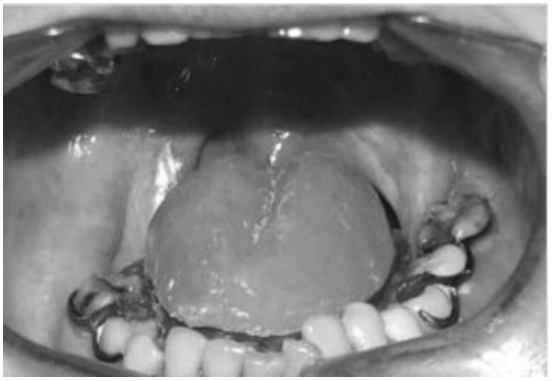

Figure 6 Finished mandibular tongue prosthesis in the patient's mouth.

Medical Sciences, Shiraz, Iran. The tumor was initially treated with radiotherapy, after which total glossectomy with left radical neck dissection was performed to remove the residual tumor. Surgical closure of the laryngeal opening was undertaken to reduce the incidence of aspiration and to assist the patient with swallowing liquids[12] (Fig 1).

The treatment plan was to fabricate a two-piece mandibular tongue prosthesis. The prosthesis consisted of two separate components. One component was made of acrylic resin to help the patient during swallowing food and liquids. The other component was made of silicone to assist the patient with speech. This second silicone component allowed the patient to produce speech, but needed to be removed to permit swallowing. The two components were attached by magnets instead of the conventionally used mushroom-like projection.[4,7,11]

Before active treatment began, clinical and radiographic evaluation was performed to determine the crown-to-root ratios of abutment mandibular teeth and the condition of the associated periodontal tissues, and to screen for pathologic conditions. No contraindications were found. The carious lesions were restored, and the importance of oral hygiene maintenance was re-emphasized.

A stock plastic maxillary tray of the appropriate size was used to register the entire floor of the mouth. The tray was modified with impression compound (Kerr, Orange, CA) to ensure a proper fit and confine the impression material. A fast-setting irreversible hydrocolloid (Zhermack, Badia Polesine, Italy) was poured in type III dental stone (Elite, Zhermack). This preliminary cast was surveyed, and tooth preparation was performed. The final impression was made with a custom tray using the same fast-setting irreversible hydrocolloid (Zhermack) suitable for making diagnostic and final impressions for removable partial dentures (RPDs).[13]

A polished chromium-cobalt RPD framework was made by conventional techniques (Fig 2) and placed in the patient's mouth to ensure complete, passive seating and to verify that the retentive meshwork of the framework did not touch the floor of the mouth during functional movements. A layer of sticky wax was luted to the retentive meshwork, covered with a layer of mouth-temperature softening wax (Iowa Wax, Kerr, Romulus, MI), and then placed in the patient's mouth (Fig 3). The patient performed functional movements, such as swallowing and pronouncing sounds such as "eee," with the floor of her mouth. The wax tracing was inspected, and more wax was added to ensure passive contact with the floor of the mouth during functional movements. After completion of this tracing, the prosthesis was processed in clear, heat-cured acrylic resin (Meliodent, Bayer Dental, Bayer Italia, Milan, Italy).

Pressure areas in the floor of the mouth were located by pressure-indicating paste and were relieved. The tongue portion of this prosthesis had two elevations to facilitate the pronunciation of anterior linguoalveolar sounds (t, d) and posterior linguoalveolar sounds (g, k).[1] The two elevations shaped the oral cavity to improve vowel production. To form these elevations, mouth-temperature softening wax (Iowa Wax) was added to the acrylic resin base, and the patient was asked to pronounce the consonants t, d, k, and g. The wax was modified during this procedure until the desired sounds were attained.

A groove was created in the posterior middle aspect of the waxed tongue to facilitate speech production (Fig 4). This wax tracing was then removed and duplicated in MDX 4-4210 silicone (Dow Corning Corp, Midland, MI) with appropriate intrinsic coloration. This silicone tongue was attached to the acrylic resin base by three circular cobalt-samarium magnets (Job Masters, Randallstown, MD), which were added to the underside of the prosthetic tongue. These areas were transferred to the acrylic base with the help of pencil markings, and the corresponding areas in the acrylic resin base were prepared to receive the magnets (Figs 5 and 6). The magnets were covered with a 2 mm layer of silicone and were secured in the silicone prosthesis with nylon hose as described by Lemon et al[14] during silicone processing.

At the 1-month follow-up visit, the patient had adapted to the prosthesis. Speech was improved, and the patient was satisfied with her improvement in communication. Although bilabial and labiodental sounds were unaffected, fluid speech was basically unintelligible. Prior to prosthetic rehabilitation the patient needed to extend her head posteriorly to swallow, and was able to swallow only water and liquids. At the 1-month follow-up she was able to swallow pureed or blended foods with her head in an upright position.

Discussion

The detachable magnetic mandibular tongue prosthesis comprises two separate components to facilitate swallowing and speech. The contact surfaces between the acrylic resin base and silicone tongue are smooth and lack the projection and depression used in conventional mushroom-like prostheses.[4,7,11] Thus, the potential advantages of our artificial tongue prosthesis are ease of cleaning compared to conventional devices, and increased comfort and convenience for patients in removing and replacing the artificial tongue before and after mastication and swallowing.

The incorporation of a silicone rubber tongue to the mandibular prosthesis improves speech because the tongue is the major articulator during sound production with the exception of bialabial and labiodental sounds. The anterior elevation of the prosthetic tongue allows positive contact with the palate during the formation of anterior linguoalveolar sounds such as t and d. The posterior elevation aids in the articulation of the glottal stops g and k. A trough-like groove in the posterior middle aspect of the prosthetic tongue assists with the pronunciation of s, sh, and ch sounds.[15]

The pliable silicone tongue simulates the texture of the natural tongue, is more comfortable for patients, and is more esthetically and socially acceptable. One disadvantage of this material, however, is that it does not combine chemically with acrylic resin. Therefore, a mechanical anchoring mechanism is required to maintain positional relationships between the two components of the prosthesis.[15] We used magnets to attach the silicone tongue component to the acrylic resin base instead of the conventionally used mushroom-like projection.[4,7,11] However, these magnets may need to be replaced or repositioned as a result of loss, wear, or corrosion.

Our patient's speech improved, but prosthodontic rehabilitation alone cannot be expected to result in marked improvements in speech. Therefore, it is recommended that a speech pathologist evaluate the patient's speech in conjunction with prosthodontic therapy.

With the prosthesis in place, the patient was able to swallow pureed or blended foods rather than just liquids and water without the prosthesis. We are hopeful that future adaptation to the prosthesis may eventually help her to swallow solid food.

The success of prosthodontic rehabilitation in glossectomy patients depends on the presence or absence of teeth, radiation therapy, morbidity of the surrounding structures, and patient cooperation. The patient we treated was highly motivated, and the presence of teeth was a valuable contribution to the final prosthetic results; however, osseointegrated implants in edentulous glossectomy patients may provide the most reliable prosthesis retention and help the patient swallow nearly normal foods. Potential drawbacks of osseointegrated implants are the

need for additional surgeries and the higher expense. In addition, adequacy of the bone must be evaluated before therapy, and prior radiation therapy to the area may contraindicate implant treatment.

Conclusion

Prosthodontic rehabilitation in our patient with total glossectomy improved the oral functions of mastication, swallowing and speech. This tongue prosthesis, in conjunction with a mandibular partial denture, can speed the recovery of similar patients and allow them to return to society sooner. The prosthesis we developed allowed our patient to swallow pureed and blended foods and improved her speech.

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References

1. Zaki HS: Prosthodontic rehabilitation following total and partial glossectomy. In Taylor TD (ed): Clinical Maxillofacial Prosthetics. Chicago, Quintessence, 2000, pp. 205-213
2. Davis JW, Lazarus C, Longman J, et al: Effect of a maxillary glossectomy prosthesis on articulation and swallowing. J Prosthet Dent 1987;57:715-719
3. Chi AC: Epethelial pathology. In Neville B (ed): Oral and Maxillofacial Pathology (ed 3). St Louis, Elsevier, 2009, p 415
4. Moore DJ: Glossectomy rehabilitation by mandibular tongue prosthesis. J Prosthet Dent 1972;28:429-433
5. Groetsema WR: An overview of the maxillofacial prosthesis as a speech rehabilitation aid. J Prosthet Dent 1987;57:204-208
6. Lehman WL, Hulicka IM, Mehringer EJ: Prosthetic treatment following complete glossectomy. J Prosthet Dent 1964;16:344-350
7. Lauciello F, Verge T, Schaal N, et al: Prosthodontic and speech rehabilitation after partial and complete glossectomy. J Prosthet Dent 1980;43:204-211
8. Taicher S, Bergen S: Maxillary polydimethyl siloxane glossal prostheses. J Prosthet Dent 1981;46:71-77
9. Gillis RE, Leonard RJ: Prosthetic treatment speech and swallowing in patients with total glossectomy. J Prosthet Dent 1983;50:802-814
10. Godoy AJ, Perez DJ, Lemon JC, et al: Rehabilitation of a patient with limited oral opening following glossectomy. Int J Prosthodont 1991;4:70-74
11. Aramany MA, Downs JA, Berry QC, et al: Prosthodontic rehabilitation for glossectomy patients. J Prosthet Dent 1982;48:78-81
12. Mitrani M, Krespi YP: Functional restoration after subtotal glossectomy and laryngectomy. J Otolaryngol Head Neck Surg 1988;98:5-9
13. Phoenix, RD, Cagna, DR, DeFreest CF: The first diagnostic appointment. In Phoenix RD, Cagna DR, DeFreest CF (eds): Stewart's Clinical Removable Partial Prosthodontics (ed 4). Chicago, Quintessence, 2008, p 131
14. Lemon JC, Martin JW, Chamber MS, et al: Technique for magnet replacement in silicone facial prostheses. J Prosthet Dent 1995;73:166-168
15. Grisius R, Moore DJ: Miscellaneous prostheses. In Beumer J, Curtis TA, Marunick MT (eds): Maxillofacial Rehabilitation: Prosthodontic and Surgical Considerations (ed 2). St. Louis, Ishiyaku EuroAmerica, 1996, pp. 511-529