

Assisted retention of a hearing device in an implant-retained auricular prosthesis

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The use of bone-anchored hearing aids is not possible for all patients who wear an implant-retained auricular prosthesis. For some patients, the external ear canal cannot be occluded with a conventional hearing device. Currently manufactured hearing aids may not readily fit the contours of an implant-retained auricular prosthesis. This article describes a technique that allows a modular hearing aid device to be inserted into a custom “sleeve.” With this device, the patient can take advantage of binaural cues. (*J Prosthet Dent* 2001;86:386-9.)

The hearing-impaired patient is handicapped in the rapid processing of information, including speech, localization of sounds in the auditory space, and binaural cues.¹ The use of bone-anchored hearing aids²⁻⁴ is not possible for all patients who wear an implant-retained auricular prosthesis.

A behind-the-ear (BTE) instrument (Telex Cros, Telex Communications, Inc, Minneapolis, Minn.) consists of a module that contains a microphone, an amplifier, a battery, and a loudspeaker and is located behind the pinna. The internal loudspeaker is connected to the external meatus through a short piece of tubing that traverses the pinna and enters into the external ear through an earmold.⁵ This assembly serves to hold the device on the pinna and to direct the amplified sound to the ear. However, there are situations in which the external ear cannot be occluded with a conventional hearing aid device (for example, chronic otitis) and in which the external ear canal will not accept a device (for example, congenital aural atresia and chronic suppurative otitis).⁵

Polyurethane is often used as a liner for extraoral prostheses; it provides a smooth, hygienic intaglio surface, seals the porous silicone material, and improves the esthetics of the margin. Polyurethane lining of the facial prosthesis provides increased tear strength and limits fungal ingrowth often associated with silicone restorative materials. Techniques have been described for lining a silicone facial prosthesis with prefabricated polyurethane film⁶⁻¹⁰ and for



Fig. 1. Retentive bar connects 2 implants positioned to support auricular prosthesis.

bonding silicone to the acrylic resin substructures of extraoral prostheses.^{11,12}

Currently manufactured hearing aids may not readily fit the contours of implant-retained auricular prostheses. This article describes a technique that allows a modular hearing aid device to be inserted into a custom “sleeve” in the polyurethane-lined auricular prosthesis.

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Fig. 2. Superior surface of acrylic resin substructure.



Fig. 4. Acrylic resin substructure mold.



Fig. 3. Completed auricular pattern and BTE hearing aid.



Fig. 5. Loops pulled through backside of Velcro strip.

TECHNIQUE

Bar and retentive substructure fabrication

1. Make a master cast, wax the auricular prosthesis, and then design and fabricate the implant bar. Verify the fit of the metal framework clinically (Fig. 1).
2. Position plastic retention clips on the bar, and fabricate an acrylic resin substructure (Fig. 2).
3. Secure the auricular wax pattern with the embedded BTE (nonfunctional duplicate) onto the acrylic resin substructure, and verify correct orientation and fit on the patient (Fig. 3).
4. Prepare a 2-mm space between the skin and intaglio surface of the substructure to prevent soft tissue irritation caused by moisture accumulation.¹³
5. Duplicate the master cast, and fabricate a perforated cast.⁷ Secure the wax pattern with the

embedded BTE analogue to the perforated master cast. Expose sufficient surface area of the BTE to ensure retention in the stone mold.

6. Flask the pattern and bar in a 3-part stone mold.
7. Follow conventional procedures for wax elimination of the mold.
8. Make a 2-part mold of the acrylic resin substructure (Fig. 4).
9. Remove a layer of acrylic resin from the substructure, taking care not to encroach on the position of any retentive attachments.
10. Prepare a Velcro strip¹² (Velcro USA, Inc, Manchester, N.Y.), with the loops down, by running a rosehead bur (GEBR Brassler GmbH & Co KG, Lemgo, Germany) at slow speed through the back of the strip, engaging some of the loops. Pull the bur through the Velcro strip at approximately 2-mm intervals. This procedure creates a double-sided Velcro strip (Fig. 5).



Fig. 6. Silicone applied to resin substructure and polyurethane lining.



Fig. 7. Processed auricular prosthesis.

11. Cut the Velcro strip to the prepared substructure contours.
12. Replace the acrylic resin substructure in the mold.
13. Apply Dent-Kote (Dentsply/York Division, Dentsply International, Inc, York, Pa.) to the acrylic resin margins to seal the acrylic resin/mold interface.
14. Apply autopolymerizing acrylic resin, mixed according to manufacturer's directions, to the substructure.
15. Position the Velcro strip on the substructure engaging the fibers, which have been pulled through the back surface.
16. Close the 2-piece stone mold to allow for compression of the Velcro tags into the acrylic resin mixture. Secure the mold with rubber bands or a clamp, and submerge the assembly in warm water



Fig. 8. Auricular prosthesis after extrinsic coloration.

in a pressure pot at 20 psi until polymerization is complete.

17. Trim excess acrylic resin and Velcro with a flame-shaped carbide bur, and shorten the exposed Velcro loops with scissors.

Prosthesis Fabrication

1. Position a polyurethane sheet in a vacuum former (Buffalo Manufacturing, Buffalo, N.Y.). Coat the bonding surface twice with a reagent grade acetone, and allow it to dry. Apply one coat of 1205 prime coat (Dow Corning Corp, Midland, Mich.), and allow it to dry for 15 minutes at room temperature.
2. Heat the polyurethane until it sags one-half inch below the frame. Apply the vacuum, and adapt the sheet to the perforated master cast.
3. Prepare a 60:40 mixture by volume of Medical Adhesive Silicone Type A (Dow Corning Corp) and Silastic MDX4-4210 medical grade elastomer (Dow Corning Corp) that has been properly shaded to the patient's skin tone.
4. With the vacuum on, position the acrylic resin substructure, and apply a layer of pure Medical Adhesive Silicone Adhesive Type A directly to the polyurethane sheet and exposed Velcro tags (Fig. 6).
5. Add intrinsic staining and characterization as desired directly to the mold surface, and pack the mold with the prepared silicone.
6. Remove the assembly from the vacuum former, secure the assembly with clamps, and set it aside for 24 hours to polymerize.
7. Remove the prosthesis from the mold, and trim the borders of the polyurethane (Fig. 7).
9. Verify fit and orientation of the prosthesis on the patient, and apply extrinsic colorants as needed (Fig. 8).



Fig. 9. Fitting surface of BTE within silicone prosthesis.

10. Replace the BTE analogue with its functional counterpart (Fig. 9).
11. Instruct the patient in the care of the skin surrounding the abutments and in the care of the prosthesis.

SUMMARY

The use of a custom sleeve to retain a behind-the-ear hearing device in an implant-retained, polyurethane-lined auricular prosthesis has been described. When a conventional hearing aid cannot be used, this device allows the patient to take advantage of binaural cues.

REFERENCES

1. Loovis CF, Schall DG, Teter DL. The role of assistive devices in the rehabilitation of hearing impairment. *Otolaryngol Clin North Am* 1997;30:803-47.

2. Burton MJ, Niparko JK, Johansson CB, Tjellstrom A. Titanium-anchored prostheses in otology. *Otolaryngol Clin North Am* 1996;29:301-10.
3. Wolfaardt JF, Wilkes GH, Parel SM, Tjellstrom A. Craniofacial osseointegration: the Canadian experience. *Int J Oral Maxillofac Implants* 1993;8:197-204.
4. Arcuri MR, Rubenstein JT. Facial implants. *Dent Clin North Am* 1998;42:161-74.
5. Popelka GR, Gates GA. Hearing aid evaluation and fitting. *Otolaryngol Clin North Am* 1991;24:415-28.
6. Taft RM, Cameron SM, Knudson RC, Runyan DA. The effect of primers and surface characteristics on the adhesion-in-peel force of silicone elastomers bonded to resin materials. *J Prosthet Dent* 1996;76:515-8.
7. Udagama A. Urethane-lined silicone facial prostheses. *J Prosthet Dent* 1987;58:351-4.
8. Wang R, Collard SM, Lemon J. Adhesion of silicone to polyurethane in maxillofacial prostheses. *Int J Prosthodont* 1994;7:43-9.
9. Gonzalez JB. Polyurethane elastomers for facial prostheses. *J Prosthet Dent* 1978;39:179-87.
10. Lemon JC, Martin JW, King GE. Modified technique for preparing a polyurethane lining for facial prostheses. *J Prosthet Dent* 1992;67:228-9.
11. Lemon JC, Martin JW, Echeverri JC, King GE. An acrylic resin core for processing silicone facial prostheses. *J Prosthet Dent* 1992;67:374-6.
12. Zolty J. A practical method of bonding silicone elastomer to acrylic resin. *J Facial Somato Prosthetics* 1995;1:29-32.
13. Bergstrom K. Anaplastological technique for facial defects. In: Branemark PI, De Oliveira, MF, eds. *Craniofacial prostheses. Anaplastology and osseointegration*. Chicago: Quintessence Publishing Co, Inc; 1997. p. 101-10.

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