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Self Retentive Partial Silicone Auricular Prosthesis: A Case Report

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Abstract - *An auricular prosthesis may be required for a number of conditions including congenital abnormalities, malignancy and trauma, which result in disfigurement of the pinna. Whatever the cause of the absence of the pinna, it is a significant loss of a prominent part of the face for the person involved. This article describes a simple and cost effective technique for retention of a silicone partial auricular prosthesis. A Fish-bone shaped substructure (FSS) designed and fabricated using orthodontic wire and autopolymerizing acrylic resin, was embedded into the silicone elastomer of a self-retentive silicone prosthesis. The prosthesis is designed to overcome the disadvantages associated with traditionally fabricated prostheses; namely poor structural strength, inadequate retention, poor adaptation and durability over time.*

KEY WORDS: Auricular prosthesis; Retention of prosthesis; Prosthesis substructure

INTRODUCTION

The need for an auricular prosthesis may result from congenital abnormalities, malignancy or trauma. Whatever the cause of absence of the pinna, it is a significant loss of a prominent part of the face with considerable cosmetic anxiety for the person affected[1]. Smaller defects may be repaired by secondary reconstructive surgical procedures including: wedge repair, skin grafts, advancement or transposition flaps, or the chondrocutaneous helical rim advancement flap[2]. Larger defects involving significant loss of cartilage often require staged island pedicle or interpolation pedicle flaps[3-5]. However, some patients prefer not to undergo reconstructive surgical procedures or may require a long delay before reconstruction because of an underlying medical condition or the need to monitor the area for recurrence of an aggressive skin malignancy. The fabrication of a silicone auricular prosthesis in such situations is a good alternative option. Retention of the auricular prosthesis is always a challenge for the prosthodontist. Conventionally, the auricular prosthesis can be retained by snapping it onto patient's eyeglass earpiece or using specially formulated facial prosthetic adhesives [6]. Limitations like inability to wear eyeglasses and hygiene concerns of adhesive retained prostheses limit their use in most situations. Use of craniofacial osseointegrated implants for retention of auricular prosthesis offers excellent support and retentive abilities. Subperiosteal grouped implants also offer an alternative in unfavorable anatomic situations [7-9,10]. Silicone auricular prostheses can be retained with the use of bar-clip attachments or magnets when osseointegrated implants are used[11-13]. Some patients, however, may refuse additional surgical procedures for implant placement citing economic or health constraints. This article describes a simple technique to retain a partial silicone auricular prosthesis. A Fish-bone shaped substructure (FSS) designed and fabricated using orthodontic wire and autopolymerizing acrylic resin, was embedded into the silicone elastomer producing a self-retentive silicone prosthesis.

* MDS

CASE HISTORY

A 54 year old man presented wishing to replace his missing left ear. The patient lost part of his left ear 3 years previously in a traumatic accident. Surgical reconstruction of the ear had been attempted, but did not prove successful, leaving the patient with the present defect. On examination the auricular defect was found to be partial with the helix of the external ear intact. Various treatment modalities were discussed with the patient, including prosthesis retained by osseointegrated implants. The patient refused to undergo any additional surgical procedures. Hence a prosthesis retained by a hook suspended from the base of his pinna was planned.

Proceedure

An impression of the auricular defect was obtained using medium body polyether (Impregum Penta, ESPE, Norristown, Pa.) and light-body polyvinyl siloxane (Reprosil; Dentsply DeTrey GmbH, Konstanz, Germany) as described by Kubon *et al.*[14]. A master cast was fabricated in Type IV gypsum material (Ultrarock; Kalabhai Karson, Mumbai, India) (Fig. 1). The missing portion of the ear was sculpted with baseplate wax (Modelling wax; Deepti Dental Products of India, Ratnagiri, India) from the impression of the contralateral ear and tried on patient's face[15]. The master cast was invested along with the wax sculpture into the base flask (Fig. 2). The flasking procedure was completed to form a mould in three sections using type II gypsum material (Dental plaster; Kalabhai Karson, Mumbai, India) as per the guidelines given by Allen[1]. The first section of the mould was the master cast invested in the base flask, the second section was the portion of the mould (in two halves) below the height of contour of the pinna and the

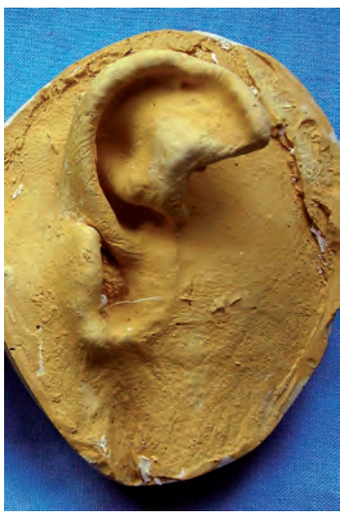

Figure 1. *Master cast of defective ear.*

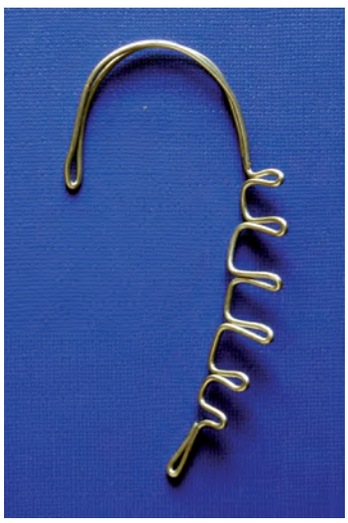

Figure 4. *Wire manipulated into fish-bone shaped framework.*

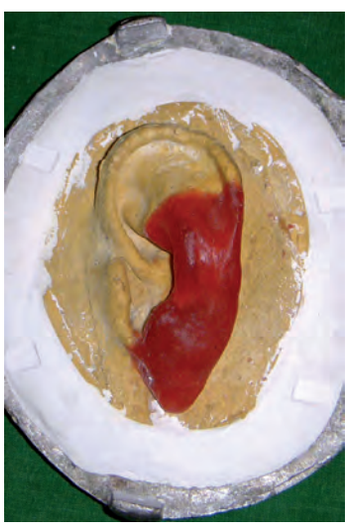

Figure 2. *Master cast with final wax sculpture invested in base flask (first section of the mold).*

Figure 3. *Three sections of the mold.*

third section was the portion above the height of contour of the pinna. All the sections of the mould were indexed to reassemble accurately (Fig. 3). Once fully hardened, the entire mould was placed in hot water to soften the wax pattern and subsequently the mold sections were separated. All traces of wax were removed from the mould in preparation for the packing procedure. A 19 gauge hard round stainless steel orthodontic wire (KC Smith & Co; Monmouth, UK) was manipulated to form a 'fish-bone shaped' wire framework as represented in figure 4. The wire framework was checked on the master cast and manipulated with universal pliers. The wire framework was shaped to form six "U loops" (with both arms of each loop pinched together) occupying the entire dewaxed (missing) portion of the pinna and one "hook" engaging the base of the pinna (origin of the external ear from the head) to aid in retention of the prosthesis (Fig. 4). The loops were kept approximately 6-8 mm apart from each other during manipulation. The number of loops incorporated in the design depends on the superio-inferior length of the auricular defect. The length of each loop should be kept 4-6 mm short of the closest outer border of the defect. Both halves of the intermediate section of the mould (surrounding the base of the pinna) were relieved sufficient enough to provide space for the "retentive hook" of the wire framework. The intermediate sections of the mould were placed in position and the planes of the loops of the wire framework were adjusted to completely embed in the silicone without exposure. Care was taken to keep a minimum of 2 mm of space all around the framework for overlying silicone. The third section of the mould was checked for complete seating with wire framework in position, without interferences. The wire framework was coated with a layer of autopolymerizing pink acrylic resin (DPI RR Cold cure; Dental Products of India, Mumbai, India) (Fig. 5) thus completing the fabrication of the FSS. The acrylic resin was extended below the substructure by keeping it in final position to form 3-4 widely distributed stops (2 mm in diameter) resting on the mould surface to maintain uniform space under the FSS. All the sections of the flask were reassembled to check for interferences. Application of the resin layer bonded the wire components together

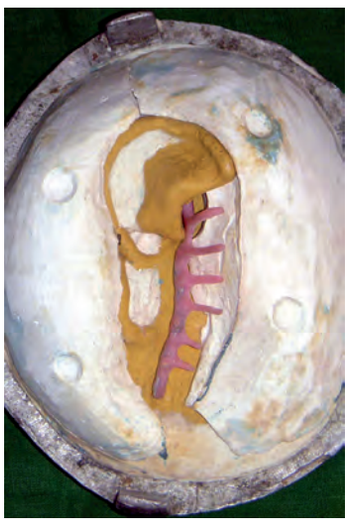

Figure 5. *Acrylic resin applied to complete the fish-bone shaped substructure prior to packing.*

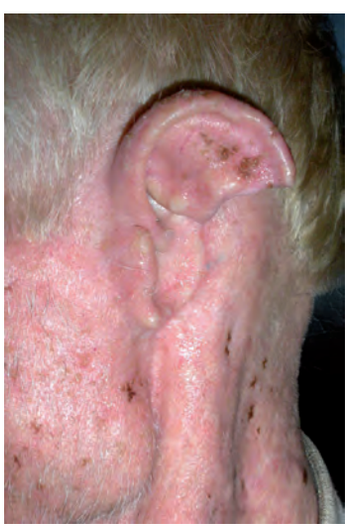

Figure 6A. *Auricular defect.*

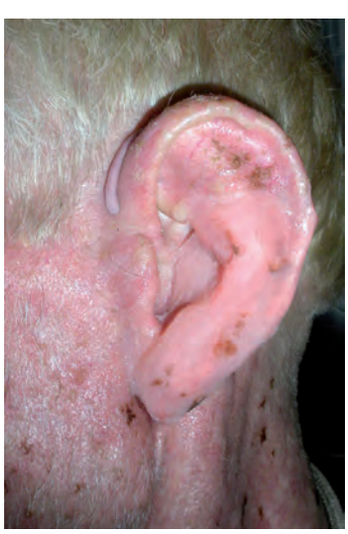

Figure 6B. *Reinforced partial auricular prosthesis retained by substructure hook.*

and permitted the application of an adhesive agent to the substructure prior to packing of silicone in the mould. A thin layer of medical adhesive type A (Factor II, Lakeside, Ariz) was applied to the FSS to facilitate bonding of the framework to the silicone. The prosthesis was packed with MDX4-4210-base silicone (Dow Corning Corp, Midland, Mich.) and coloured using intrinsic stains (KT-699, Silicone Colouring Kit; Factor II, Lakeside, Ariz) selected according to the patient's skin colour. The polymerization cycle was carried out according to the manufacturer's instructions (2 hours at 90°C) and the prosthesis was deflasked, trimmed and cleaned. Polyurethane liner was applied on the intaglio surface of the prosthesis to provide a smooth and hygienic intaglio surface. The prosthesis was tried on the patient and extrinsic colouring (**KT**-199 - Extrinsic Coloration System, **Factor II**, Lakeside, Ariz) completed. The prosthesis was finished and polished in a conventional manner and seated using the retentive-hook hooked around the base of the pinna. (Fig. 6 A and B). The prosthesis was delivered and the patient was educated regarding the care of the prosthesis and hygiene maintenance. The method of wearing and removing the prosthesis was demonstrated to the patient. Hygiene instructions were reinforced and recall appointments were scheduled on a regular basis for examination of the defect and the prosthesis. Two recall appointments at 6 months and 15 months post-delivery of the prosthesis were completed. The prosthesis showed satisfactory function and aesthetics at both visits. However discoloration of the silicone over time was anticipated and the patient was advised to report for regular 6 monthly recall appointments.

DISCUSSION

Methods of retention described for ear prostheses include self-retention (where the prosthesis engages undercut areas), silicone adhesives, snapping the prosthesis onto eyeglass earpiece and magnet or bar-clip attachment with osseointegrated implants[1,6-12]. The self-retention method is not a consideration for auricular prostheses, except in situations where a pedicle has been created, allowing the flexible material to clip into its undercut areas. Retention with adhesives is fraught with limitations like poor retentive quality and inability to maintain hygiene. The need to wear eye glasses along with the prosthesis, limits the use of the eyeglass retained option. Nelogi *et al* described a cost effective technique using resin template for better retention and orientation of silicone auricular prostheses[16]. In the technique described in our article, the hook of the FSS (adapted around the base of the pinna) allows satisfactory retention of the prosthesis without the requirement of eye glasses or adhesives. The only limitation of the FSS is that it requires an intact base of the pinna to engage the retentive hook.

The FSS fabricated for the silicone prosthesis in this article serves the purpose of retention as well as reinforcement of silicone auricular prosthesis. Distanis[17] used acrylic resin as an integral part of the sililcone pinna, forming a framework representing a cartilaginous structure within the prosthesis. The auricular prosthesis described in this article uses a similar concept of a substructure forming a cartilaginous scaffold in a silicone prosthetic ear. The wire framework of the FSS is designed in such a way that it embeds itself completely inside the silicone with a minimum of 2 mm

of silicone around the substructure at the thinnest portion of the prosthesis. A thin layer of autopolymerizing acrylic resin (laminated to the wire framework) allows binding of the wire loop-arms together and permits application of an adhesive agent to the substructure prior to packing silicone in the mould. An adhesive layer applied to the FSS helps achieve a satisfactory bond at the silicone-resin interface thus reinforcing the silicone prosthesis[18]. Techniques have been described for bonding silicone to the acrylic resin substructures of extraoral prostheses[18-20]. Polyurethane is often used as a liner for silicone facial prostheses which seals the porous silicone material, limits the fungal growth, increases tear strength and improves aesthetics of the margins. Techniques have been described for lining a silicone facial prosthesis with polyurethane liner[11,21-23].

The increased weight of resin substructures is also a detriment to the prosthodontist's aim of minimizing the weight of the prosthesis. The FSS described in this article is lighter in weight than conventional acrylic resin substructures used for auricular prostheses. A glass fibre-reinforced composite substructure to reinforce the silicone elastomer of a large facial prosthesis has also been used as an alternative[24]. Though this procedure is an advanced option for fabrication of the extraoral prosthesis, technique sensitivity and increased cost limits its utility. Also, the long term durability of this material has not yet been substantiated as compared to the more durable option of using acrylic resin as reinforcing material. Manufacture of implant-based ear prosthesis and substructures by means of a computer aided design-computer aided manufacturing (CAD-CAM) procedure and rapid prototyping (RP) technology is a time saving and reproducible option. The unavailability of CAD CAM and RP technology, is the only constraint in universal use of this technique [25].

CONCLUSIONS

A simple and cost effective method of retaining and reinforcing an auricular prosthesis with a resin substructure has been described in this paper. The durability of the FSS permits its reuse in subsequent prostheses if the silicone needs to be replaced over time. Although anatomical limitations limit the use of this technique, it can prove to be a solution for certain situations, where modern, complex treatment options cannot be applied.

ADDRESS FOR CORRESPONDENCE

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