Case Report

Rehabilitation of a missing ear with an implant retained auricular prosthesis

Satyabodh Sheshraj Guttal, Shruti Shanbhag, Sudhindra S. Kulkarni[1], Srinath L. Thakur[2]

Department of Prosthodontics, [1]Department of Oral Implantology, SDM College of Dental Sciences and Hospital, Dharwad, Karnataka, [2]SDM College of Dental Sciences and Hospital, Dharwad, Karnataka, India

Abstract

Burns can leave a patient with a severely debilitating disability even after treatment. The objectives of burn rehabilitation are to minimize the adverse effects caused by the injury while rehabilitating the patient's physical and psychological well-being, maximizing social integration. Long-term success of maxillofacial prostheses mainly depends on the retention. Extra oral implant retained prostheses have proved to be a predictable treatment option for maxillofacial rehabilitation. Replacement of a severely deformed external ear with burned tissues may be satisfactorily accomplished by a cosmetic prosthesis anchored by implants integrated in the skull. The use of such implants is now a well-recognized method for creating a stable result in maxillofacial rehabilitation. This case report describes a safe, simple and economical method for the rehabilitation of a patient with missing right auricle using an implant supported silicone prosthesis. The implant was placed in the mastoid region of the temporal bone. Reconstruction of the ear was done with auricular silicone prosthesis, retained using magnets incorporated in an autopolymerizing resin shim to decrease the weight of the prosthesis on a single implant. This method eliminates the need of tedious laboratory procedures and exact casting and fitting requirements of a metal substructure while minimizing the overall weight and cost of the prosthesis while maintaining adequate support, esthetics and retention of the prosthesis.

Key Words: Auricular prosthesis, burn patient, implant retained prosthesis, magnet retained prosthesis

Address for correspondence:
Dr. Satyabodh Sheshraj Guttal, Department of Prosthodontics, SDM College of Dental Sciences and Hospital, Dharwad - 580 009, Karnataka, India.
E-mail: drsatyabodh@gmail.com

Received: 20th August, 2014, **Accepted:** 26th March, 2015

INTRODUCTION

Maxillofacial defects may have a profound psychological impact on the patient. With the rehabilitation of these defects, we not only restore normalcy to the patient's face, but also restore his self-image and the ability to function and interact in a social environment, thus giving him the confidence needed to live in society.

Access this article online	
Quick Response Code:	Website: www.j-ips.org
	DOI: 10.4103/0972-4052.155046

A maxillofacial prosthodontist must undertake the task of head and neck rehabilitation posttrauma in cases where a surgical approach is no longer possible.

Burns can leave a patient with severely debilitating and deforming contractures, which can lead to significant disability even after treatment. The objectives of burn rehabilitation are to minimize the adverse effects caused by the injury in terms of maintaining a range of movement, minimizing contracture development, maximizing functional ability, maximizing psychological wellbeing, maximizing social integration.[1]

Maxillofacial rehabilitation is advantageous for such patients because it allows for early rehabilitation, shortening surgery and

hospitalization time, lowering treatment cost, and allowing the patient early psychosocial reintegration.[2,3]

The use of implants in maxillofacial prosthetics provides patients with a predictable esthetics, improved retention and stability of their prostheses in comparison with other retention methods. Traditional methods include the use of medical-grade skin adhesives, spectacles, and tissue undercuts. These modalities are associated with difficulties related to retention reliability, stability, adverse tissue reactions, and accelerated discoloration and prosthesis deterioration, discomfort, and reduced acceptance.[4]

Implant retained prostheses are a suitable option for their enhanced retentive property and are preferable to surgical reconstruction which may have unpredictable results. The construction of the missing auricle puts a test on the skill of the prosthodontist to reproduce the form, texture and tone of the existing contralateral ear but its successful rehabilitation is a rewarding experience for the dentist and patient alike.

This clinical report describes the rehabilitation of a patient who had received substantial burns to the face with loss of the right auricle by overcoming challenges including lack of conventional retentive modalities and the compromised condition of surrounding burn tissues.

CLINICAL REPORT

A 47-year-old male patient was referred to the Department of Maxillofacial Prosthodontics and Maxillofacial Prosthetics with the chief complaint of facial disfigurement along with the loss of the right ear after severe burns received to the face. The patient had received these burns several years ago when scalding hot water fell on the right side of the face [Figure 1].

The patient was extremely concerned about his facial disfigurement and requested for an economic solution for replacing the missing ear in order to regain some normalcy of appearance.

A thorough evaluation of the affected area, medical history, and physicians consent was taken. External examination revealed scarring of tissue with gross discoloration, complete loss of hearing from the right ear. A dermatologic evaluation was conducted which revealed that the patient had scarred tissue, decreased blood supply to the area, increased contracture formation; and reduced epithelialization and collagen formation.

A radiographic evaluation conducted showed suitable bone quality, adequate thickness of the temporal bone and density of the mastoid air cells to receive implants. Three-dimensional (3D) lateral cephalography were recorded of the affected and normal side along with soft tissue reconstruction.

A stereolithographic model was obtained of the patient's temporal bone and temporomandibular joint [Figure 2]. Sites for the placement of implants were located and marked and used as a guide to fabricate a surgical stent for use during surgery.

A single stage implant placement surgery was carried out. The surgical site was isolated, and the surgical stent was fastened in place with surgical tape and used as a guide. The surgical procedure was conducted as a routine under local anesthesia. Two (3.75 mm × 10 mm) Branemark Mark II implants were placed in the region of the missing right auricle, in the mastoid bone of the temporal bone of the patient [Figure 3].

The higher placed implant showed adequate stability and osseointegration 4 months postoperatively while the lower placed implant showed repeated signs of infection and was subsequently submerged and left as a sleeping implant.

The opposing left ear was normal and healthy, and was used as a guide for the fabrication of the wax pattern for the missing auricle. To make an impression of the healthy ear, an unused casting ring of adequate dimensions was used to hold the irreversible hydrocolloid impression material (Algitex; Dental Products of India, Mumbai, India). The surrounding hair was coated with petroleum jelly, and the ear canal was blocked with cotton. The alginate was first coated into the folds of the ear in a thin consistency, followed by application in bulk. The impression was further stabilized using the impression plaster. The impression was beaded and boxed and poured in dental stone (Kalastone; Kalabhai Pvt Ltd., Mumbai, India).

Using this mold of the left ear, a wax pattern of the right ear was carved out as a mirror image of the opposite side using modeling wax (Hindustan Dental Products, Hyderabad, India) [Figure 4].

Figure 1: Preoperative frontal and profile view of the patient

The implant abutment was blocked out with carding wax. The surrounding tissue was coated with petroleum jelly. Light body consistency of polyvinyl siloxane elastomeric impression material (Aquasil, Dentsply, Caulk, Milford, Del) was applied to the implant and surrounding tissues, followed by a base of putty consistency polyvinyl siloxane elastomeric material (Aquasil, Dentsply, Caulk, Milford, Del). Impression compound was further layered above to give rigidity to the impression. The impression was boxed and poured in die stone (Elite Rock-extra hard, Zhermack, Germany).

The retrieved cast was used as a template to fabricate a shim of clear autopolymerizing acrylic resin (DPI Cold Cure; Dental Products of India Ltd.,) to hold the prosthesis. A triangular shaped acrylic shim was fabricated which was attached to an acrylic cap to be cemented on the implant abutment. Samarium cobalt magnets of 4 mm diameter were embedded into the three angles of the acrylic triangle using an autopolymerizing acrylic resin [Figure 5].

Another acrylic triangle of similar dimensions as the original was fabricated to support the magnets of the opposing poles to be embedded into the final prosthesis. It was ensured that the magnets were of differing polarities such that the two triangular shims fit together in only one orientation. Care was taken to ensure proper incorporation of the magnets with the autopolymerizing resin to avoid abrasion during the final polishing.

The sculpted wax model of the missing right ear was tried on the patient's face, and its size, orientation and position was confirmed to ensure symmetry with the opposing side [Figure 6]. The acrylic shim with cap was cemented in position onto the implant abutment using glass ionomer cement in luting consistency. Excess was removed allowing space for cleansibility around the implant. The opposing acrylic shim was embedded into the sculpted auricular model, and the position was finalized chair side.

After satisfactory positioning, the acrylic shim was sealed into the wax pattern, and the entire framework was flasked and invested using a combination of dental stone and die stone forming a three piece mold. After wax elimination, the die stone component was separated out of the flask to aid in layered packing of the maxillofacial silicone. Gold Primer (A-330-Gold, Factor II, Lakeside, AZ) was applied to the acrylic to assist bonding with the silicone. Color matching was done using intrinsic colors (Principality Medical, UK) to blend with the patient's skin tone and the medical grade silicone (Cosmesil M511 - part A and B, Cosmesil Prosthetic System, South Wales, UK) was packed into the mold and left to cure for 1 h at 100°C.

The prosthesis was retrieved and finished, and an initial trial was performed. Extrinsic tinting Principality Medical, UK) was performed to further blend with the patient's skin tone. The

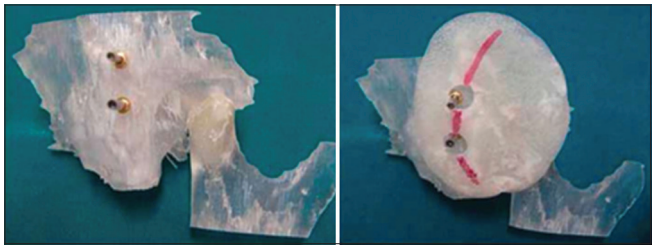

Figure 2: Surgical stent fabricated on the stereolithographic model of temporal bone

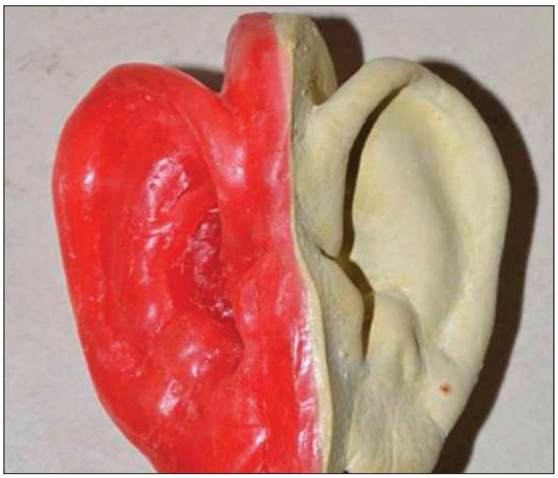

Figure 4: Wax up of mirror image of contralateral ear

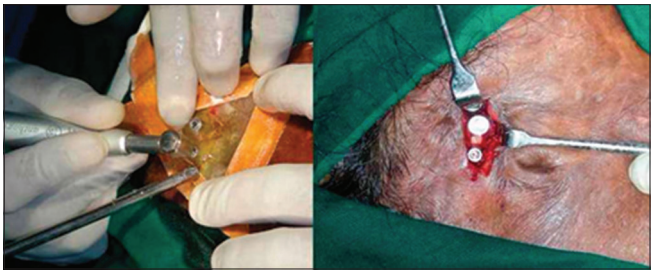

Figure 3: Surgical procedure for implant placement

Figure 5: Acrylic shim trial on patient face

excess silicone was cut out. The light weight of the prosthesis ensured easy support by the magnets.

The final fitting of the prosthesis was done, and the patient was instructed on the placement and removal as well as the home care instructions of the same [Figure 7]. A follow-up evaluation of 3 months was ensured.

DISCUSSION

Deformity in the burned ear may be characterized by various combinations such as: (i) The presence of scarred skin at the site of, and surrounding the ear, with dramatic loss of skin elasticity; (ii) the presence of longitudinal scars of the pinna due to previous drainage of the perichondritis as an initial trial for saving the ear; (iii) absence of different components of the framework of the ear, mostly the helix/antihelix complex (the cartilage-containing part) with or without the ear lobule.[5]

Patients with missing ears deserve comprehensive care that could be of the following types. Surgical treatment including the autogenous ear reconstructive surgery, use of osseointegrated implants and bone anchored hearing aid. Reconstruction techniques vary from Brent's 4-stage technique to Nagata's 2-stage surgery. Prosthetic replacement is a more suitable option for patients who are not surgical candidates, e.g. those with high operative risk, failed previous reconstructions and severely compromised conditions like burned tissues.[6]

Extraoral implant retained prosthesis have been proven to be a predictable treatment option for maxillofacial rehabilitation. Implant retained auricular prosthesis provide multiple advantages for the patient: Convenience, security, consistent retention and positioning, elimination of the need for adhesives, and maintenance of marginal integrity and longevity.[7]

The densely corticated bone of the auricular region makes it easy to stabilize the implant at surgery, and the vasculature in this region ensures the maintenance of a bone/implant interface adequate to support the functional loads.[8] Despite the inability to use both implants, in this case, the suitable bone surrounding the implant, and successful osseointegration enabled the use of the single implant supporting a light weight prosthesis.

Not using adhesives long-term can prolong the life of the prosthesis. Specifically, they eliminate disengagement caused by surrounding soft tissue movement or perspiration, which can result in loss of contact of the silicone prosthesis margins. Furthermore, elimination of adhesives can eliminate tissue irritation. The implant-retained auricular prosthesis has become a viable treatment alternative for auricular deformed patients because of its predicable results.[7] Branemark intraoral implants were used in the present case. Extra-oral implants differ from

Figure 6: Trial of waxed up ear on patient's face-frontal and profile view

Figure 7: Final prosthesis-frontal and profile view

intra-oral in terms of length and prosthetic platform. Ideally, small length implants are placed in the auricular region. However, in this case, there was sufficient bone length; hence 10 mm intra-oral implants were placed in the mastoid air cells. Though the inside bone was porous with spaces, the 3 mm cortical bone at the surface gave good primary stability for the implant.

Similar case reports[9] suggest the use of a magnet and bar clip retained prosthesis as the primary source of retention for an implant supported prosthesis. In the present case report due to the inability to use both implants, light weight magnets were found to be more suitable than a bar and clip. The use of metal components would have increased the weight on the single implant, so the use of autopolymerizing acrylic resin was preferred.

Chung *et al*.[10] made use of a composite bar to eliminate the costly and technique-sensitive casting procedures. In the present study, an alternative of autopolymerizing acrylic resin was used to retain the prosthesis with the use of Gold Primer to bond the acrylic resin to the silicone structure.

The use of magnets is advantageous over other attachments because metal clips may fracture over time making revision and repair difficult. Furthermore, they are easily available,

economical, hygienic, esthetic and convenient to use and maintain and replacement is easy.[10]

The patient's financial condition also suited the use of magnets which are indigenously acquired and economical. Furthermore, the use of autopolymerizing resin for the framework is more economical and less technique sensitive than a cast framework which would increase the overall cost and weight of the prosthesis.

Use of a triangular framework provides an increased area for placement of larger magnets and the use of an increased number of magnets. This also helped increase the surface area for support and retention of the prosthesis on a single implant. Because the flexural strength of autopolymerizing resin is lower than precious alloys, the thickness of each bar must be increased for adequate stiffness and accommodation of keepers. The thickness of the bar itself also provides additional support for the ear prosthesis against gravitational and lateral dislodgement forces.[10]

Lemon and Chamber[11] gave an active, passive engagement of a Slant-Lock system to improve the retention of the prosthesis which is unlike the breakaway force required to disengage the prosthesis as in magnets. However, a large amount of vertical space is required to incorporate the attachment which can be problematic.

Intrinsic coloring of silicone is difficult to master for proper matching with the adjacent tissues and the use of extrinsic stains are useful in providing the additional effect to further improve the esthetic appeal of the prosthesis. The intrinsic coloring was done based on the silicone shade guide reported by Guttal *et al*.[12]

In the present situation, the patients burnt half of the face showed substantial color difference in comparison with the normal side. After consulting with the patient, it was decided that the color tone of the replacement ear would be matched to the burned skin to help blend better for a more natural appearance. However, a slight discrepancy in color match was observed in the end result. The severe skin contractures and reduction of malar prominence on the affected side of the patients face due to burns, and further during reconstructive grafting, resulted in difficulty in accurate symmetric placement of the ear.

The future trends in auricular cartilage engineering include stem cell, biomaterial, and bio-molecules. Researchers have demonstrated that neo-cartilage can be constituted in a predetermined shape and in complex 3D structures, such as a human ear, using cell transplantation on polymer constructs. However, these are still in the trial phase, and many unsolved problems exist. No perfect materials and methods have been found to substitute the shapely elastic cartilage normally present in the ear, and the current constructs have not proven to be durable over time. Further *in vitro* and *in vivo* studies are required before these become a clinical norm.[13]

The end result showed a suitably retentive, well-stabilized prosthesis. The magnets on the acrylic shim helped in proper orientation and fixation of the silicone ear. The symmetric placement and size ensured a good fit with the help of the implant providing for a natural looking replacement albeit with a slight discrepancy in color match.

The patient was satisfied with the end result of the prosthesis. At follow-up visits, he informed us of increased social interaction due to acceptance of the prosthesis by his peers.

It is important to remember that each patient is different, and the technique for rehabilitation and handling will differ with each case. The treatment plan must be customized for every individual to ensure a tailor made prosthesis that becomes a part of the patient's body.

SUMMARY

Although challenging, maxillofacial prosthesis can be an excellent mode of rehabilitation of patients if successful. This article describes the reconstruction of a missing right auricle of the patient using an implant supported silicone prosthesis which is retained using indigenously acquired magnets. It is a simple technique which was suitable for the patient and prosthodontist with its simplified clinical and laboratory procedures along with reduced cost of the prosthesis.

ACKNOWLEDGEMENTS

The authors thank Dr.Shweta Poovani Pradeep, Reader, Rajarajeshwari Dental College, Bengaluru, for her initial assistance in this case.

REFERENCES

1. Procter F. Rehabilitation of the burn patient. Indian J Plast Surg 2010;43 Suppl: S101-13.
2. Hatamleh MM, Watson J. Construction of an implant-retained auricular prosthesis with the aid of contemporary digital technologies: A clinical report. J Prosthodont 2013;22:132-6.
3. Goiato MC, Pesqueira AA, Ramos da Silva C, Gennari Filho H, Micheline Dos Santos D. Patient satisfaction with maxillofacial prosthesis. Literature review. J Plast Reconstr Aesthet Surg 2009;62:175-80.
4. Hatamleh MM, Haylock C, Watson J, Watts DC. Maxillofacial prosthetic rehabilitation in the UK: A survey of maxillofacial prosthetists' and technologists' attitudes and opinions. Int J Oral Maxillofac Surg 2010;39:1186-92.
5. Ibrahim SM, Salem IL. Burned ear: The use of a staged Nagata

technique for ear reconstruction. J Plast Reconstr Aesthet Surg 2008;61 Suppl 1:S52-8.
6. Wang RR, Andres CJ. Hemifacial microsomia and treatment options for auricular replacement: A review of the literature. J Prosthet Dent 1999;82:197-204.
7. Ozturk AN, Usumez A, Tosun Z. Implant-retained auricular prosthesis: A case report. Eur J Dent 2010;4:71-4.
8. Kumar PS, Satheesh Kumar KS, Savadi RC. Bilateral implant-retained auricular prosthesis for a patient with congenitally missing ears. A clinical report. J Prosthodont 2012;21:322-7.
9. Del Valle V, Faulkner G, Wolfaardt J, Rangert B, Tan HK. Mechanical evaluation of craniofacial osseointegration retention systems. Int J Oral Maxillofac Implants 1995;10:491-8.
10. Chung RW, Siu AS, Chu FC, Chow TW. Magnet-retained auricular prosthesis with an implant-supported composite bar: A clinical report. J Prosthet Dent 2003;89:446-9.
11. Lemon JC, Chambers MS. Locking retentive attachment for an implant-retained auricular prosthesis. J Prosthet Dent 2002;87:336-8.
12. Guttal SS, Patil NP, Nadiger RK, Kulkarni R. A study on reproducing silicone shade guide for maxillofacial prostheses matching Indian skin color. Indian J Dent Res 2008;19:191-5.
13. Sterodimas A, de Faria J, Correa WE, Pitanguy I. Tissue engineering and auricular reconstruction: A review. J Plast Reconstr Aesthet Surg 2009;62:447-52.

How to cite this article: Guttal SS, Shanbhag S, Kulkarni SS, Thakur SL. Rehabilitation of a missing ear with an implant retained auricular prosthesis. J Indian Prosthodont Soc 2015;15:70-5.

Source of Support: Nil, **Conflict of Interest:** None.