Rehabilitation of Auricular Defect with Implant-Retained Auricular Prosthesis - A Case Report

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Abstract

Rationale: Maxillofacial defect is of great concern physically, emotionally, and psychologically for a patient. However, it is an even bigger challenge for a team attempting rehabilitation, as a crucial decision has to be made between surgical approach and/or prosthetic rehabilitation. However, if both are combined, it will result in best of esthetics and function with ease of maintainance, resulting in a sucessful rehabilitation. This case report represents a case of auricular defect rehabilitated with a combination of implants and bar-retained silicone prosthesis. **Patient Concern:** A 38-year-old male patient with right auricular defect reported with the main concern of esthetic rehabilitation of a lost part of the external ear. **Diagnosis:** With through evaluation and examination, a diagnosis of acquired partial auricular defect of the right side secondary to trauma was established. **Treatment:** An implant-retained auricular prosthesis was planned for this case. Surgically, three intraoral implants were placed in the mastoid bone, and after healing, bar framework was fabricated and attached. Finally, silicone prosthesis was fabricated and delivered to the patient. **Outcome:** A successful rehabilitation was carried out in this case using implants and bar attachment for retention of the silicone prosthesis. This prosthesis provided excellent retention and restored the appearance and confidence of the patient. **Take-away Lessons:** Rehabilitation of the auricular defect can be carried out with surgical approach, which involves multiple surgeries, and still, the results may not be esthetically favorable. Prosthetic rehabilitation is an option, but retention is generally a hindrance. However, implant-retained prosthesis has really paved a way for rehabilitation of the maxillofacial defect esthetically and more reliably. Cone-beam computerized tomography (CT) can be used for planning and evaluation instead of CT, which will save the patient from a lot of radiation exposure. Hence, in the maxillofacial defect, attempts should be made to explore the option of implant-retained prosthesis.

Keywords: Auricular prosthesis, implant-retained silicone prosthesis, maxillofacial implants

Introduction

Loss of any facial structure is associated with psychological impact compromising the self-confidence of an individual. External ear is an integral part of the face, and loss of any part of the auricular structure in an individual changes his esthetics and overall appearance, hereby affecting his mental status. Absence of auricle results in an asymmetric, distorted appearance which may not affect function to a great extent, but patient's psychological state and self-esteem are affected deeply. Etiology of auricular defect can be congenital or acquired, and reconstruction of such defects can be surgical or prosthetic. Surgical reconstruction involves many steps and surgeries, and still, predictability of outcome is not reliable. Further, if cartilage reconstruction has to be planned, it will involve two site of the surgeries and it is not generally accepted by the patient due to added difficulty.[1] In these conditions, silicone prosthesis provides a reliable replacement and a predictable treatment modality.[2] The common problem faced in rehabilitating auricle defect with silicone prosthesis is mode of retention. Methods to achieve retention in conventional auricular prosthesis include soft tissue undercuts, adhesives, or mechanical methods (using hair band/spectacle). However, their retention may be compromised, or patient has to wear additional accessories. Specific to this case report more conventional methods of retention of auricular prosthesis

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were not feasible hence an implant retained silicon auricular prosthesis was planned.[3] Unique to this case was the novel approach to place intraoral implants in the mastoid bone for retention of the maxillofacial prosthesis.

After 1977, implants were first placed in the mastoid bone for attaching bone-anchored hearing aid and the idea of placing implants for retention of prosthesis in maxillofacial region sparked up.[4] In 1970–1990, many groups from Sweden, The United States, and Canada were working on implant-supported facial prosthesis.[5] In 1981, Tjellström was among first to describe about implants as the mode of retention for auricular prosthesis. He also published a 1–5–year follow-up on an implant-supported retention of facial prosthesis in 1983. By 1987, different research groups from Goteborg University of Sweden declared implants as more reliable method of retention with success of implants in the mastoid as high as 98.7%.[6] This article describes a unique and simplified approach for fabricating implant-retained auricular prosthesis.

Outline of the Case

A 38-year-old male patient who lost his right ear in an accident was referred from the Department of Reconstructive Surgery for Prosthetic Rehabilitation. Extraoral examination showed that the face was symmetrical, but loss of right ear made overall look of the face to appear asymmetrical. The right ear had missing helix, anti-helix, helical fold, and scapha, but external auditory meatus was present. Computerized tomography (CT) scan showed that the bone was not involved and there was adequate mastoid bone. Thus, a diagnosis of acquired partial auricular defect of the right side secondary to trauma was established.

The patient was not ready for surgical reconstruction, and he was not willing to use an adhesive or external mechanical attachment to retain the ear prosthesis. Hence, after discussing all the treatment options, an implant-retained prosthesis was decided as the treatment modality. A diagnostic impression of the defective ear was made in irreversible hydrocolloid (Zelgan alginate, Dentsply), and the cast was made in type IV dental stone (Kala Stone; Kalabhai Pvt. Ltd.).

Implant planning stage

The first challenge was to determine the site of implant placement. The exact positioning of the placement of implants was determined using cone-beam CT (CBCT). This was done using a closely matching donor ear. Impression of this donor ear was made in irreversible hydrocolloid (Zelgan alginate, Dentsply), and a wax pattern from this impression was made. The wax pattern was then duplicated into autopolymerizing polymethyl methacrylate (DPI RR cold cure), and this was used as a stent with radiographic markers which were added as per the tentative implant site as seen in Figure 1. This stent was secured on to the patient, and scan was performed using conventional CBCT machine. As conventional CBCT does not give scan of mastoid region. Hence, few modifications were made while taking CBCT like the patient was positioned without craniostat and maximum field of vision was selected for the scan. The CBCT findings showed adequate bone for implant placement, with minimum being 9.3 mm to maximum 16.8 mm bone available in the mastoid region. This stent was used as a surgical guide for the implant placement.

Surgical procedure of the implant placement

After planning for implant placement, the next challenge was to surgically place the implants in the planned extraoral site with keeping an account of many vital structures in close approximation. Routine presurgical checkup of the patient was carried out, and the patient was operated under general anaesthesia. After administering local anaesthesia at the local site, the stent was used to mark the planned implant location as shown in Figure 2. Then, using a pilot drill, a transmucosal puncture was made to create a dent on the bone to mark the implant site on to the bone. Then, a full-thickness flap was raised to expose the site planned for implant placement which was demarcated by dents on the bone created by pilot drill. Further, osteotomy was done as per the protocol for endosseous implants using AB implant system with dimension 3.2 mm × 10 mm for all three sites (Compact Surgical Kit TKS, AB Dental Implants). After osteotomy, three I2 screw-type internal hex implants (AB Dental Implants) were screwed in with a torque of 25 N, and final tightening was done using hand wrench. To further prevent stage II surgery, gingival formers were planned to be placed during surgery to act as a physical barrier. But, as their height was not enough; therefore, impression post was used as physical barrier to epthelial growth as seen in Figure 3. Before closure, debulking of the flap was done to reduce the volume of tissue at the site. Closure was done using sutures 3-0 silk (Sutupak Black Braided Silk Ethicon), and the implants were allowed to osseointegrate for 3 months.

Prosthetic phase of rehabilitation

Patient was kept on constant review to closely monitor the recovery and healing around the implants. Once the implants were integrated, prosthetic rehabilitation was carried out. Post 3 months, implant site showed satisfactory healing and radiographic findings showed well-integrated implants clearly as seen in Figure 4. For prosthetic phase, impression was made using polyvinyl siloxane impression material (Elite H-D, Type 1, Zhermack), and to record the implant location more accurately, the impression post was splinted together using intraoral welder (IOW Device SRL) an implant level open tray single stage putty wash impression was made in a custom-made tray as shown in Figure 5 and poured in type IV dental stone (Kalastone; Kalabhai Pvt. Ltd.) after attaching implant analog to the impression post so as to obtain a cast with exact implant location as on patient. For the fabrication of the bar framework, castable abutment (P2 Plastic Sleeve AB Dental Implants) and prefabricated castable bar (Vario-Soft-Bar-Pattern, Bredent GmbH and Co. KG) were used. Design of framework was finalized on the cast, and then, it was cast in cobalt chromium alloy (Wironit, Bego). The framework was tried onto the patient to check for a passive fit as shown in Figure 6. The frame work was screwed and another impression was

made in polyvinyl siloxane impression material (Elite H-D, Type 1, Zhermack). The cast received from this impression was used to make acrylic substructure and silicone prosthesis. Clear autopolymerizing acrylic resin (DPI Cold Cure; Dental Products) was used to fabricate substructure, which will provide mechanical retention for the silicone prosthesis and pick up of silicone sleeves of bar and clip attachment system. Wax up of final prosthesis was done on substructure using donor ear technique and free hand sculpting. The wax pattern was tried for appropriate size, orientation, and position. After patient's approval, the wax pattern was invested in steps to result in a three-part mold. A three-part mold allowed access to all the parts of the mold eliminating any undercuts. This assisted in shading and giving colour gradients to prosthesis clearly as seen in Figure 7. Dewaxing was done and mold was made ready for packing of silicone. A room temperature silicone (Cosmesil M511 part A and B, Cosmesil Prosthetic System) was used for fabrication of final prosthesis. Colour matching was done using intrinsic colours (Principality Medical Ltd.) to blend with the patient's skin tone. Different shades matching the specific part of ear were also made using more colours and flocking. These specific shades were then painted to the specific parts of three-part mold, and the bulk was filled with base shade. The mold was closed and allowed to cure for 1 h at 100°C and left to cure overnight. The prosthesis was retrieved after 24 h from the mold and finished. Initial trial was performed to check for adaptation esthetics and retention. Extrinsic tinting using stains (Principality Medical Ltd.) was done to further blend with the patient's skin tone and give prosthesis a life-like appearance. The attachment system was finally added to the prosthesis by directly picking up silicone sleeve on the patient. These sleeves provided retention with the bar by completing bar and clip assembly. After minor adjustments were made, the prosthesis was delivered to the patient. The patient was instructed on the placement and removal of the prosthesis along with home care of prosthesis and implant site. A follow-up evaluation of 3 months was ensured. Final prosthesis is shown in Figure 8.

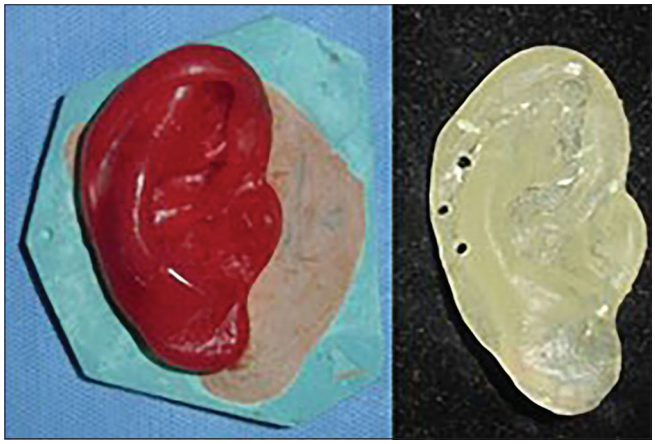

Figure 1: Donor ear and stent

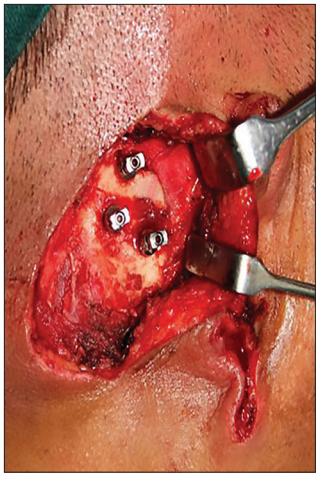

Figure 3: Postsurgery with impression post as physical barrier

Discussion

Auricular defects can be congenital (sometimes, associated with syndrome) or acquired. Acquired defects could be due to road traffic accidents or gunshot wound and sometimes related to sports injuries.[2,7] Whatever be the cause of the auricular defect, it will always post a challenge to the rehabilitating

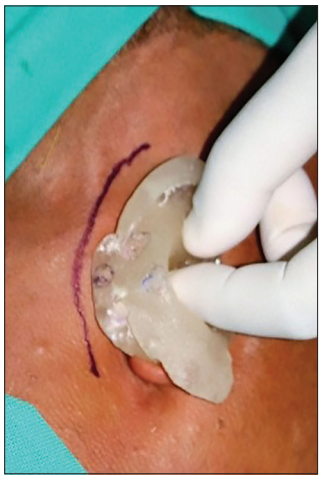

Figure 2: Surgical stent used at the time of surgery

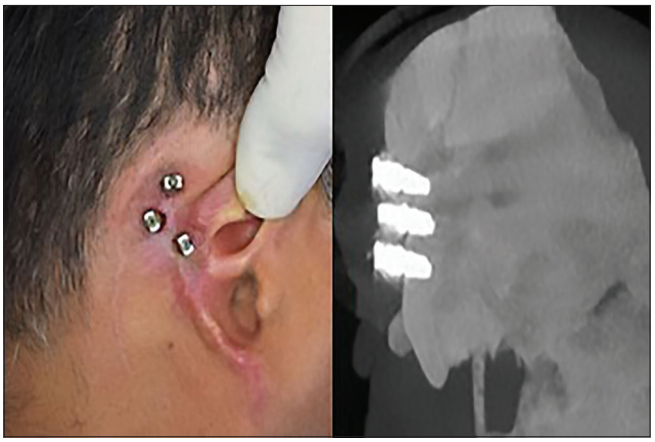

Figure 4: Healing post 3 months with well-integrated implants on radiograph

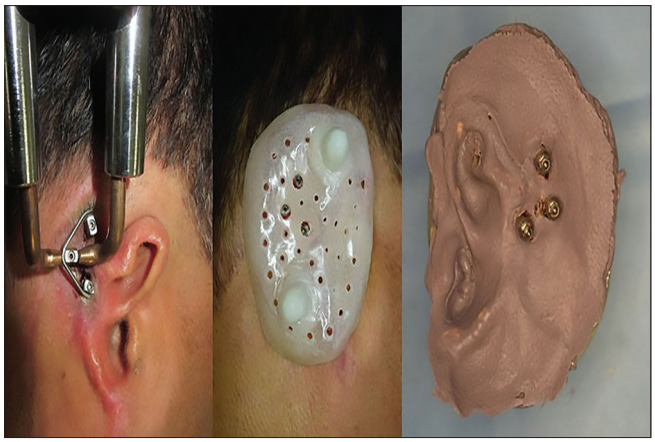

Figure 5: Splinting the impression post using intraoral welder and making final impression

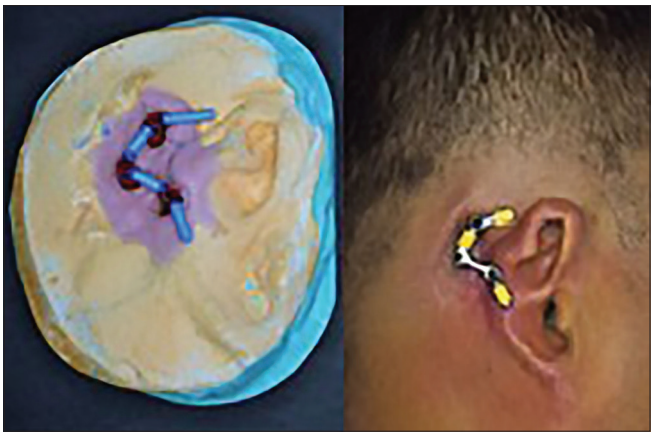

Figure 6: Bar framework fabrication and screwing onto the patient

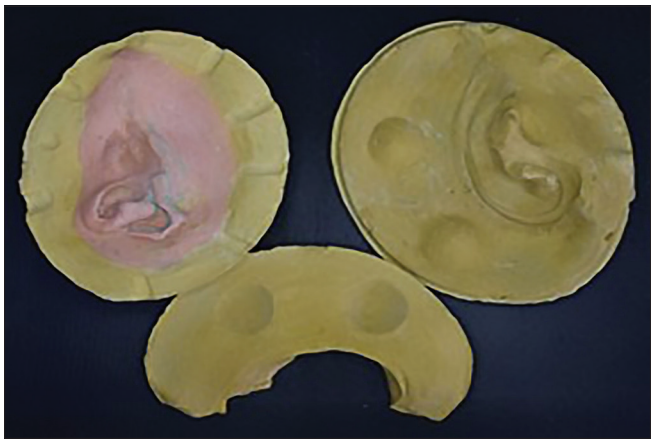

Figure 7: Three part mold

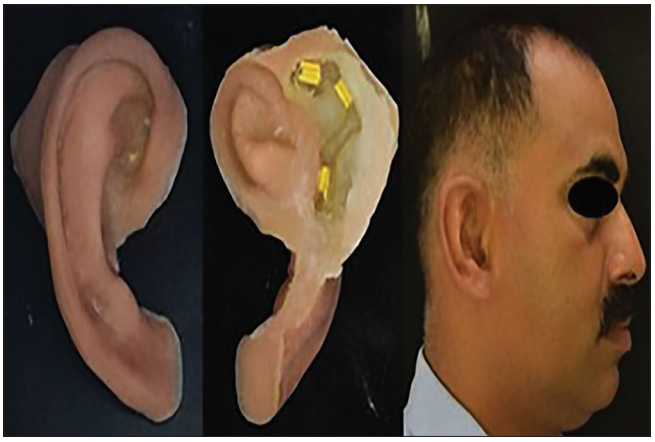

Figure 8: Final prosthesis fabricated and clips picked up

team. The challenge is enhanced by the expectation of the patient and the complexity of the auricular structure, which makes it very difficult to replicate and reproduce.[8] Defects of the auricular region can be rehabilitated by many ways which broadly include surgical reconstruction, prosthetic rehabilitation, or combination of both.[7]

Surgical option is not always feasible because of multiple surgical steps involved, associated complications, and limitation of the predictability of outcome. Prosthetic option is more predictable and also relatively easy. However, it possesses with its own challenges such as retention of the prosthesis. There are various means of retaining auricular prosthesis such as using adhesives, skin tapes, spectacles, soft tissue, or bony undercuts, but the most reliable method is by implant and attachment system. Implants provide with the best and most reliable mode of retention of an auricular prosthesis. However, implants themselves cannot provide the desired retention and require various attachment systems which connect with prosthesis; these include magnets, bar and clip system, or ball end system.[9]

The difficulty is deciding the placement of the implants with such complex structures in vicinity. Conventionally, a fan-beam CT is used to evaluate bone at the desired site. Fan-beam CT gives a three-dimensional picture of the bone and the adjoining structures. Following that, a digital image of the desired anatomic structure can be made. Only complication is the amount of the radiation exposure, which is approximately 2000 μSv. However, CBCT (craniofacial CT) which has been used in this case has only 68–599 μSv exposure as compared to the conventional CT.[10]

Implants may be the best system, but they require intense planning and precise execution, and for this, we require to do presurgical conformation of the implant site. There are various methods describe to orient the stent at the defected site, such as face-bow method when external acoustic meatus (EAM) is absent. Various authors have also specified the location of the implants. The common location preferred is 11-o'clock to 7-o'clock position for the right ear and from 1-o'clock to 5-o'clock location for left ear, 20 mm from EAM.[11] The surgical stent approach followed in this case was similar to followed by Asher *et al*. This technique was simple and cost-effective as well as a reliable means of determining tentative implant site.[12] Use of a surgical stent reduces risk of procedure in this case as vital structure was avoided and implants were placed in the predefined position for better outcomes.

Use of bar and clip system has been proved to be a more effective modality of the attachment as advocated by Gary and Donovan and Khan and Bowden. The advantage of this system is that the bar can be retained over two implants, and it will still provide adequate retention.[13-15] Various materials have been used in the past for reconstructing the auricular defect such as acrylic resin, wood, metal, and silicones. Silicones are the best choice as they give life-like appearance and the resiliency is closely matching the tissue. This gives patient a natural feeling about the prosthesis.[16]

Conclusion

Whenever surgical reconstruction of the lost natural tissue is not possible, a prosthetic replacement provides a good and reliable option for the patient. Further, mastoid bone has best suited anatomy and physiology for placing the extraoral implants which resolve the issue of retention in auricular prosthesis. Thus, with a well-fabricated, retained, and esthetically appealing prosthesis, we can improve the quality of life of the patient.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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