Skin reaction around auricular implant abutment using different attachment mechanisms

author_ Walid Sadig, Ziad Salameh, Saudi Arabia

_Introduction

With the advent of osseointegration in dental rehabilitation and recent advances in surgical and laboratory techniques, it has been possible to transfer and extend the osseointegration principle to facial rehabilitation.[1] Retention, stability and aesthetics have been significantly improved with the use of endosseous implants, contributing to natural appearing prostheses.

Facial prostheses in the past have been retained primarily by skin adhesives,[1,2] to improve retention and stability, such techniques had several disadvantages including damage to the customized surface of the prosthesis when removing glue from the skin surface; contact dermatitis as a result of long-time use and progressive discoloration and breakdown of the elastomeric maxillofacial restorative material.[2] Major advantages of implant-retained facial replacement, include ease of placement, predictable retention, improved esthetics, and increased life span of the prosthesis.[3] Several studies reported high functioning success rate for auricular prostheses,[4,5,6] however this treatment modality is not without complications. Adverse skin reactions are the most common well documented complication with craniofacial osseointegration.[7,8] 48 per cent of patients who had implant retained auricular prostheses developed soft tissue infections at some stage during the follow-up period.

Craniofacial implants maybe connected to the prosthesis with attachment devices of various designs and retention levels. Magnet or bar-and-clip retention are the two primary forms of retention used separately or combined in the auricular region. The use of single standing magnet attachments clinically seemingly reduced the number of inflammatory skin reactions.[10]

A photoelastic study of the auricular-temporal region of a human skull, found that the Locator attachment correlated with higher retention values as well as with higher peri-implant stress compared to the Hader bar-and-clip attachment design.[11] Non-submerged single stage implants are well established treatment modality in oral implantology because of the many advantages it include.[12] It seems such implant design is not utilized extraorally to retain a facial replacement. The purpose of this clinical report was to describe the placement of non-submerged single stage implants to retain auricular prostheses. Management of adverse skin reaction was evaluated also through this report by utilizing three types of attachment mechanisms.

_Patient report

A 43-year-old woman who sustained traumatic loss of the scalp and left ear when she was 35-year-old in a motor vehicle accident, presented to our clinic. The affected area was grafted with a

Fig. 1_ Two non submerged implants at the time of the surgery.
Fig. 2_ Two implants were used 10 mm apart and at 12 mm from the external auditory canal.
Fig. 3_ A 5 mm healing cover was then placed into the internal thread of the implant fixture.


Fig. 1


Fig. 2


Fig. 3

split thickness graft harvested from the elna. The patient always refused the option of adhesive-retained auricular prostheses, but she accepted the option of implant-retained auricular prostheses after being aware of its benefits.

Treatment planning included consultations with otolaryngologist, plastic surgeons and radiologist. To avoid perforation of the inner cortical margin of the neurocranium, standard radiographic images were combined with a CT scan that allows preoperative determination of temporal bone thickness and proper positioning of the implants in relation to prosthesis location.[8,13]

Two implants were used 10 mm apart and at 12 mm from the external auditory canal, and were sufficient for adequate retention 14 (Fig. 1 and Fig. 2). A surgical template was used to obtain accurate implant placement.

At the surgery day the planned implant sites were marked with surgical ink. An incision was made and the bone surface exposed by elevating the skin and periostium. Using a depth limiting drill the predetermined depth of 5 mm was prepared using twist drills up to size 3.5 mm diameter. The osteotomy sites were then threaded with a titanium screw tap. Using a ratchet, two tapered implant fixtures of 4.1 mm diameter and 5 mm in length with 1.8 mm non submerged neck (Industrie Biomediche E Farmaceutiche®, di Muollo Ferdinando, Italy) were inserted into the threaded holes. A 5 mm healing cover was then placed into the internal thread of the implant fixture (Fig. 3).

Thinning of the subcutaneous tissue was preformed to minimize the thickness of the skin graft also to prevent free skin movement around the implant healing abutments. The skin flap was then punched over the implant head using a 4 mm diameter disposable punch before replacement and suturing so a multilayered closure of the wound is affected. Subsequently a pressure bandage has been applied for the first four days to prevent a postoperative hematoma. Postoperative radiographic examinations were performed to control the implant position and sutures were removed after ten days.

The implant fixtures were allowed to integrate with the bone for two months. No intra operative or post operative complication was encountered and since a non submerged implant was used, a second surgery was not needed.

During the healing period the patient was instructed to maintain cleanliness around the healing abutments by asking a family member to remove any dry tissue crust with small brush and whip the area with moistened towel soaked in diluted iodine solution. Care was taken to inspect the abutments and surrounding tissue for cleanliness and evidence of any infection. Crusting and epithelial debris around the base of the abutment was removed with a probe.

Fabrication of the superstructure

After the healing period, the fabrication of the auricular prostheses started by taking a fixture level impression to fabricate a Hader bar splint (Fig. 4). Adjustments were made to ensure passivity of fit, so as not to place any undue stress on the implants. Rider clips are then positioned onto the bar to ensure adequate retention. The undercuts of the bar were blocked out using wax. Self-curing acrylic resin was then poured using standard orthodontic techniques to cover the bar clips, and area of required base. The prosthesis was then sculpted (Fig. 5) upon the base plate acrylic resin and model and then tried onto the patient by following standard evaluation guidelines.

The advantage of the implants is that final sculpting can be performed on the patient. The bar splint and prosthesis were placed back on the model and invested as usual.

After wax elimination and in order to enhance bonding with the silicon, the outer surface of the base was perforated with small round bur before cleaning with acetone and a layer of primer is applied and allowed to dry thoroughly. Normal procedure of color matching and curing was then performed. The silicon was allowed to cure under the bench press for two hours. Upon completion of the prosthesis it was tried on the patient and clip adjustments performed (Fig. 6). The patient was then instructed on how to place and remove the prosthesis. After two weeks of wearing the bar retained prostheses, the patient complained from pain and tenderness; clinical examination revealed heavy

Fig. 4_ A Hader bar joining the implant fixtures.
Fig. 5_ Auricle prostheses sculpted before patient's trial.
Fig. 6_ Prostheses finished and ready to be placed.


Fig. 4


Fig. 5


Fig. 6

sebaceous crusting with evidence of exudates oozing from the peri-implant epithelial tissue surrounding the head of the lower fixture. When the bar was removed no granulation tissue was noted, the implants were immobile, and the skin showed slight mobility with raised contour of 5 mm thickness. The upper fixture was not affected by the infection and the skin thickness was 3 mm as it was before. Skin culture grew *Staphylococcus aureus* *β-hemolytic Streptococcus* which is considered not normal skin flora. To manage the infection the area around the healing abutment was wrapped with strips of gauze, saturated with 1 per cent triamcinolone and 0.5 per cent bacitracin (Aureomycin, Wyeth, Madison, NJ, USA). When no improvement was noticed within 72 hours, the patient was given Ciprofloxacin 250 mg two tablets twice daily for ten days (Ciprobay 250, Bayer AG, Germany). The bactericidal effect of the systemic antibiotic used with this patient was very successful. After the infection has resolved, the bar retained prostheses was redelivered to the patient. Unfortunately after one month of wearing the ear prosthesis, patient reported reinfection of the same area.

Since no adverse skin reaction was noticed whenever a healing abutment of 5 mm in height was used, a decision was made to replace the Hader bar connector by a magnetic attachment system with individual keeper over each implant. Rigid flat type magnetic keeper of 4 mm in height was secured to the implants Magfit™ IP IFN 40 (Aichi Steel Co. Ltd., Nagoya, Japan).

Since the height of the keeper of the magnetic attachment was almost at the skin level, one week later tissue over growth by secondary epithelialization was noted over the lower magnetic keeper.

A thickness reduction of the skin surrounding the emerging magnet keeper was attempted at chair side under local anesthetic solution using a diode laser beam. Ten days later skin re-growth again over the lower keeper and the patient complained from poor retention of the prosthesis when compared to the Hader bar connector. Consequent to this and because of the claimed health hazards of using magnets in the head neck area, a decision was made to use a Locator attachment. The locators connector has a skirt around the denture components that easily locates the permanent mating component on the implant (Fig. 7 and Fig. 8). The self-aligning feature of the locator aids the patient in a similar manner as a guide plane for the removable overdenture (Fig. 9). The patient can easy align and seat the prosthesis. The locators have extra advantages in complex cases as they can compensate for sever angle misalignment and a divergence up to 40 degrees between the implant and the connector system.[12]

_Discussion

Craniofacial osseointegration care is a stepwise, protocol-driven process involving multiple disciplines. The interdisciplinary consultation is the starting point for the process of treatment. The prosthodontist is responsible for the diagnosis and treatment planning, recording of tissue surfaces as they relate to implants, design of retention, design and assessment of fit of superstructures, and long-term maintenance. Hader bar is the most common bar used, offering the advantages of a better retention and resistance against horizontal force 16 while disadvantages are that it needs more space to place and is easier to break down. Due to the location of the site of the ear prosthesis most clinicians prefer to use a combination of a bar splint utilizing rider clip and magnetic retention.[17] This is to ensure absolute margin integrity during soft tissue movement caused by the proximity of the temporo-mandibular joint.

Clinical experience suggests that magnet attachment is indicated where low dislodging forces are anticipated, when the patients has poor dexterity, or where a special need for independent abutments exists.[17] In addition, magnets facilitate improved access around the abutments for the cleaning and easier concealment of the retention system within the normal contour of the prostheses.[18] The locator connecter poses similar advantages as the magnets with additional features such as higher retention, different retention levels, and available in different cuff length.

The main advantages of the non-submerged one stage implant is the fact that the location of

Fig. 7_ Locators attachment on the implants.
Fig. 8_ Locators attachment in the fitting surface of the prosthesis.
Fig. 9_ The final prosthesis.


Fig. 7

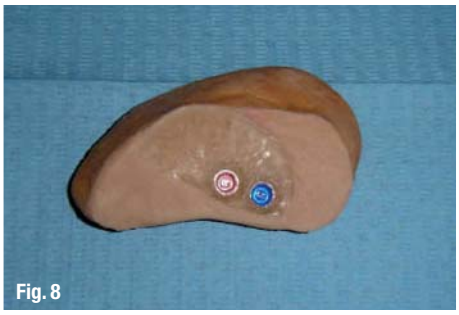
Fig. 8


Fig. 9

the connection between the implant and the superstructure is typically above the bone level by 2 mm with no microgap which allow biological collar of connective tissue interface, therefore better peri-implant seal can be maintained.[12] Whereas with the conventional flanged extra oral implant in swine showed that junctional epithelium diminishes to a one-cell-thick layer as it approaches the flange of the titanium implant, this mono layer of cell create the biological barrier against bacterial contamination.[19]

Possible reasons for infection and infection control

Loosening of retaining screws of the bar may occur for several reasons; misfit of the bar superstructure to the implant will lead to screw loosening hence, greater movement of the bar abutment resulting in shear forces that disrupt the epithelial abutment interface. This disruption then serves as a pathway by which bacteria can cause infection. As there is essentially no completely passive (perfect) fit of the bar superstructure 20, independent abutments attachment system should be the first option with craniofacial implants, especially when increased thickness of the peri-implant abutment tissues is encountered. Retrospective analysis of adverse soft tissue reactions showed that peri-implant soft tissue problems tended to occur during the first two years after implant exposure.[20] The skin is not intended to have a persistent interruption of its integrity as a result of the presence of the penetrating alloplastic material, so time is needed for peri-abutment skin and the local immune system to adapt and to cope with this unnatural condition.

In the initial stages of endosseous-retained prosthetic rehabilitation, patients need time to appreciate the new commitments required for the success of such treatment. In the first year after implants placement, clinical and radiographic examinations were conducted monthly and after prosthetic reconstruction it was performed every six months.

The assessed clinical outcome parameters include health of the peri-implant tissue, implant hygiene, and mobility of implants.

_Conclusion

In contrast with a conventional craniofacial prosthesis, an implant-retained auricular prosthesis often is not experienced as a prominent foreign object and can improve the quality of life. Utilization of non-submerged one stage implant in the craniofacial region is considered viable option as it is intraorally. Although adequate patient hygiene is a must, this clinical report indicates that type and fit of the attachment, to create an intimate seal around the peri-implant epithelial tissue is crucial to maintaining healthy tissues in the peri-implant abutment site._

The literature list can be requested from the editorial office.

_contact implants

Prof. Dr Walid Sadig
Department of Prosthetic Dental Sciences
College of Dentistry, King Saud University
60169 Riyadh 11545, Saudi Arabia
Phone: +966-1-4677325
Fax: +966-1-4678548
E-mail: walidsadig@yahoo.com