Auricular Rehabilitation by Means of Bone Grafting from the Iliac Crest in Combination with Porous Extraoral Implants: A Case Report

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ABSTRACT

Background: Maxillofacial defects caused by cancer treatment are a huge problem affecting the quality of life of patients. Some of these deformities are minimized using facial epitheses, which need some additional retention devices like glasses or skin adhesives. The use of extraoral fixtures as bone anchorage was introduced many years ago and since then many patients were rehabilitated with better results.

Purpose: Because of poor bone conditions, for example, irradiated bone, the success rate of extraoral implants is less than in the oral cavity, causing difficulties to rehabilitation. One possible cause of fixture failure could be the poor primary stability achieved in some cases, hence, with an increased bone contact implant stability and survival could be improved. The present report discusses possibilities to use extraoral fixtures with a modified surface structure.

Materials and Methods: A new porous surfaced Brazilian extraoral implant (MasterExtra®, Conexão, Sistema de Próteses, São Paulo, Brazil) was used. A bone transplant from the iliac crest was taken to make it possible to insert at least three extraoral implants for an auricle epithesis. Clinical evaluation and resonance frequency analysis (RFA) measurements were performed during the course of the treatment.

Results: Eight months after grafting, four fixtures were inserted. Three fixtures were used for connection of an auricular epithesis. RFA measurements did show high initial values and the values remained stable during the course of the treatment and at later checkups.

Conclusion: Porous fixture is a good option in areas where the bone is compromised. RFA is a good tool also in the clinical setting to evaluate immediate and long-term stability of extraoral fixtures.

KEY WORDS: auricular rehabilitation, extraoral implants, grafting

With the knowledge of osseointegration in dental rehabilitation[1] and advances in surgical and laboratory techniques, osseointegration has been transferred to the principle to facial rehabilitation. Retention, stability, and aesthetics of different epitheses have been significantly improved by means of endosseous implants, hence, resulting in more natural appearing and functioning prostheses. The use of endosseous implants in temporal bone started as early as in the late 1970s to support a bone conduction hearing processor.[2] This pioneering work was performed at the Göteborg University, Sweden, and since then endosseous implants have been used to anchor, for example, hearing aids and facial epitheses.

To compensate for the lesser bone quantity in the temporal, orbital, and midface regions, compared to the maxilla and the mandible, extraoral implants are shorter than intraoral implants, 3 to 5 mm in length versus 10 to 18 mm, respectively, with a peripheral flange. This flange will increase the implant surface area in contact with the bone. Perforations in the flange add additional surface area and will also provide mechanical stability.

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Ordinary extraoral fixtures possess a machined surface whereas in intraoral fixtures, various surface modifications of the titanium implant are used to increase the mechanical[3] interlocking, at both the microscopical and the macroscopical levels between bone and implant. Several different techniques, that is, particle blasting, plasma sprayed coatings, and wet chemical etching, have been used to modify the implant surface.[4]

In this case report, a new Brazilian extraoral implant with a porous surface was used. The resonance frequency analysis (RFA) technique[5] was employed to measure clinical implant stability together with clinical examinations of function and aesthetics.

CASE REPORT

The patient is a 38-year-old woman who had problems with recurrence of a basal cell carcinoma since she was 16 years of age. In her 16th year, a basal cell carcinoma of the left preauricular area was diagnosed and she was immediately submitted to tumor resection. Six years later, she experienced tumor recurrence and another surgery was performed.

In April 1999, she was presented to the Head and Neck Department of MD Anderson Cancer Center, Houston, TX, USA, with a tumor located on the left side, anterior to the tragus and going deep toward the parotid gland, the temporomandibular joint, and the external auditory canal.

On the CT scans, it was recorded that the recurrence had extended subcutaneously to involve the external auditory canal, the temporal fossa, and the mastoid bone, as well as the zygomatic process. After looking into different possibilities, it was decided that the best chance to cure her from the disease would be extensive surgery with lateral bone resection, auriculectomy, parotidectomy with facial nerve dissection, resection of the mandibular condyle and temporomandibular joint, and immediate soft tissue reconstruction by plastic surgery.

Standard lateral bone resection was performed while preserving the main trunk of the facial nerve to retain as much function as possible. The temporomandibular joint was dissected from the articular fossa superiorly, and the zygomatic root cells were drilled to the bony plate under the middle dural fossa. A total auriculectomy was planned, along with parotidectomy, mandibular condylectomy, and a partial resection of the temporalis muscle. The skin of the external auditory canal was dissected from the ear canal and left together with the skin. The bony ear canal was dissected from the temporomandibular joint and in the anterior aspect from the parotid capsule. Furthermore, the entire tympanic ring was removed. During the resection, no bony disease was encountered. There was no recurrent disease in the bony ear canal, mastoid, or middle ear. After resection, the plastic surgery team followed up and ended surgery with repair of the defect, by means of a free flap (Figure 1).

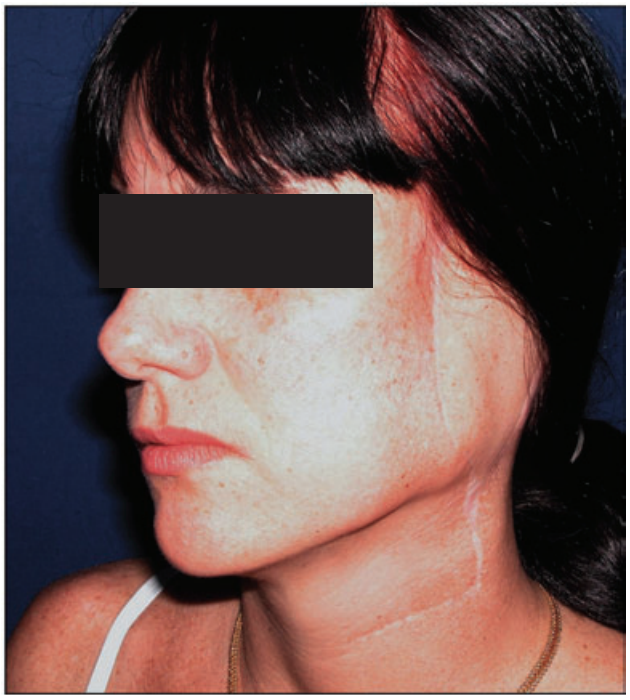

Figure 1 Extraoral photo at the start of treatment.

The acquired defect of the temporal and auricular regions measured approximately 8.5×10 cm. The reconstruction of the defect was made with a parascapular fasciocutaneous tissue flap, which measured 8.5×25 cm.

The blood flow into the flap was judged to be adequate, and the postsurgical recovery proceeded without complications.

Six months later, the patient was looking forward to auricular rehabilitation. She was presented to the dermatological clinic in São Paulo, Brazil, healthy with a good systemic condition and full circulation in the tissue flap. However, it was found that parts of the flap needed some adjustments, and in 2000 she was again submitted to MD Anderson for minor repair and removal of some fatty tissues.

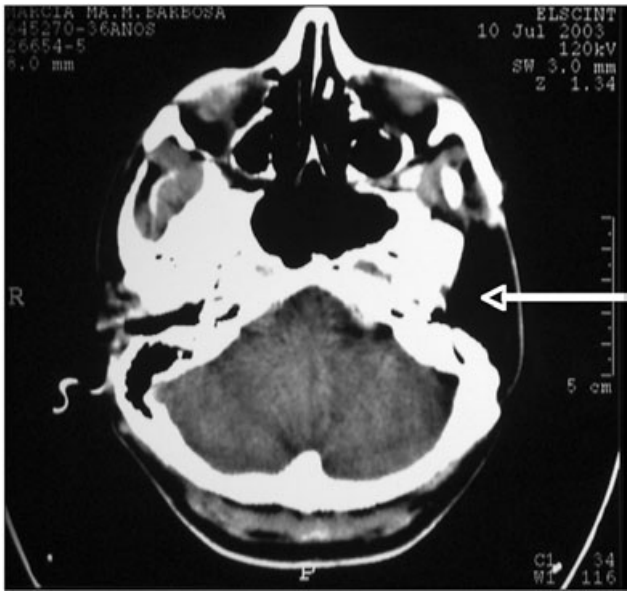

Figure 2 Radiograph. Note the lack of bone in the left temporal part (arrow).

In 2002, she was again referred to the dermatological clinic in São Paulo, and the auricular rehabilitation process was started together with our team. After extensive clinical discussion and considerations, the patient's choice was to wear an ear epithesis made from silicon. The epithesis was to be fixed by titanium implants inserted in the mastoid process. However, taking into consideration that there had been previous resections of bony parts in the area, there was not enough bone, both qualitatively and quantitatively, for fixture installation in the mastoid process of the temporal bone (Figure 2). After considering all possibilities, it was decided to perform a grafting of bone to the area; hence, the patient was looking forward to a delayed fixture installation.

In January 2003, the patient returned, and under general anesthesia, a free bone graft from the iliac crest was taken. After trimming the graft, it was fixed to the area of the mastoid region on the left temporal side using mini-plates and titanium mini-screws (Figure 3A).

No complications occurred during the surgical procedure, and the patient recovered very quickly from the procedure.

Eight months later, in September 2003, the skin flap was reopened under general anesthesia and the grafted area was accessed. It was then noted that there was very good bone formation and that the quality of the bone was excellent. To this end, there were good conditions for installation of extraoral fixtures. A new model with double-treated (blasted and etched surface) porous surface (MasterExtra®, Conexão, São Paulo, Brazil) was used (see Figure 3B), and all fixtures measured 3.75 mm diameter and 5 mm length.

The skin flap was reduced to thin out the tissue, and three fixtures were immediately connected with standard abutments with 4 mm height (Conexão) and

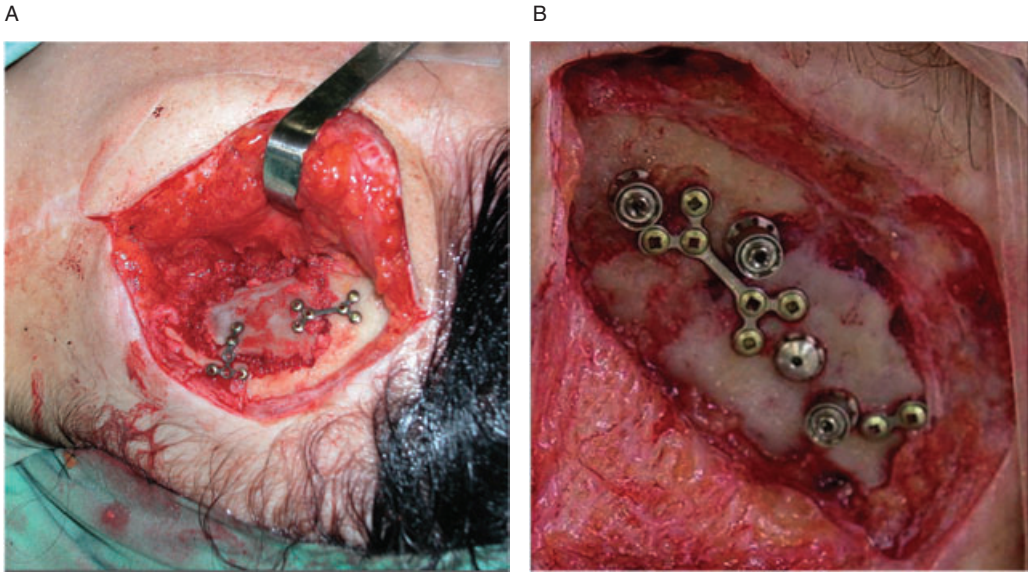

Figure 3 *A,* Left temporal region after bone grafting from the hip. High initial stability was achieved with mini-plates. *B,* Fixture installation 8 months later. Note that the second fixture from the bottom was left as a backup.

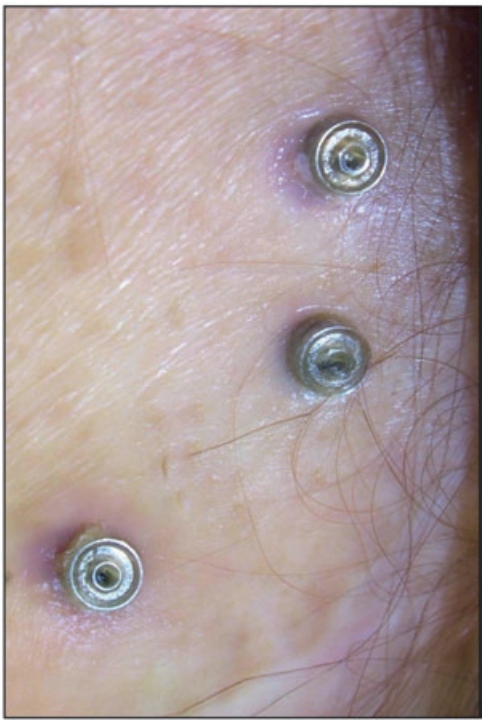

Figure 4 Healing of the skin adjacent to the fixtures.

exposed through the skin by a biopsy skin punch. It was decided to keep one of the fixtures as a backup for the future and this fixture was supplied with a cover screw.

The postoperative care was without complications, and there was good healing of the skin surrounding the abutment (Figure 4). Three months later, all four fixtures were subject to RFA. All four fixtures showed implant stability quotient (ISQ) values ranging between 74 and 79.

An impression was taken with a standard silicone impression material, and a rigid bar of gold alloy was prepared in the laboratory. The bar with magnets was connected to the abutments with Au screws (Figure 5). A new impression was taken, and in February 2004, an ear epithesis made of silicon was retained to the bar by magnets and clips (Figure 6). At this time, new RFA values were recorded and there were no changes in the individual values of the fixtures.

A checkup 1 year later revealed that the patient is doing very well and she has not experienced any problems, that is, irritations or infections, in the area of the skin surrounding the abutments. Furthermore, she feels comfortable with the epithesis and is very happy with the final result of the procedure. However, sun and heat make some minor repairs of the epithesis necessary, related to discoloration and cracking of the silicone.

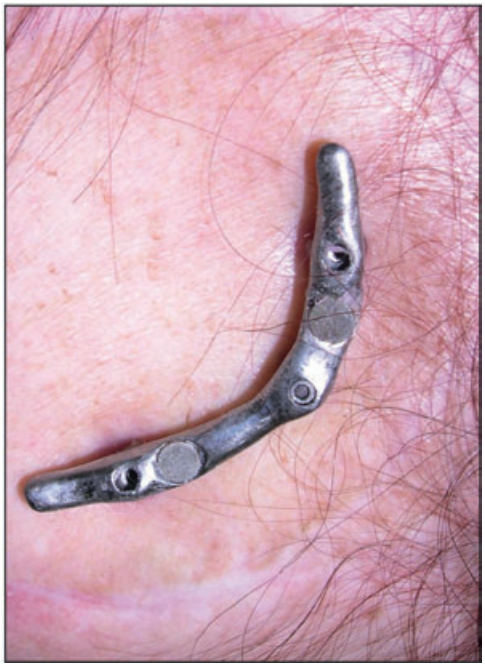

Figure 5 Bar construction with magnets.

DISCUSSION

A facial defect caused by congenital or acquired deficits often has a significant psychological impact.[6,7] Some methods for facial rehabilitation have been described, but the great majority does not restore a patient's self-confidence. Facial rehabilitation with prostheses

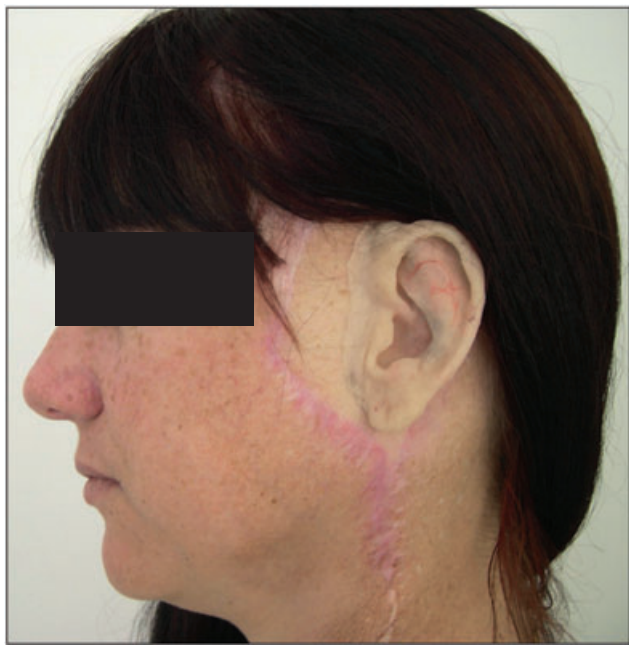

Figure 6 Try-in of epithesis. Note the slight discoloration of the skin at the area where plastic surgery was performed.

retained by implants has provided a new horizon for these patients because it offers adequate mechanical retention and accurate positioning of the prostheses.[8] The use of implants improved patients' quality of life, making possible participation in routine activities and function in society with confidence that their defect will be less noticeable. This has also been proven in patients receiving intraoral implants for treating total edentulousness.[9]

It has been reported that the bone integration of titanium implants is modulated by their surface characteristics. Based on this concept, various titanium implants with different types of surface roughness or morphology have been developed to optimize bone integration. The percentage of direct bone-implant interface of a rough titanium implant is greater than that of a smooth implant.

Long-term function of osseointegrated implants is dependent on implant stability as the implant is subjected to stresses associated with supporting, retaining, and stabilizing prosthetic restorations. The use of porous surfaced implants in facial rehabilitation may offer an increased implant stability and load bearing capacity. Furthermore, it may also shorten the healing-in time of the implants, that is, a decreased period between fixture installation and abutment connection (prosthetic reconstruction).

By means of the RFA technique, implant stability can be clinically measured and followed with time. In the orbital case, the ISQ was 68 for the medial and lateral fixtures, and 76 for the central fixture. ISQ values higher than 60 indicated a high stability at the time points measured.[5] However, RFA measurements must be accompanied by clinical testing and evaluation for each individual fixture in each patient.

In conclusion, the extraoral porous implant presented and used in this study is an excellent and promising alternative in facial rehabilitation by means of osseointegrated implants.

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