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Surgical and Prosthetic Considerations to Rehabilitate an Ocular Defect Using Extraoral Implants: A Clinical Report

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Abstract

This clinical report shows the use of extraoral implants to rehabilitate an ocular defect, focusing the surgical and prosthetic procedures. Using local anesthesia and a surgical template obtained from the diagnostic wax ocular pattern, two cylinder dental implants were strategically placed in the lateral aspect of the right infraorbital region. Four months later, an acrylic framework including two spherical magnets was made using plastic UCLA abutments. After casting laboratory steps, a customized silicon prosthetic appliance was fabricated from the diagnostic wax ocular pattern and attached to the Co–Cr framework, observing its profile and seating aspects. The patient was satisfied with the treatment result, due to the retention, esthetics, and adhesive-free method to anchor his ocular prostheses.

Cancer patients who undergo surgery for tumor removal usually present loss of soft and hard tissue as a result. In addition, most of these patients need psychosocial support.[1] Fortunately the use of cosmetic and restorative therapy has improved the quality of life of patients with disfiguring diseases.[2] Silicone prostheses have been preferred to those made of acrylic resin, due to their consistency and resilience, which closely resemble those of human skin, in addition to the final esthetics and relative comfort of this material. The extraoral application of the Branemark titanium implant system (Nobel Biocare, Zurich, Switzerland) for craniofacial rehabilitation and bone-anchored hearing aids has provided a safe, retentive, reproducible, and adhesive-free attachment for extraoral prostheses.[3] The present work reports the surgical and prosthetic interventions to fabricate an ocular prosthesis retained by magnetic cap anchorage.

Clinical report

The patient, a 57-year-old man, was accepted for treatment at the Facial Defects Center of Federal University of Ceara, Brazil, presenting a right oculo-palpebral defect (Fig 1). The tumor was a squamous cell carcinoma that could be completely resected. Chemotherapy and radiotherapy were not necessary as complementary therapies. After surgery, the peri-orbital region was kept intact; however, the patient had not been cleaning the area well. There was a noticeable psychosocial problem and feeling of distress related to his self-image. He was having trouble communicating and dealing with simple daily tasks. Modalities of prosthetic therapy, including an adhesive- or osseointegrated implant-retained silicone oculo-palpebral prosthesis, were offered. The advantages and difficulties associated with both types of prostheses were carefully explained, with regard to the prosthetic fixation methods. With the patient's agreement, it was decided to fabricate an implant-retained prosthesis, due to the possibility of obtaining a more retentive prosthetic device by means of this treatment option. Normal systemic health and absence of irradiated bone tissue around the defect favored this choice.

A precise facial cast made of artificial type IV dental stone (Herostone, Vigodent, Rio de Janeiro, Brazil) was poured from an irreversible hydrocolloid (Jeltrate, Dentsply, Petropolis, Brazil) impression. A custom-made artificial acrylic resin eye was selected according to the color, contour, and size of the patient's healthy left eye. Over the stone cast, a layer of warm wax (New Wax, Technew, Rio de Janeiro, Brazil) was placed on the defect area. This wax sheet was tried on the patient's face to serve as the basis for correctly positioning the artificial eye, based on referential face lines (Fig 2). This was an important procedure, because inadequate eye positioning frequently leads to a poor esthetic result. After this step, the remaining tissues surrounding the artificial eye were carved in wax, observing the anatomic details of the left side, especially the upper and lower eyelids. A natural and esthetic wax-up was completed after several clinical appointments and finally accepted by the patient (Fig 3).

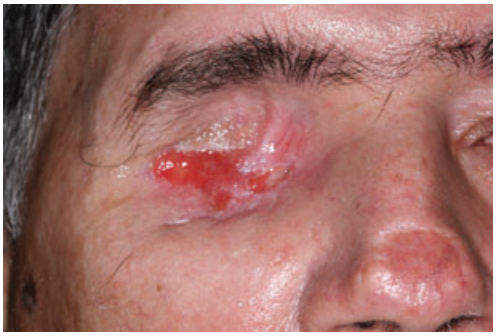

Figure 1 Oculo-palpebral defect.

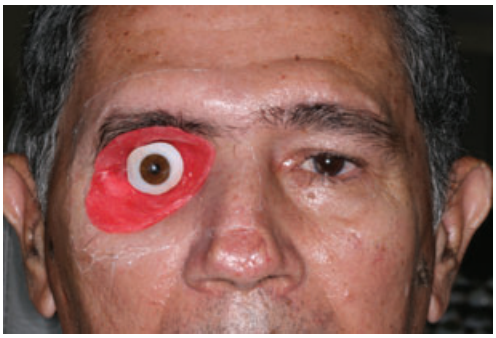

Figure 2 Artificial eye positioning, based on reference facial lines.

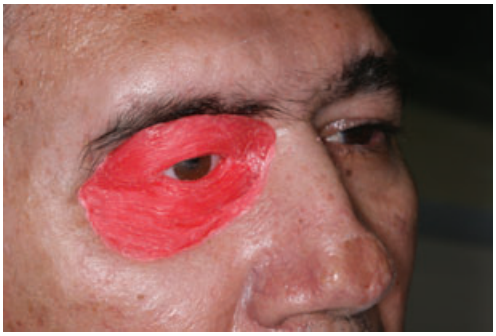

Figure 3 Final diagnostic wax-up.

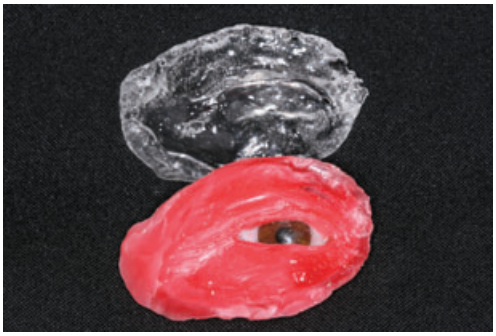

Figure 4 Surgical template based on the diagnostic wax-up.

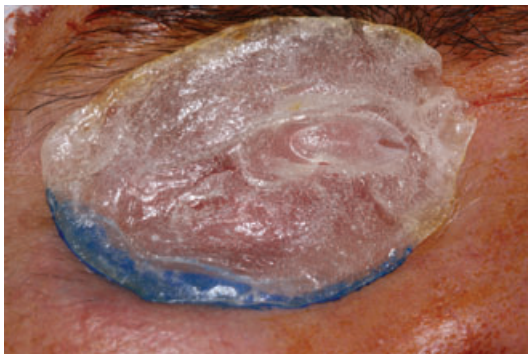

Figure 5 Prosthesis margin reference lines to guide correct implant placement.

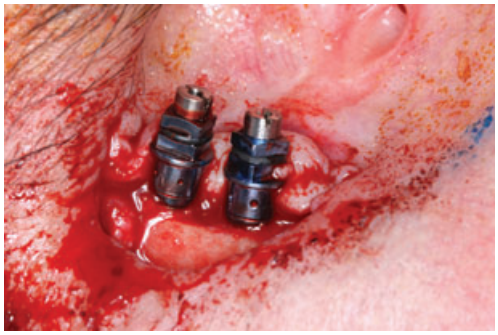

Figure 6 Titanium cylinder dental implants placed in the zygomatic bone.

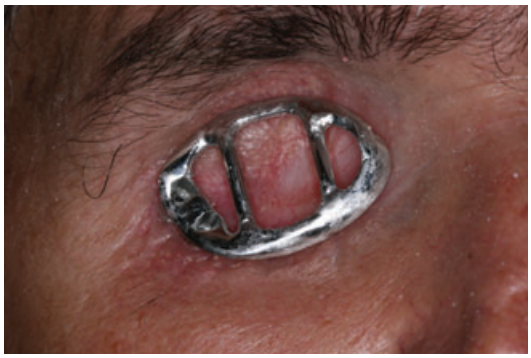

Figure 7 Initial clip bar framework design.

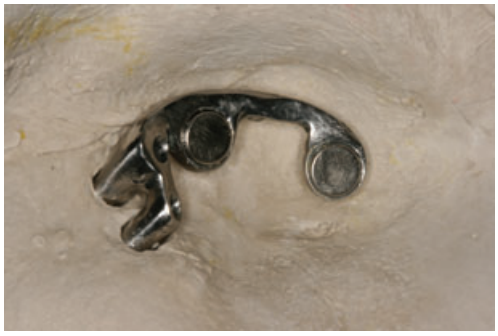

Figure 8 Final magnet metal framework.

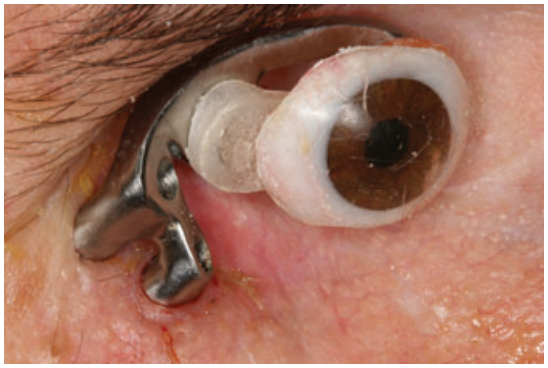

Figure 9 Acrylic resin eye attached to a magnet and acrylic resin understructure.

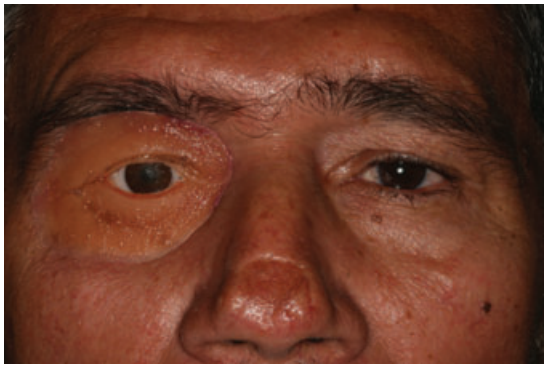

Figure 10 Frontal aspect of the silicone prosthesis.

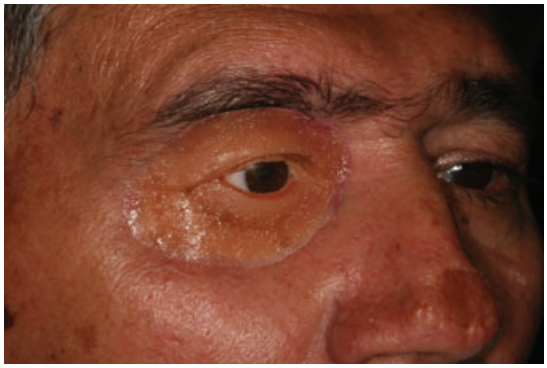

Figure 11 Lateral aspect of the silicone prosthesis.

A surgical template was made of clear self-polymerizing acrylic resin (Jet, Classico Dental Products, Sao Paulo, Brazil) based on the diagnostic wax pattern (Fig 4). The main function of the surgical template was to guide the placement of implants within the limits of the prosthesis, aided by a CT scan. The surgical procedure was performed under local anesthesia. The positioning of the template allowed a peripheral prosthetic border reference line to be drawn (Fig 5). Above this line a 3-cm long incision was made in the lateral aspect of the right infraorbital region. Two 3.75 × 11 mm external hex titanium cylinder dental implants (Conexao Co, Sao Paulo, Brazil) were placed parallel to each other and lightly inclined in the zygomatic bone, angled to the center of the right orbit (Fig 6). Special care was taken to ensure space in between them to make cleaning easier. The healing abutments were installed at the same time. A reduction in skin thickness and a compressive suture were performed in the one-stage implant surgery.

A framework pattern was planned after verifying there was adequate space for the skin (1 mm) and the external contour. Plastic bar segments (Original Microbrush, Vigodent) stabilized by acrylic resin with low polymerization shrinkage (Duralay, Polidental Dental Products, Cotia, Brazil) were used to establish the bar-clip design connected with plastic UCLA abutments. The patient experienced a great deal of difficulty in maintaining a clean defect area after casting procedures and the use of this framework for a week (Fig 7). The framework of the metal structure was designed with a volume too large to hold an orbital prosthesis. Therefore, another framework design was planned with a retention method consisting of two cylinder magnets (Magnetos Gerais, Sao Paulo, Brazil) strategically positioned on a bar segment (Fig 8). After final casting procedures, the magnet cap bases were fixed on an acrylic base behind the iris (Fig 9), and the prosthesis diagnostic silicone pattern was invested in a Number 6 brass flask (DCL, Campinas, Brazil) and processed in an RTV platinum silicone elastomer (A103, MDX4-4210, Factor II, Inc. Lakeside, AZ). The prosthesis color was clinically chosen by mixing different artificial pigments (Rare Earth Pigments, Factor II, Inc.) to match the patient's skin color. The final silicone prosthesis was made based on the initial wax pattern, preserving ideal contour and esthetic aspects of the diagnostic steps (Figs 10 and 11).

The patient was satisfied with the treatment result due to the safe, reliable, adhesive-free method of anchoring his ocular prosthesis and restoring a normal appearance.

Discussion

Patients with facial defects need a full-range professional care team including psychosocial support and pre- and post-prosthetic rehabilitation. Facial prostheses may be fabricated of various materials and use different anchoring methods. Skin-adhesive application on the peripheral prosthetic borders is frequently related to very low retentive strength and stability. The situation is more difficult when rehabilitating large defects in which the prostheses become heavier, or when the prosthetic borders have to be placed on moving skin tissues. Therefore, implant-retained facial prostheses are better tolerated than the adhesive-retained type and offer an improvement in the quality of life.[4]

Osseointegrated implants as a substitute for an adhesive method of fixing facial prostheses have been used to great advantage due to satisfactory comfort, retention, and safety.[5] Previous studies have reported that implant-retained craniofacial prostheses are a reliable treatment option for the restoration of craniofacial defects[6,7] in both irradiated and non-irradiated patients[8] However, implants placed in the orbital region have demonstrated a high failure rate. Most implant failures occurred late as opposed to early in the study period. Orbital implants

should be placed in patients who understand that long-term success rates may be low, and that these implant require meticulous hygiene maintenance.[9,10]

This patient presented characteristics that favored implant therapy: preserved systemic health, surgical resection of the entire lesion with safe margins, presence of non-irradiated, healthy, and thick bone around the residual defect, and the patient's chief complaint, which was "to have a well secured prosthesis," leading to our decision to perform implant rehabilitation. The use of two implants enabled us to provide biomechanical support and adequate retention of the prosthetic device. The surgeon must be careful to position the implant within the limits of the prosthesis for a correct prosthetic rehabilitation, and this requires the use of a surgical template.[11,12] In this situation the acrylic surgical template was made of self-curing acrylic resin. The presence of small bubbles had no influence on the surgical procedure (Fig 4). During the one-stage implant surgery, a reduction in skin thickness and a compressive bandage were performed around the healing abutments to guarantee ideal seating of soft tissues and later, soft tissue health.

Prostheses may be retained using either a clip bar or magnetic caps. Clip bars may offer satisfactory retention, but may have less ability to establish adequate marginal sealing, and more space is generally required to fit the fixation system components. On the other hand, magnets have a lower profile and can improve marginal adaptation.[13] They are also easier to remove, clean, and put back into place. Because of the moisture from the skin and the risk of oxidation, we used a special four-layer magnet, on which the final layer is gold plated. Soft tissue health around the abutments is critical. Therefore, the retentive bar with magnets was built for the sake of comfort and being conveniently hygienic, and was designed not to compromise the contours of the prosthesis. In this situation the eye defect had soft tissue in the inferior margin of the eyebrow. This fact demanded that the top edge of the prosthesis had to stay slightly on the eyebrow (Fig 11). It is important for the framework design to be based on two principles: resistance and easy cleaning.

Kurunmaki et al[14] showed it was possible to use a glass fiber-reinforced composite (FRC) substructure to reinforce the silicone elastomer of a large facial prosthesis; however, the prosthesis in the present study was reinforced with acrylic resin because of its short size and the ease of using acrylic resin. The framework design is based on two principles: strength and ease of cleaning.

During the prosthetic phase of treatment, focusing on tissue assessment, impression taking, sculpting, mold fabrication, familiarity with materials, appreciation of color, and patient education will ensure a satisfactory outcome.[15] A previous study reported the importance of prosthesis control and maintenance due to redness, moist peri-implant tissues, inflammation, granulation tissue, and infection of the peri-implant soft tissues.[16]

The problems experienced by these patients may decrease when specialists regularly monitor the patients. Rehabilitation through alloplastic procedures or prosthetic restoration provides satisfactory conditions of esthetics and well-being, and reinstates individuals in their family and social environment.[17]

Conclusion

Retention and anchorage provided by extraoral implants is almost always the best method to support facial prostheses; however, before performing the rehabilitation, meticulous reverse planning based on a diagnostic wax-up of the future prosthesis is necessary. Extraoral implants must have an ideal positioning to guarantee satisfactory prosthesis volume and contours. Adequate laboratory processing and silicone color selection are also important to achieve the successful outcome of a case.

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