# THE USE OF OSSEOINTEGRATED EPISTHESES IN SEVERE FACE BURN SE-QUELAE

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**SUMMARY**. Four cases are presented of severe face burn sequelae with mutilation of one or both pinnae, treated using osseointegrated epistheses. In the light of over 10 years' use of this technique, applied in other forms of anatomical deficits in the head such as congenital malformations, demolition owing to extensive neoplasias, and serious traumatic sequelae, it is recommended that burn patients should be carefully considered from both the psychological and the technical point of view. It is suggested that such patients should be analysed by a specific team consisting of a plastic surgeon, a psychologist, and a prosthetist who assess their expectations, analyse their actual reactions, and above all judge their degree of acceptance of an episthesis. A description is provided of the advantages of the technique, which is mainly indicated when the mutilated area presents a deficit of tissues capable

## Introduction

For many years attempts have been made to use facial epistheses to restore the physical appearance of a face that has been disfigured by severe damage due to trauma or by demolition performed because of extensive neoplasias. This technique has been used since 1976 at the Division of Plastic Surgery and Burns Therapy in Palermo Civic Hospital in view of certain surgical experiences, such as:

1. the possibility of using a simple free skin graft for the immediate repair of extensive osseocutaneous areas of the upper third of the facial area, after repeated protracted operations to remove vast neoplasias in elderly patients in poor general conditions, thus avoiding complex, repeated reconstructive operations;<sup>1-3</sup>

2. the observation that after the removal of such forms of neoplasia - nearly always possessing infiltrating characteristics - the use of epistheses permitted easier verification of neoplastic recidivation, which is often masked by reconstructions using various types of flap;

3. the possibility of avoiding lengthy repeated reconstructions of certain anatomical parts (pinna, nasal pyramid, orbital area) thanks to the possibility of masking a seriously mutilated and disfigured face - these reconstructive operations are not only complex and protracted but often lead to aesthetically unsatisfactory results that the patient may be unwilling to accept.

The first attempts were made using epistheses that were technically very successful, with facial parts being created that were very similar in shape to the missing portions, matching the adjacent parts in colour, and long-lasting. However, the technique presented an important drawback in the fixing system, as the application was possible only with the use of adhesive substances that limited its use for various practical and medical reasons. The hold proved to be unstable when patients moved their head suddenly or violently, and the holding quality was also unreliable in moments of extreme sweating. In addition, there were also cases of allergic phenomena in the skin due to contact with the adhesive.<sup>2</sup>

The fixing of epistheses using the technique of osseointegration was proposed by Brånemark, who in 1977 was the first to use extra-orally the principle that he had himself conceived for the fixing of oral prostheses.

Briefly, osseointegration is the biological process by which an alloplast material in direct contact with living bone and subject to stress is incorporated by the bone. The biological principle on which the technique is based is that of the biocompatibility of implants made of titanium.

Brånemark<sup>38</sup> began his research on osseointegration using titanium implants in animal bone in the 1950s. In 1977 he performed the first extra-oral implant to hold a hearing aid. The technique was later used in other forms of anatomical deficit in the head, such as congenital malformations and severe traumatic sequelae.<sup>9</sup>

For the last 15 years the technique has been used at the Division of Plastic Surgery and Burns Therapy in Palermo, Italy, and subsequently also at the Specialization School of Tor Vergata Second University, Rome, Italy, in the treatment of severe congenital and acquired facial disfigurement of the upper third of the head. Up to now, 112 cases have been treated (*Table I*).



 Table I - Patients undergoing osseointegration in the two operating units respectively in Palermo and in Rome
 Table II - Incidence of pathologies of the pinna

This paper presents the results of the treatment of four patients with severe face disfigurement caused by deep extensive burns that caused total destruction not only of anatomical parts but also of the surrounding area of skin, thus excluding any possibility of surgical reconstruction.

## Materials and methods

#### The patients

The period in question ran from 1994 to 2004, during which time the two operating teams, respectively in Palermo and in Rome, used the osseointegration implant technique in 112 patients, four of whom presented severe invalidating burns sequelae in the face.

- Patients: three male, one female
- Age: between 9 and 45 years
- Pathology: face burn sequelae two patients presented destruction of one pinna and two of both

The follow-up ranged between 8 months and 14 years.

The therapeutic course was divided into three phases:

- pre-operative period for the planning of the operation
- · the surgical operation
- post-operative period

## Specialist team

Disfiguring face burns certainly rank among those with the greatest psychological impact on patients. Scarring, together with the amputation of parts of the neck and face, makes such patients emotionally fragile, for which reason there has to be a particular pre-operative approach with a specific specialized team that is able to interact with them while the operation is being planned. This team is composed of:

- · a plastic surgeon
- a psychologist
- a prosthetist

The plastic surgeon assesses the case, together with possible alternative techniques and the choice of the most appropriate surgical methods.

The psychologist, who begins to assist the patients immediately after hospitalization in the burns centre, is the professional figure who most closely relates to them. Having followed them during their long stay in hospital, the psychologist knows their story and is best placed to assess their expectations, to analyse their actual reactions, and above all to evaluate their degree of acceptance of the episthesis.

The prosthetist is responsible for creating the episthesis *sensu strictu* and collaborates with the surgeon in the realization of a functional implant that is lifelike, stable in the long term, and acceptable to the patient.

The *surgical procedure* is performed in two distinct stages at least three months apart. In the first stage, after skin incision and detachment as far as the periosteal plane, a special drill is used to implant from two to four titanium fixtures in the bone. In the second stage, after osseointegration has taken place, the abutments, i.e. supports, are screwed into the fixtures. These abutments are little cylinders made of titanium, 3.0, 4.0 or 5.5 mm long, that protrude above the skin through previously created perforations. Three weeks later the patient can be handed on to the prosthetist.

The surgical treatment does not require general anaesthesia but only sedation and local anaesthesia.

The *prosthetist* starts preparation of the implant by placing the laboratory items on percutaneous supports, after which the mould is prepared by pouring onto the site



Fig. 1 - Examples of epistheses that can be constructed to compensate for various anatomical deficits of the face.

first the alginate and then, separated by small gauze pads, a flow of gypsum, taking care to keep the head part of the implants well in view. A wax model is then prepared of the part to be created, as also the gold support bar, and the acrylic resin plate which fixes the episthesis by means of three clips. The material employed to make the final episthesis is silicone blended with colouring matter to give the prosthesis a colour as similar a possible to that of the patient's skin. The resin plate is placed in a muffle and the silicone is packed onto it. The three overlapping pieces of the muffle, pressed with a stirrup, are then placed in an oven at a temperature of 90 °C.

The prosthesis is applied by fitting the clips onto the gold bar screwed to the fixtures.<sup>3</sup>

#### Clinical cases and results

The four patients fitted with epistheses presented sequelae following partial or total face burns. They all had mutilations of one or both pinnae. The auricular regions were affected by severe scarring and the possibility of reconstruction using flaps or the expansion of adjacent tissues had to be ruled out. The patients were fully informed and psychologically prepared for the use of bone-anchored epistheses.

# Caso 1: A.G., male patient aged 21 years

At the age of 4 years the patient suffered extensive thirddegree burns in 60% body surface area (BSA) in the head, anterior and posterior thorax, upper limbs and hands, and partially in the lower limbs. He was subjected to various surgical procedures of escharectomy, amputation of both pinnae and the fingers of the right hand (which were totally carbonized), and repair with free autologous skin grafts. At the age of 9 he began to wear corrective lenses owing to the onset of myopia and astigmatism - he could not wear glasses. The decision to use auricular epistheses employing the osseointegration technique was dictated by the presence of extensive scarring in the adjacent areas (Figs. 2-6).



Fig. 2 - The patient on admission and after amputation of the pinnae and repair with free skin grafts.



Fig. 3 - Same patient, at age of 9 years, after application of auricular epistheses to enable him to wear glasses.





Fig. 4 - Detail of left auricular region. Lower figure shows gold bar, attached to the fixtures, onto which the episthesis is to be fixed.



Caso 2: C.A., male patient aged 24 years

At the age of 5 years C.A. suffered third-degree burns in 30% BSA in the head, anterior thorax, abdomen, and hands. He had operations for escharectomy, as well as the amputation of both pinnae and coverage with free skin grafts, including the auricular areas. At the age of 24 it became necessary to restore the overall shape and harmony of the face. Owing to the presence of scar tissue in the entire auricular area, it was decided to use bilateral auricular epistheses with the osseointegration implant technique (*Figs.* 7,8).

*Caso 3*: F.S., male patient aged 42 years At the age of 39 the patient suffered a serious indus-

**Fig. 7** - The patient on admission. Notice the ample scarring in the auricular regions.



Fig. 8 - After application of the epistheses.



# Fig. 9 - The patient on admission.

Fig. 10 - After application of the left auricular episthesis.

trial accident, with burns in the left half of the face and amputation of the homolateral pinna. He was subjected to various operations for reconstruction of the damaged side of the face. The patient was informed of the possibility of reconstructing the pinna either with a series of operations or with the use of a bone-anchored episthesis. The patient opted for the second solution (*Figs. 9,10*).

Caso 4: F.K., female patient aged 25 years

This Pakistani lady, at the age of 20, suffered chemical burns in the face when she was splashed with sulphuric acid. The right pinna was seriously damaged - it was reduced to a shapeless cicatricial mass. The patient was informed of the possibility of restoring the anatomical form and opted for a bone-anchored episthesis (*Figs. 11-14*).



Fig. 11 - The right pinna as it appeared when the patient was admitted.



Fig. 12 - The phase of positioning the abutments.



Fig. 13 - The gold bar fixed to the abutments.





Fig. 14 - The pinna episthesis in position.

#### **Considerations and conclusions**

In the light of the objective results obtained, the options taken, and the degree of satisfaction expressed by the patients who saw the improvement in their appearance, we are of the opinion that the use of bone-anchored epistheses is mainly indicated when the mutilated area lacks suitable tissue for reconstruction using traditional surgical techniques.

The technique's advantages can be listed as follows:

- The surgical operations are limited in number and easy to perform.
- The rate of anaesthesiological risk is very low.
- It provides a rapid solution for aesthetic problems and is well accepted by the patients, with a consequent reduction of the psychological stress that is so high in burn patients.
- The epistheses are well anchored to the bar attached to the osseointegrated fixtures and they enable the patient to perform all activities, including sport, without any fear of sudden detachment. The epistheses can be removed, using a particular manoeuvre, in order to check on the area that is covered up and for cleaning purposes.

The disadvantages can be synthesized as non-acceptance in the long-term of the decision to opt for a prosthesis (this happens when the patient is not psychologically prepared) and wear and tear of the episthesis in the course of time (the colour tends to change, becoming lighter especially in parts exposed to the sun). In a limited number of cases (1%) we observed a phlogistic reaction around the implant, which was successfully treated with local application of antibiotics.

**RÉSUMÉ**. Les Auteurs présentent quatre cas de séquelles graves de brûlures du visage, avec mutilation d'un ou de tous les deux pavillons de l'oreille, traitées moyennant l'emploi d'épithèses ostéointégrées. A la lumière d'une expérience ultra décennale utilisant cette technique, appliquée en autres formes de déficit anatomique de l'extrémité céphalique comme les malformations congénitales, les démolitions à cause de néoplasies étendues et les séquelles graves de traumatismes, ils recommandent une étude attentive du patient du point de vue soit technique que psychologique. Ils proposent qu'il soit examiné par une équipe spécifique composée du chirurgien plastique, du psychologue et du prosthétiste, qui devront évaluer son attente, analyser son effective réactivité et surtout juger son degré d'acceptation d'une épithèse. En conclusion, ils illustrent les avantages de la technique, qui trouve son indication principale quand la zone mutilée présente un déficit de tissus, appropriés pour la reconstruction, moyennant les techniques chirurgicales traditionnelles.

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