

Implant-Retained Maxillofacial Prostheses for Reconstruction of Burned Patients: A Report of Two Cases

Yanık Hastalarının İmplant Destekli Maksillofasiyal Protezlerle Rekonstrüksiyonu: İki Olgu Sunumu

Seçil KARAKOÇA NEMLİ,^a
Merve BANKOĞLU GÜNGÖR,^a
İrem TÜRKCAN^a

^aDepartment of Prosthodontics,
Gazi University Faculty of Dentistry,
Ankara

Geliş Tarihi/Received: 10.01.2014
Kabul Tarihi/Accepted: 20.03.2014

*This study was presented as a poster at
18th Annual Congress of BaSS, 25-28 April,
2013, Skopje, Macedonia*

Yazışma Adresi/Correspondence:
Seçil KARAKOÇA NEMLİ
Gazi University Faculty of Dentistry,
Department of Prosthodontics, Ankara,
TÜRKİYE/TURKEY
secilkarakoca@yahoo.com

ABSTRACT Surgical reconstruction of facial structures of burned patients remains one of the most difficult areas of plastic surgery, and the esthetic results are not always acceptable. Implant-retained maxillofacial prostheses are an alternative treatment to surgical reconstruction for patients who lost facial structures from burn. This article describes fabrication of an implant-retained auricular prosthesis and a nasal prosthesis for two burned patients and represents treatment outcomes. Extraoral implants were placed in the defect sites. After a 3-month osseointegration period, abutments were connected to the implants at stage 2 surgery. Retention was obtained with bar-clips attachment for auricular prosthesis and magnetic attachment for nasal prosthesis. The prostheses were fabricated from silicone. After prosthetic reconstruction, clinical follow-ups were performed every six months. The implant-retained prosthetic rehabilitation of the burned patients discussed in this article resulted in acceptable functional and cosmetic results.

Key Words: Burns; maxillofacial prosthesis

ÖZET Yanık hastalara ait yüz yapılarının cerrahi rekonstrüksiyonu, plastik cerrahinin zor alanlarından birini oluşturmada ve estetik sonuçlar her zaman başarılı olmamaktadır. Yanık nedeniyle yüz yapılarını kaybeden hastalarda, implant destekli yüz protezleri cerrahiye alternatif bir tedavi seçeneğidir. Bu olgu sunumunda yanık nedeniyle defekte sahip 2 hasta için implant destekli kulak ve burun protezinin yapımı ve tedavi sonuçları anlatılmaktadır. Defekt bölgelerine ekstra-oral implantlar yerleştirilmiştir. 3 aylık osseointegrasyon süreci sonunda, 2 aşamalı cerrahi ile abutmentler implantlara bağlanmıştır. Retansiyon; kulak protezi için bar tutucular ile, burun protezi için ise mıknatıslı tutucular ile sağlanmıştır. Protezler silikondan üretilmiştir. Protezlerin takılmasından sonra, klinik takipler 6 ayda bir yapılmıştır. İmplant destekli yüz protezlerinin yanık hastalarda başarılı fonksiyonel ve kozmetik sonuçlar oluşturduğu belirlenmiştir.

Anahtar Kelimeler: Yanıklar; maksillofasiyal protez

Türkiye Klinikleri J Dental Sci 2016;22(1):63-9

Facial disfigurements may result from congenital malformations, traumatic injuries, diseases and burns.^{1,2} Loss of facial structures due to trauma including burn leads to functional deficits and high level of emotional stress. Burn trauma is extremely complex and mortality rate for these patients is high. Burn injuries can cause significant changes in patients' appearance through scarring, contractures, changes in skin pigmentation, or amputations. Facial burn patients not only suffer from huge chronic physical impairment but also have psychological and social problems as consequences of facial burn can be critical to appearance and feel-

ings of self-esteem.^{3,4} These patients have to receive long term or even lifetime functional reconstruction and rehabilitation therapy.⁵ In cases of facial burns, the main goal should be restoration of the facial structures, with good or acceptable anatomical balance and symmetry and a dynamic facial expression.⁶

Surgical reconstruction methods which require a multidisciplinary team are being prescribed for facial burn patients to improve their appearances and ultimately their mental and physical well beings.^{7,8} The multidisciplinary team approach is required for psychological preparedness for surgery, adequate nutrition, postoperative splinting, and postoperative psychological support.^{9,10} Esthetic reconstruction of burned face, however, remains one of the most difficult areas of plastic surgery.¹¹⁻¹³ The outcomes of surgically treated facial burn defects are usually less than ideal both functionally and esthetically, though many operative sessions spanning many years are required. Also, surgical reconstruction carries ongoing complication risks and the cost of the treatment is high.

An acceptable alternative for facial burn patients is implant-retained maxillofacial prostheses. Implant-retained facial prostheses is a well known and reliable treatment option for patients with auricular, orbital, nasal and combined facial defects. The current literature, however, predominantly addresses the use of maxillofacial prosthesis for treatment of defects resulted from tumor surgery and congenital disorders.¹⁴⁻²⁴

In the literature, there is only limited information on the use of implant-retained maxillofacial prostheses for the treatment of burned patients.¹¹⁻¹³ There are reports, in the current literature, which describe the use of extraoral implants for ear reconstruction in burned patients and analyze treatment outcomes.¹¹⁻¹³ Fabrication of a nasal prosthesis in a burned patient, however, is described for the first time to the best of authors' knowledge. This article describes fabrication of an implant-retained auricular prosthesis and a nasal prosthesis for two burned patients and represents treatment outcomes.

CASE REPORTS

CASE REPORT 1

A 23-year-old man presented with history of burn in a traffic accident. Right sides of his head, face, neck and body were affected. He presented for reconstruction of his right ear. After the accident, he underwent multiple surgical procedures to improve his esthetic appearance and functional performance of his ear. Expansion was applied to the unaffected scalp to create scalp on the affected side of the head. An implant-retained auricular prosthesis was planned for the patient during the expansion. The patient signed a written informed consent before his treatment.

Hearing function was normal and external auditory canal was remained open and in position. Potential implant sites were evaluated for bone depth and width by means of computed tomography scans. A surgical template was used to ensure optimal implant placement.¹ A 2-stage surgical procedure was applied.^{1,14} Three extraoral implants (EO implant; Institut Straumann AG, Basel, Switzerland), 4 mm in length and 3.3 mm in diameter, were placed along an arc approximately 20 mm posterior to the external auditory canal. The implants were allowed to osseointegrate for 3 months.

At stage 2 surgery, the implants were exposed, and the abutments (EO Conical abutment; Institut Straumann AG) were connected to the implants. Abutments were tightened with a torque control device (Institut Straumann AG), up to 15 Ncm, as recommended by the manufacturer. The skin flap was sutured down to the periosteum without pressure using nylon sutures. The implants were located, the flap was perforated over the abutments, and gauze pack packing was applied with pressure. The periimplant tissue was allowed to heal for 2 weeks. Impression cylinders (048.104; Institut Straumann AG) were secured on the abutments. Impressions of the abutments and defect area were made using a silicone impression material (Zeta-plus; Zhermack SpA, Badia Polesine, Italy). The impression was poured in ADA-type V dental stone (Die Keen; Heraeus Kulzer, Armonk, NY) to pro-

duce the working cast. A prefabricated bar (Dolder bar; Institut Straumann AG) was used to splint the implants together and to provide a mechanism for retention by means of clips (Dolder bar matrix; Institut Straumann AG). Passive and accurate fit of the bar was verified on the patient (Figure 1a). An acrylic resin substructure (Panacryl; Arma Dental, Istanbul, Turkey) which housed retentive clips was fabricated. A wax (Epithetic Wax; Bredent GmbH, Senden, Germany) pattern of the prosthesis was then completed on the cast. The size, shape, position, fit, and contours of the wax pattern were evaluated on the patient. The auricular prosthesis was fabricated from silicone (Cosmesil; Principality Medical Ltd, South Wales, UK) which was intrinsically pigmented to match different shades of the patient's skin. Silicone was processed as described previously.¹⁵ The fit and the shade of the auricular prosthesis were evaluated on the patient. Following processing, extrinsic coloration was applied on some areas of the prosthesis to enhance the color match to the patient's tissues (Figure 1b and 1c).

CASE REPORT 2

A 57-year-old woman presented with history of burn with hot water at home. Forehead, eyelids,



FIGURE 1a: Dolder bar in place with passive fit.



FIGURE 1b: Lateral view of silicone auricular prosthesis in place.



FIGURE 1c: Frontal view of silicone auricular prosthesis in place.

nose, cheek, and upper lip were affected. Corrective surgery has been made by means of skin grafts; but complete absence of the nose required implant-retained prosthesis. The patient signed a written informed consent before her treatment.

Surgical procedure similar to Case 1 was applied. Three extraoral implants, 5 mm in length and 3.3 mm in diameter, were placed at the floor of the nose. After a 3-months osseointegration period, magnetic abutments (EO Magnetic abutment; Institut Straumann AG) were connected to the im-

plants at stage 2 surgery. Abutment tightening and wound closing were performed as described for Case 1. At the end of a 2-week periimplant tissue healing period, impression copings (048.530; Institut Straumann AG) were secured on the abutments (Figure 2a). An impression of the abutments and the defect area was made and the cast was obtained. An acrylic resin substructure incorporating the magnets (EO Magnet; Institut Straumann AG) was fabricated. Wax pattern of the prosthesis was completed and evaluated on the patient. Silicone nasal prosthesis was fabricated as described for Case 1. Color match of the nasal prosthesis was found sufficient by the patient and clinicians. Therefore, extrinsic coloration was not applied (Figure 2b).

In both patients, the prostheses were inserted and they were instructed in home care and maintenance. The patients were instructed to clean the prostheses and the peri-implant skin daily with a soft toothbrush and to make irrigation with warm water and soap to remove skin accretions. Also, patients were told not to sleep with prostheses. The patients were examined one week after the prostheses fit. Then, clinical follow-up examinations were carried out at every 6 months, unless some complications occurred sooner.

RESULTS

In both patients, all implants were clinically integrated in the bone as revealed by absence of clinically detectable mobility and peri-implant skin showed no signs of infection during the follow-up period. The follow-up period was six years for the patient with auricular prosthesis and five years for the patient with nasal prosthesis.

The patient with auricular prosthesis was very happy with appearance and comfort of his prosthesis and wore it most of the time. He had reported that he could not accept his facial disfigurement and he had psychological problems after the accident. Wearing the auricular prosthesis gave him support in terms of self-consciousness and facilitated getting back into social life. A replacement prosthesis was provided 1.5 years after the insertion of the first prosthesis because of dis-

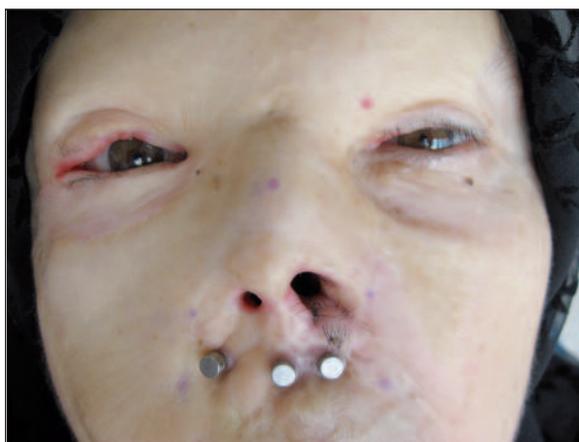


FIGURE 2a: Frontal view of silicone auricular prosthesis in place.



FIGURE 2b: Silicone nasal prosthesis in place.

coloration. He used the second prosthesis for 2.5 years, and then a third prosthesis was fabricated because of discoloration and deterioration of the silicone. In case 1, retention degradation of the clips was observed at 6, 18, 36, and 54 month controls.

Retention was improved by activating the clips with an activator device, and by frequently

refreshing the patient's memory about the instructions for insertion and removal of the prosthesis. Also, a loosening in the bar screw was observed at 36 months control. The screws were retightened using a torque control device.

The patient with nasal prosthesis was also happy with appearance and comfort. Furthermore, the nasal prosthesis with realistic sized nostrils provided her comfort while breathing. She could easily insert the prosthesis thanks to magnets. A replacement prosthesis was provided one year after insertion of the first prosthesis because of accidental fracture of the acrylic resin substructure. She used the second prosthesis for three years then a third prosthesis was fabricated because of discoloration.

DISCUSSION

Several techniques for correcting post-burn loss of the ears are reported in the literature.^{7,8} One alternative to these techniques is implant-retained auricular prosthesis. Prosthetic rehabilitation which requires fewer number of surgeries and shortens the surgical time, carries lower risk of postsurgical complications, avoids donor site morbidity, and leads to better esthetic results compared with surgical techniques.¹¹⁻¹⁴ The use of implants for retention of prosthesis provides enhanced retention and stability, improves the patient's confidence and sense of security, and natural esthetics. Implant-retained maxillofacial prosthesis enhances the patient's quality of life, providing high satisfaction with the prosthesis and self-confidence in social life.^{2,16-18} Furthermore, due to the high success rates of implants in the craniofacial region, implant-retained maxillofacial prosthesis becomes a reliable treatment modality.¹⁹⁻²³ Though limited information can be found on the implants placed in regions exposed to burns, existing reports indicate high success rates.¹¹⁻¹⁴ Further clinical studies with large cohort sizes and long study periods are needed to assess success of implants in the burned regions.

Disadvantages of this treatment may include that a prosthesis is a foreign body that has to be

taken off at night, lifespan of the prosthesis is limited, complications related to implant components may occur, and color matching might be difficult in burned patients because of complex color and texture of burned skin and grafts.^{2,13,23,24} Studies assessing patient satisfaction with implant-retained maxillofacial prostheses reveal a high rate of satisfaction.^{2,16-18} In line with the authors' previous experience with a large number of maxillofacial defect patients, the prosthesis became an integral part of the patient's body in a short time after the prosthesis insertion. The patient does not feel the prosthesis as a foreign body although (s)he has to take it off for cleaning and during the night. Furthermore, during remaking procedure which leaves the patient without prosthesis for a few days, the patient feels uncomfortable. The lifespan of the facial prostheses was reported one to two years in the literature.^{2,23,24}

Despite improvements in maxillofacial prosthetic materials, discoloration and deterioration of the silicone over time remain as the major problems. Considering that clinical and laboratory production of a maxillofacial prosthesis is a time-consuming, labor-intensive, and costly process; the limited lifespan may be an important disadvantage. Replacement prosthesis, however, generally requires less time and effort.² Also, personal habits of the wearer (cleaning regimes and use of cosmetics), and environmental staining (climate, fungal, and body oil accumulation) may contribute to life expectancy and serviceability of the prosthesis as well as intrinsic characteristics of the material and pigments.^{2,25} Another consideration for prosthetic treatment of facial burn patients is the construction challenges. Deeply burned skin is often so densely scarred that it may be difficult to fabricate a prosthesis harmonious with the face in terms of chromatic and anatomical characteristics. Therefore, it is a challenge to provide an esthetically pleasing facial prosthesis. To provide facial balance, the prosthesis should follow surrounding scarring as well as be harmonious with full anatomy.

To provide retention for maxillofacial prostheses via implants, different retentive attachments have been used including bar-clips, magnetic, stud,

and combined attachments.²⁶⁻³¹ The most commonly used retentive attachments are bar-clip and magnetic systems. The attachment type is selected in each case by assessing the advantages and drawbacks of bar-clip retention and magnetic retention.^{26,30,31} The bar-clip system provides good retention to the prosthesis; therefore, it is generally used in auricular and large facial defects. Bar-clips, however, may limit access to the prosthesis for hygienic care and render insertion and removal of the prosthesis difficult. Magnetic retention provides ease for cleaning thanks to the individual standing abutments. Magnets create relatively low moment forces on the supporting abutments when the prosthesis is removed by a tilt slide release action. Thus, overload is avoided on the implants and easy insertion and removal of the prosthesis is ensured. Also, shallow defects do not have clearance for the bar and its components.^{26,29,31} In the present cases, retentive attachment of each case revealed satisfactory clinical results. For the auricular prosthesis patient who is a young and active person, bar-clip system provided adequate retention. For the nasal prosthesis patient who has a compromised vision for inserting the prosthesis and cleaning

peri-implant tissue, magnetic system proved to be an ideal attachment.

The health of peri-implant tissue is a critical factor for the long-term success of extraoral implants. After osseointegration, the most frequent complications occur in the area of skin penetrating abutment. The inflammation of peri-implant soft tissue is associated with poor hygiene, physical irritants, and thickness and excessive mobility of tissues.³² To optimize peri-implant soft tissue, a layer of subcutaneous tissue not exceeding two mm in thickness should be created during surgery. Previous reports, however, emphasized that tissue reactions were most commonly associated with lapses in hygiene.^{22,32} Hygiene procedures must be carried out daily. Peri-implant tissue should be wetted with a cotton swab and a solution of hydrogen peroxide and water (1:1) to soften the sebaceous crusting. Then, the area should be cleaned with a soft toothbrush and facial soap without hurting the junction between the skin and the abutment.³³ Patient's motivation and rigid adherence to the hygiene is a critical factor for the success of implant-retained extraoral prosthetic treatment.

REFERENCES

- Henry PJ. Maxillofacial prosthetic considerations. In: Worthington P, Branemark PI, eds. *Advanced Osseointegration Surgery: Applications in the Maxillofacial Regions*. 1st ed. Chicago: Quintessence Book; 1992. p.313-26.
- Hooper SM, Westcott T, Evans PL, Bocca AP, Jagger DC. Implant-supported facial prostheses provided by a maxillofacial unit in a U.K. regional hospital: longevity and patient opinions. *J Prosthodont* 2005;14(1):32-8.
- Van Loey NE, Van Son MJ. Psychopathology and psychological problems in patients with burn scars: epidemiology and management. *Am J Clin Dermatol* 2003;4(4):245-72.
- Arno A, Barret JP, Harrison RA, Jeschke MG. Face allotransplantation and burns: a review. *J Burn Care Res* 2012;33(5):561-76.
- Xie B, Xiao SC, Zhu SH, Xia ZF. Evaluation of long term health-related quality of life in extensive burns: a 12-year experience in a burn center. *Burns* 2012;38(3):348-55.
- Koljonen V, Laitila M, Sintonen H, Roine RP. Health-related quality of life of hospitalized patients with burns-comparison with general population and a 2-year follow-up. *Burns* 2013;39(3):451-7.
- Bhandari PS. Total ear reconstruction in post burn deformity. *Burns* 1998;24(7):661-70.
- Zhao Y, Wang Y, Zhuang H, Jiang H, Jiang W, Hu X, et al. Clinical evaluation of three total ear reconstruction methods. *J Plast Reconstr Aesthet Surg* 2009;62(12):1550-4.
- Klein MB. Burn reconstruction. *Phys Med Rehabil Clin N Am* 2011; 22(2):311-25.
- Wiechman SA. Psychosocial recovery, pain, and itch after burn injuries. *Phys Med Rehabil Clin N Am* 2011;22(2):327-45, vii.
- Bottini DJ, Gentile P, Colicchia G, Grimaldi M, Trimarco A, Cervelli V. Alternative techniques in reconstructive surgery: bone-anchored extraoral implants for burn cases. *Aesthetic Plast Surg* 2008;32(1):58-62.
- Gentile P, Bottini DJ, Colicchia GM, Trimarco A, Cervelli V. Burns: bone-anchored, extraoral implantology. *J Burn Care Res* 2008;29(4):627-31.
- Gacto-Sanchez P, Infante-Cossio P, Gomez-Cia T, Lagares A, Belmonte-Caro R. The Ti-Epiplating system as an alternative for ear prostheses in burned patients. *J Burn Care Res* 2011;32(3):e101-7.
- Lundgren S, Moy PK, Beumer J 3rd, Lewis S. Surgical considerations for endosseous implants in the craniofacial region: a 3-year report. *Int J Oral Maxillofac Surg* 1993;22(5):272-7.
- Seelaus R, Troppmann RJ. Facial prosthesis fabrication: Coloration techniques. In: Taylor TD, ed. *Clinical Maxillofacial Prosthetics*. 1st ed. Chicago: Quintessence; 2000. p. 233-44.

16. Nemli SK, Aydin C, Yilmaz H, Bal BT, Arici YK. Quality of life of patients with implant-retained maxillofacial prostheses: a prospective and retrospective study. *J Prosthet Dent* 2013;109(1):44-52.
17. Chang TL, Garrett N, Roumanas E, Beumer J 3rd. Treatment satisfaction with facial prostheses. *J Prosthet Dent* 2005;94(3):275-80.
18. Anderson JD, Szalai JP. The Toronto outcome measure for craniofacial prosthetics: a condition-specific quality-of-life instrument. *Int J Oral Maxillofac Implants* 2003;18(4):531-8.
19. Jacobsson M, Tjellstrom A, Fine L, Andersson H. A retrospective study of osseointegrated skin-penetrating titanium fixtures used for retaining facial prostheses. *Int J Oral Maxillofac Implants* 1992;7(4):523-8.
20. Abu-Serriah MM, McGowan DA, Moos KF, Bagg J. Outcome of extra-oral craniofacial endosseous implants. *Br J Oral Maxillofac Surg* 2001;39(4):269-75.
21. Roumanas ED, Freymiller EG, Chang TL, Aghaloo T, Beumer J 3rd. Implant-retained prostheses for facial defects: an up to 14-year follow-up report on the survival rates of implants at UCLA. *Int J Prosthodont* 2002;15(4):325-32.
22. Karakoca S, Aydin C, Yilmaz H, Bal BT. Survival rates and periimplant soft tissue evaluation of extraoral implants over a mean follow-up period of three years. *J Prosthet Dent* 2008;100(6):458-64.
23. Visser A, Raghoebar GM, van Oort RP, Vissink A. Fate of implant-retained craniofacial prostheses: life span and aftercare. *Int J Oral Maxillofac Implants* 2008;23(1):89-98.
24. Karakoca S, Aydin C, Yilmaz H, Bal BT. Retrospective study of treatment outcomes with implant-retained extraoral prostheses: survival rates and prosthetic complications. *J Prosthet Dent* 2010;103(2):118-26.
25. Dootz ER, Koran A 3rd, Craig RG. Physical properties of three maxillofacial materials as a function of accelerated aging. *J Prosthet Dent* 1994;71(4):379-83.
26. Gary JJ, Donovan M. Retention designs for bone-anchored facial prostheses. *J Prosthet Dent* 1993;70(4):329-32.
27. Lemon JC, Chambers MS. Locking retentive attachment for an implant-retained auricular prosthesis. *J Prosthet Dent* 2002;87(3):336-8.
28. Chung RW, Siu AS, Chu FC, Chow TW. Magnet-retained auricular prosthesis with an implant-supported composite bar: a clinical report. *J Prosthet Dent* 2003;89(5):446-9.
29. Mekayarajananonth T, LoCascio SJ, Winkler S, Salinas TJ, Guerra LR. Alternative retention for an implant-retained auricular prosthesis. *J Oral Implantol* 2002;28(3):117-21.
30. Arcuri MR, LaVelle WE, Fyler E, Jons R. Prosthetic complications of extraoral implants. *J Prosthet Dent* 1993;69(3):289-92.
31. Alvi R, McPhail J, Hancock K. Closed-field titanium magnets for the retention of complex craniofacial prostheses. *Br J Plast Surg* 2002;55(8):668-70.
32. Goiato MC, Takamiya AS, Alves LM, dos Santos DM. Postsurgical care for rehabilitation with implant-retained extraoral prostheses. *J Craniofac Surg* 2010;21(2):565-7.
33. Reisberg DJ, Habakuk SW. Hygiene procedures for implant-retained facial prostheses. *J Prosthet Dent* 1995;74(5):499-502.