 Prague Medical Report / Vol. 111 (2010) No. 2, p. 148–157

Team Approach in Treatment of Extensive Maxillofacial Defects – Five Case Report Serie

Hubálková H.[1], Holakovský J.[1], Brázda F.[2], Diblík P.[2], Mazánek J.[1]
[1]Charles University in Prague, First Faculty of Medicine and General University Hospital, Department of Stomatology, Prague, Czech Republic;
[2]Charles University in Prague, First Faculty of Medicine and General University Hospital, Department of Ophthalmology, Prague, Czech Republic

Received February 4, 2010; Accepted April 13, 2010.

Key words: Dentistry – Plastic surgery – Oncology – Epithesis – Dental titanium implants – Maxillofacial defects

Abstract: Long-lasting functional and esthetic rehabilitation and good health-related quality of life of patients with maxillofacial defects is based on effective interdisciplinary cooperation especially of surgeons, dentists and technicians. Extensive defects occur after the first phase of the oncologic surgery and immediately after injuries. Subsequent plastic surgery is the initial step of functional reconstruction and creates a base for future fabrication of post-operative dentures and implant-born epitheses. Five clinical reports demonstrate complex rehabilitation of typical maxillofacial defects solved within the multidisciplinary cooperation. Four patients with oncological diagnoses and complex surgical treatment, resp. radio- and chemotherapy are reported with interim and long-term prosthetic solutions. One patient suffered from a congenital malformation. Titanium implants were inserted in defect bone margins using two-phase method. Healing time was at minimum three months and after this period superstructures were applied. Artificial eyes were made of both glass and acrylic materials. Retention of presented postoperative prostheses was reliable; patients were satisfied with the functional and esthetical results of the reconstruction. Prognosis of the rehabilitation depends on the histological stability of adjacent tissues, quality of osseointegration and durability of materials used (silicones, acrylates). Satisfactory health-related quality of life of these patients is based on the multidisciplinary healthcare.

This study was supported by the grant MPO CR FI-IM5/218 2008004/66 (Lasak).

Mailing Address: Assoc. Prof. Hana Hubálková, MD., PhD., Charles University in Prague, First Faculty of Medicine and General University Hospital, Department of Stomatology, Kateřinská 32, 121 08 Prague 2, Czech Republic; e-mail: hana.hubalkova@lf1.cuni.cz

Introduction

The maxillofacial (M-F) region can be affected by serious diseases destroying all structures – soft and hard tissues of jaws, facial skeleton, oral tissues, lips, cheeks, nose and eyes. This situation can be connected with oro-antral, oro-nasal, oro-nasal-orbital communications (Ortegon et al., 2008). This fact represents abnormal connections between internal and external environments. In spite of successful plastic surgery we cannot absolutely avoid the possibility of persistence of such problems which sometimes exist only for a limited period. Extended M-F defects are caused by oncologic diseases, injuries or congenital malformations. Important role in the final decision of suitable treatment has an evaluation as well as general health status and as of local conditions, e.g. histo-pathologic stability of tissues.

The necessity of cooperation of different medical specialists is inevitable: maxillofacial surgeon, oncologist, ophthalmologist, otorhinolaryngologist, prosthodontist and an experienced dental technician, radiologists and other specialists.

Lost tissues need to be replaced in order to gain their former function (Ikeda et al., 2007; Ono et al., 2007). There are different methods in this way: plastic surgery (flaps and bone transfers, augmentations), and prosthetic rehabilitation: metallic implants, post-operative dental prostheses, epitheses with artificial eyes, replacing noses and ears, obturator appliances (Zhao et al., 2001; Cheng et al., 2008; Depprich et al., 2008). The most sophisticated method of individual bone replacement is based on a series of CT scans followed by 3D model of the defect for verification of the shape and size accuracy. This procedure allows exact fabrication of individual implant for replacement of lost bone tissues (Jirman et al., 2009).

Performance of the craniofacial surgery on the 3D CT images has provided surgeons chances to formulate the most suitable surgical blueprint and to become familiar with the operational procedures (Lee et al., 2002).

Effective team-work contributes to achieving a better health-related quality of life for treated patients. It involves as functional as well as esthetic aspects of rehabilitation. The aim of complex treatment is to facilitate the basic function of M-F region, e.g. biting and swallowing for adequate nutrition and speech for social communication. Esthetic rehabilitation is an important condition for improved psychological well-being. All these factors play a basic role to increase the health-related quality of life of these patients.

Apart from medical specialists, an important contribution in the care of the patient is the support of psychologists. He is able to help the patient to understand and accept postoperative changes and existing limits of the treatment and also positive perspectives of future rehabilitation.

Methods

Following text of our paper describes five patients treated in our institution. All procedures performed throughout the work have complied with ethical guidelines corresponding to relevant laws.

Case 1

J. M., female, 52 years old, Caucasian; in the age of 1 year there was observed exenteration of her left orbita due to a malignant tumor. Radiotherapy followed surgical treatment. At the age of 15 her first orbicular epithesis was manufactured. Figure 1 demonstrates the status of orbital defect. During the following years new epitheses were delivered; last of them at the beginning of 2008 (Figure 2). The retention and stability of this epithesis is assured by the ocular frames (Figure 3). This solution has been positively accepted by this patient. Due to long-term histological stability of the exposed area, titanium implants for more effective retention were considered but the patient refused them.

Figure 1 – Situation after the orbita exenteration, the base of defect is covered by a movable skin.

Figure 2 – Prosthetic rehabilitation of the defect with epithesis supported by the ocular frame.

Figure 3 – Orbicular epithesis joined to the glasses.

Case 2

R. K., male, 38 years old, Romany; in 2007 this patient observed redness of the conjunctiva in his left bulbus and diplopia. Magnetic resonance imaging revealed an extended tumor at the temporal region and in the orbita, dislocating the bulbus. Exenteration of the orbita was followed by radiotherapy in October 2007. Both eye lids were preserved (Figure 4). Histological examination showed solid carcinoma with basaloid features. A short period after realized radiotherapy, subsequent surgical treatment involving dental implants has not been indicated yet. Figure 5 demonstrates orbital epithesis supported by frames as a temporary solution. Figure 6 shows details of the epithesis fixed to the frame.

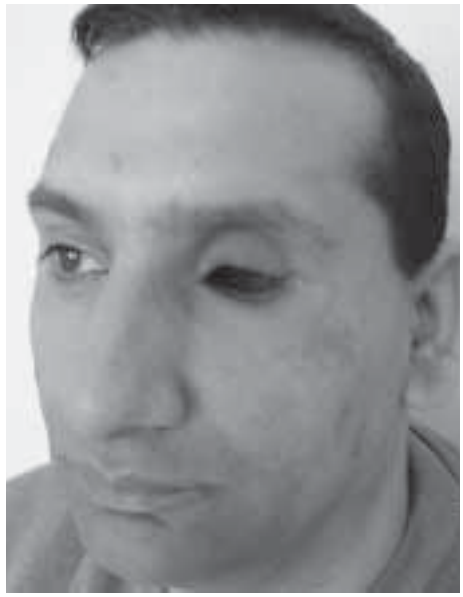

Figure 4 – Postoperative defect in the left orbita after the exenteration with persisting eye lids.

Figure 5 – View of orbital area with epithesis supported by the frame.

Figure 6 – Detail of the ephitesis fixed to the frame, temporary solution realized immediately after the oncological surgery.

Case 3

E. Z., female, 62 years old, Caucasian; at the age of 6 years there was realized enucleation of her right eye due to a congenital malformation. After enucleation the eye was replaced by the glass ocular prosthesis. In the year 2001 extirpation of the desmoid cyst in her right orbita was performed, followed by removal of both eye lids and insertion of titanium dental implants. Figure 7 demonstrates the situation after dental implants osseointegration. Figure 8 shows results of rehabilitation using orbicular epithesis supported by 3 dental titanium implants placed in supraorbital and infraorbital bone margins.

Figure 7 – Healed wound after the orbita exenteration with intraosseal titanium implants placed in margo supraorbitalis and infraorbitalis.

Figure 8 – Result of prosthetic rehabilitation by implant-born ephitesis.

Case 4

P. J., male, 65 years old, Caucasian; the patient suffered from the multiple skin basaliom of the facial area penetrating the right internal eye corner. Basaliom from this localisation was extirpated and lost tissues were replaced by arm skin flap in 2002. One year later a recurrence of basaliom was found in the postoperative scar and adjacent nasal tissues, penetrating into the right orbita. This relapse was treated by the exenteration of the right orbita and consequent insertion of titanium implants for future epithesis support. Figure 9 demonstrates situation 6 years after the surgery, 3 titanium implants with ball attachments are present in marginal bone structures; in the deepest part of this orbita, small rounded communication into paranasal sinuses is visible. In Figure 10 a new orbital epithesis replacing lost tissues

before final cosmetic adjustments *in situ* is shown. The same patient with fitted epithesis is cosmetic improved (Figure 11). Optimal esthetic effect is achieved by a suitable design and size of glasses. Figure 12 is a lateral view of the epithesis and its silicone margin. Cosmetic effect achieved by this rehabilitation was positively accepted by the patient.

Figure 9 – Status after the exenteration of the right orbita; 3 titanium implants inserted in margo supraorbitalis and infraorbitalis.

Figure 10 – Large defect of the right orbita is filled by the epithesis replacing facial soft tissues and the right bulbus. The silicone surface of the epithesis before the final cosmetic adjustment.

Figure 11 – Epithesis in situ; completed by frames achieving better esthetic effect.

Figure 12 – Detail of epithesis from lateral view demonstrating thin silicone layer. Surface of the silicone material reveals similar appearance as adjacent skin.

Case 5

J. P., male, 76 years old, Caucasian; the patient with a diagnosis of carcinoma maxillae l. sin. was surgically treated by the resection of the left maxilla connected with the exenteration of his left orbita and adjacent soft facial tissues (Figure 13).

Figure 13 – Status after the exenteration of the orbita, resection of the maxilla and adjacent buccal soft tissues.

Figure 14 – Another view demonstrates postresectional upper complete obturator denture with a magnetic attachment in situ.

Figure 15 – Situation after complex prosthetic rehabilitation of extremely large defect caused by surgery.

Figure 16 – Facial and orbital epithesis fixed to glasses and connected with a magnet to the upper obturator denture.

In 2008 there was the last surgical intervention due to a recurrence of malignancy followed by radiotherapy. Enormous defect in this M-F region caused by the loss of the bone structures, cheeks, orbicular area including left eye results in a functional difficulties of patient's speech, mastication, drinking, swallowing, vision. Mutilation of the whole face was accompanied by psychological and social problems. Histological instability of affected tissues and performed radiotherapy does not allow definitive reconstruction based on bone augmentation, flap transfer and insertion of dental titanium implants. Figures 14–16 demonstrate temporary prosthetic rehabilitation. Figure 14 shows lateral view on the facial and orbital defect in the patient having upper complete obturator denture equipped with a magnet attachment. Frontal view (Figure 15) demonstrates complete prosthetic rehabilitation: orbital epithesis including an acrylic eye; upper and lower complete dentures supporting soft facial tissues and facilitating speech, eating and drinking. Figure 16 shows the epithesis firmly connected with frames, the lower impression surface is joined with a magnet to the upper obturator denture.

Discussion

Plastic reconstructive surgery is able to treat successfully large defects affecting all tissues of M-F region. The subject of continuous discussion is the timing of final surgical and prosthodontic treatment. The treatment plan depends on histological diagnosis, prognosis of the basic status, morphological and histological stability of adjacent tissues, general health status of the patient and types of previous treatment procedures, e.g. radiotherapy. Irradiation is followed by a higher implant failure rate (Granström, 1998).

Motivation of the patient and his cooperation with the interdisciplinary team of specialists influences future rehabilitation procedures and their staging. The generally accepted recommendation is to close defects in the first surgical phase. In above special cases with conditions discussed the final plastic rehabilitation is postponed to achieve more convenient circumstances. During this temporary period the most suitable solution is the application of simple appliances without more sophisticated retentive and stabilization elements. Final solution includes maximal plastic reconstruction or eventual usage of dental titanium implants (Hubálková et al., 2008) supporting as small as possible prostheses for replacement of persisting defects.

The reconstruction of bone defects is widely described in medical literature. Bone replacement after the surgery covered by soft tissues need accuracy of fabrication and biocompatibility of used materials. But results of this appliance are not exposed to the esthetic demands.

In our case serie correction of face defects replaced only part of facial skeleton. The challenge for surgical team is to replace successfully all lost soft tissues, highly exposed to visual aspects. One of the most critical sites is the epithesis transition

on the facial skin. The skin shade is different in summer and winter and vascularisation changes follow differences in cold and warm environment. The longevity and long-lasting good esthetic effect of epithesis is based on properties of materials used for its manufacturing. A body of epithesis is usually made from silicone based materials. Contemporary resilient materials tend to degrade in time because of the effect of mechanical loading. Little has been reported on how the mechanical properties of a maxillofacial prosthetic elastomer may be improved by the addition of nanosized particles used as an opacifier (Han et al., 2008). Fillers, fibres, different pigments and colorants are added into a silicone mass to maintain natural appearance of prostheses. Intrinsic coloration is nearly stable in modern silicones (Kiat-amnuay et al., 2006) and resistant to handling methods, e.g. mechanical cleaning and washing with different agents. Mild soaps are friendly even to colored silicone surfaces, but cosmetic make-up agents can cause deterioration of colorants applied on the epithesis' surface.

Facial hair such as eyebrows, eyelashes, or sideburns can be added to the prosthesis to enhance multidimensionality and realism. Similarly donor or synthetic hair can be used for eyebrows (Reisberk and Habakuk, 1998).

Artificial eye fabrication is another important challenge in facial epithetic. Two kinds of material can be used: glass and acrylic resin. Both materials have specific advantages and disadvantages: glass eye offers more natural appearance due to a permanent gloss on its surface; a gloss of acrylic surface is not long-lasting. On the other hand the acrylic eye permits easier adjustments if necessary and is more mechanically resistant excluding risk of fracture. A relative cosmetic disadvantage is that acrylic material can evocate an impression of a "cold eye".

In spite of biological acceptability of used materials sometimes we can observe slight redness of underlying tissues caused by humidity of dermal/mucosal gland secretion or implant-skin sulcus exsudation. Individual differences in production of sweat (skin perspiration) can also cause skin irritation from redness to possible maceration under the epithesis. Tissue reactions are most commonly associated with lapses of hygiene. These slight complications are resolved when the patients improved their hygiene compliance (Karakoca et al., 2008). We try to minimize these negative influences by facilitating of aeration. Skin/mucosa health status can be improved by use of specific adhesive for individual skin character – adhesive agents for dry and/or wet complexion.

In spite of important success of plastic surgery, the achieving of stability and retention of prosthetic appliances remain pressing challenge. The osseointegrated extraoral titanium implants are a reliable alternative in the management of orbital, ear, and nose defects (Scolozzi and Jacques, 2004).

Both psychological and functional effects of the prosthesis enhance rehabilitation by helping patients to adjust to their loss and by permitting better or even normal professional and social life (Aydin et al., 2007).

Conclusion

Therapy of extensive maxillofacial defects is based on multidisciplinary cooperation of specialists in maxillofacial and plastic surgery, oncology, ophthalmology and prosthetic dentistry. Rehabilitation of these patients is a long-lasting process. The success and prognosis of complex therapy depend on histo-pathologic stability of surviving tissues, quality of osseointegration of implants and durability of materials used for prosthetic appliances.

References

Aydin, C., Karakoca, S., Yilmaz, H. (2007) Implant-retained digital prostheses with custom-designed attachments: a clinical report. *J. Prosthet. Dent.* **97**, 191–195.

Cheng, A. C., Koticha, T. N., Tee-Khin, N., Wee, A. G. (2008) Prosthodontic management of an irradiated maxillectomy patient with severe trismus using implant-supported prostheses: a clinical report. *J. Prosthet. Dent.* **99**, 344–350.

Depprich, R. A., Handschel, J. G., Meyer, U., Meissner, G. (2008) Comparison of prevalence of microorganisms on titanium and silicone/polymethyl methacrylate obturators used for rehabilitation of maxillary defects. *J. Prosthet. Dent.* **99**, 400–405.

Granström, G. (1998) Osseointegration in the irradiated patient. In: *Osseointegration in Craniofacial Reconstruction*, ed. Brånemark, P.-I., 1st ed., pp. 95–108, Quintessence Publ., Illinois.

Han, Y., Kiat-amnuay, S., Powers, J. M., Zhao, Y. (2008) Effect of nano-oxide concentration on the mechanical properties of a maxillofacial silicone elastomer. *J. Prosthet. Dent.* **100**, 465–473.

Hubálková, H., Holakovský, J., Tvrdek, M., Nejedlý, A., Staňková, H. (2008) Interdisciplinary cooperation in reconstructing extensive defects in maxillofacial region. *Čes. Stomat.* **108**, 61–66.

Ikeda, C., Katakura, A., Yamamoto, N., Kamiyama, I., Shibahara, T., Onoda, N., Tamura, H. (2007) Nasolabial flap reconstruction of floor of mouth. *Bull. Tokyo Dent. Coll.* **48**, 187–192.

Jirman, R., Horák, Z., Mazánek, J., Řezníček, J. (2009) Individual replacement of the frontal bone defect: case report. *Prague Med. Rep.* **110**, 79–84.

Karakoca, S., Aydin, C., Yilmaz, H., Bal, B. T. (2008) Survival rates and periimplant soft tissue evaluation of extraoral implants over a mean follow-up period of three years. *J. Prosthet. Dent.* **100**, 458–464.

Kiat-amnuay, S., Mekayarajjananonth, T., Powers, J. M., Chambers, M. S., Lemon, J. C. (2006) Interactions of pigments and opacifiers on color stability of MDX4-4210/type A maxillofacial elastomers subjected to artificial aging. *J. Prosthet. Dent.* **95**, 249–257.

Lee, M.-Y., Chang, Ch.-Ch., Lin, Ch.-Ch., Lo, L.-J., Chen, Y.-R. (2002) Custom implant design for patients with cranial defects. *IEEE Eng. Med. Biol. Mag.* **21**, 38–44.

Ono, T., Kohda, H., Hori, K., Nokubi, T. (2007) Masticatory performance in postmaxillectomy patients with edentulous maxillae fitted with obturator prostheses. *Int. J. Prosthodont.* **20**, 145–150.

Ortegon, S. M., Martin, J. W., Lewin, J. S. (2008) A hollow delayed surgical obturator for a bilateral subtotal maxillectomy patient: a clinical report. *J. Prosthet. Dent.* **99**, 14–18.

Reisberg, D. J., Habakuk, S. W. (1998) Orbital prosthesis. In: *Osseointegration in Craniofacial Reconstruction*, ed. Brånemark, P.-I., 1st ed., pp. 245–258, Quintessence Publ., Illinois.

Scolozzi, P., Jacques, B. (2004) Treatment of midfacial defects using prostheses supported by ITI dental implants. *Plast. Reconstr. Surg.* **114**, 1395–1404.

Zhao, Y. F., Zhang, W. F., Ahao, J. H. (2001) Reconstruction of intraoral defects after cancer surgery using cervical pedicle flaps. *J. Oral Maxillofac. Surg.* **59**, 1142–1146.