Prosthetic rehabilitation in post-oncological patients: Report of two cases

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Summary

Prosthetic rehabilitation in post-oncologic patients after bone reconstruction are not substantially different than those of patients affected by severe atrophia of upper or lower jaw after bone reconstruction.
Aim of this paper is to evaluate the possibilities of prosthetic rehabilitation on these patients and to present our method. Prosthesis-based oral rehabilitation of such tumor cases rapresents a challenge.
The report analyses two cases of patients who underwent ablative oral surgery. Both have received a fibula free vascularised flap. The first was rehabilitated with a removable prosthesis fixed on the residual teeth, while the second with an implant supported prosthesis.
In case of carcinoma resection of the oral mucosa, the removable prosthesis guarantees a simplification in dental care operations. On the other hand, irradiated mucosa is frequentely unable to tolerate the friction created by the acrylic base. However, the fixed prosthesis can limit the view during follow-up controls.
In our school, according to all exposed reasons, we consider the implant supported overdenture prosthesis to be the best choice for those patients.

Key words: oral cancer, fibula free flaps, oral rehabilitation, function.

Introduction

Prosthetic rehabilitations in post-oncological patients after bone reconstruction are not substantially different than those of patients affected by severe atrophy of upper or lower jaw after bone reconstruction.
Obviously, in those patients the balance and symmetry of the mandibular function is compromised leading to altered mandibular movements and deviation of the residual fragment medially towards the resected side.
In these cases, significant facial deformity and loss of oral function such as speech, oral competence, swallowing and saliva retention, have a detrimental psychological impact on patients. When the resection only involves the alveolar portion of the bone or is confined to the associated soft tissues, it ensures maxillary continuity. Nevertheless, there are obvious facial disfigurements which may lead patients to struggle with conventional dentures because of altered oral anatomy, obliteration of sulci and loss of sensorial and motor innervation.
The more extended the ablative surgery, the stronger the complications.

Case reports

More than 360 patients affected by oral cancer underwent surgery between 2000 and 2008 at the maxillo-facial unit of the Policlinico "Umberto I" in Rome. About 40% of them had been rehabilitated either with fixed or removable conventional prosthesis; 70% of the rehabilitated patients received a conventional removable or fixed prosthesis according to the residual teeth and bone, the remaining 30% received a fix or removable implant-supported prosthesis .The report analyses two cases of patients who underwent ablative oral surgery. Both received a fibula free vascularised flap and were rehabilitated: first with a removable prosthesis fixed on the residual teeth and oral mucosa; second one with a removable prosthodontic suprastructure implant-supportated (overdenture).

Case 1

The patient – a 41 years old woman – at the clinical examination reffered a generalized pain on the right side of the face and showed a omolatheral tonsillar pillar intumescence (Fig. 1).
Histological analysis revealed an epidermoidal carcinoma of the right tonsil. The patient was subjected to three chemiotherapy cycles reducing the mass by 80%. Furthermore, the patient received immediate surgery consisting in hemimandibulectomy with the excision of the tonsillar lodge, lateral pharynx wall, lateral and posterior right hemitongue, maxillar tuberosity and soft palate. A temporal flap was used to cover the surgery site. A reconstructive plate was used to rebuild the right hemimandibula.
After thirteen years of follow up, we decided to reconstruct the hemimandibula using a fibular free flap (Figs. 2, 3). The overage time from start of surgery until bridge connection was 24 months. In this period periodic follow-up was carry out regarding to the need of giving the chance to make periodic follow up, to rebuild the lost soft tissues and to give good occlusion and function even if the masticatory muscles were excised, to restore the residual te-

Figure 1 - The patient before surgery
- a Extraoral view
- b Intraoral view

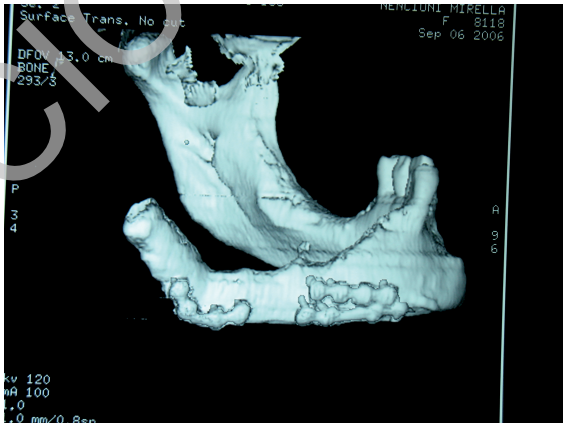


Figure 2 - CT reconstruction of lower jaw after surgery

Figure 3 - The patient after reconstructive surgery
- a Extraoral view
- b Intraoral view

eth and – finally – for the economic possibilities of the patient.

Given that the patient had not been chewing for fifteen years, she had lost her oral function and, for this reason, we decided to begin rehabilitation with a combined provisional prosthesis. Fixed crowns were used on the teeth and removable prosthesis for the edentoulous portions for the rest (Fig. 4).

Six months later, the prosthetic rehabilitation was finalized positioning definitive crowns on the natural teeth connected with telescopic crowns fixed to the removable proshesis, in order to give the patient a normal profile adding and where necessary, acrylic gingiva (Fig. 5).

The result was a very confortable prosthesis ensuring both aesthetics and functionality (Fig. 6).

Figure 4 - The provisional prosthetic rehabilitation

Figure 5 - The final prosthetic rehabilitation

Figure 6 - The patient after oral rehabilitation
- a Extraoral view
- b Intraoral view

Case 2

The patient, a 38 year old female, reported an intumescence on the body and ramus lower right jaw (Fig. 7). The preoperative radiograph examination showed an extended lesion on the mandibular angle. The histological exam revealed an ameloblastoma (Fig. 8).
The patient then received surgery consisting in hemimandibulectomy and contestual reconstruction with a double barrel free fibula flap (Figs. 9, 10).
A year later the patient received surgery based on the fibula flap remodeling, an eterologus bone graft, positioning of a resorbable Bio Gide collagen membrane and contestual implant insertion (Fig. 11).
After Six months an implant supported prosthesis was made (Fig. 12).

Discussions

In the last years, immediate surgical reconstructions of the complex soft-tissue and bone defect caused by the tumor surgery using vascularized free flaps has revolutionized post-surgical oral reconstruction and dental prosthetic rehabilitation.
The use of osseointegrated dental implants obtain a right prosthetic treatment following ablative surgery has been

Figure 7 - The patient before surgery
- a Extraoral view
- b Intraoral view

found to be beneficial in some cases (Chan 1997, Goiato 2009).
Concerning the reconstruction choice between fixed or removable prosthesis, technical considerations are important: implant position, aesthetic result etc.; psychological considerations: acceptability of a removable prosthesis; and last but not least, the economic possibilities.
Conventional removable prosthesis after oral mucosa cancer guarantees good control of the mucosa by the operator and at the same time, good hygiene control by the patient, These factors that can simply cause periimplatitis and even oncologic relapses.
On the other hand, the contact with soft tissues which causes mechanical courting, can bring about local irritation and

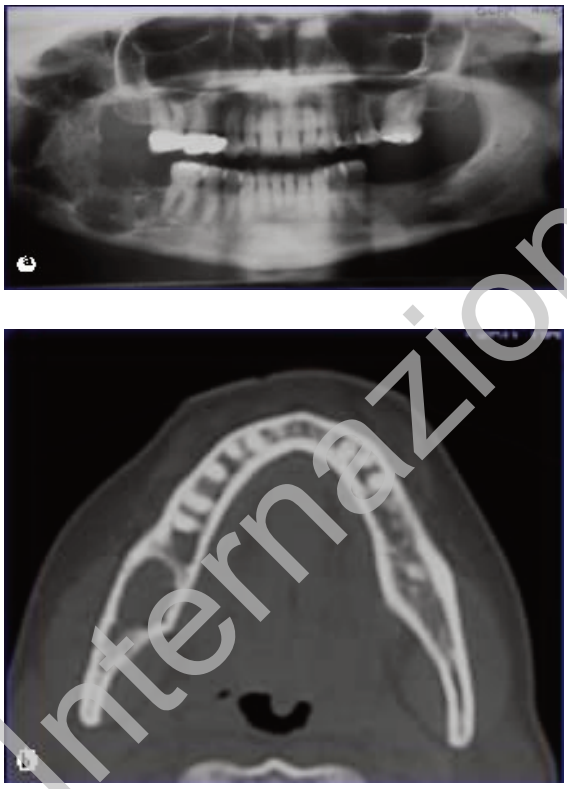
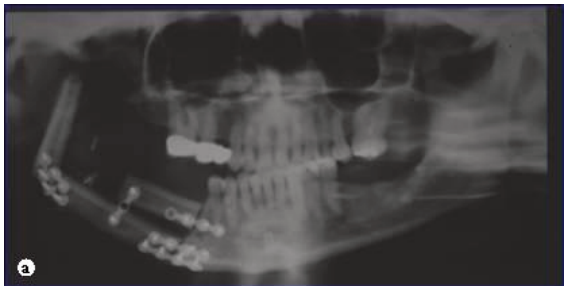


Figure 8 - X-Ray Before surgery
- a Panoramic radiograph
- b CT image



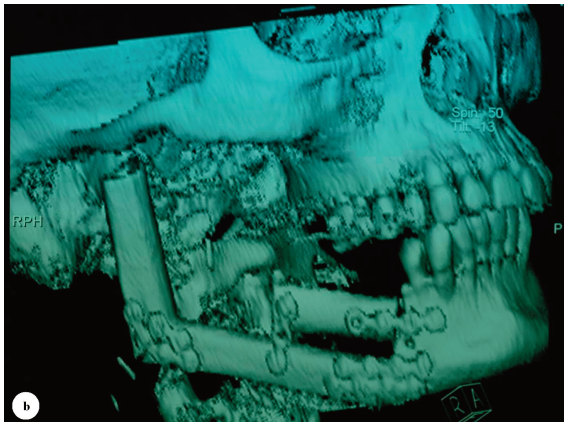


Figure 9 - X-Ray after reconstructive surgery
- a Panoramic radiograph
- b CT-3D after surgery

Figure 10 - Extraoral view

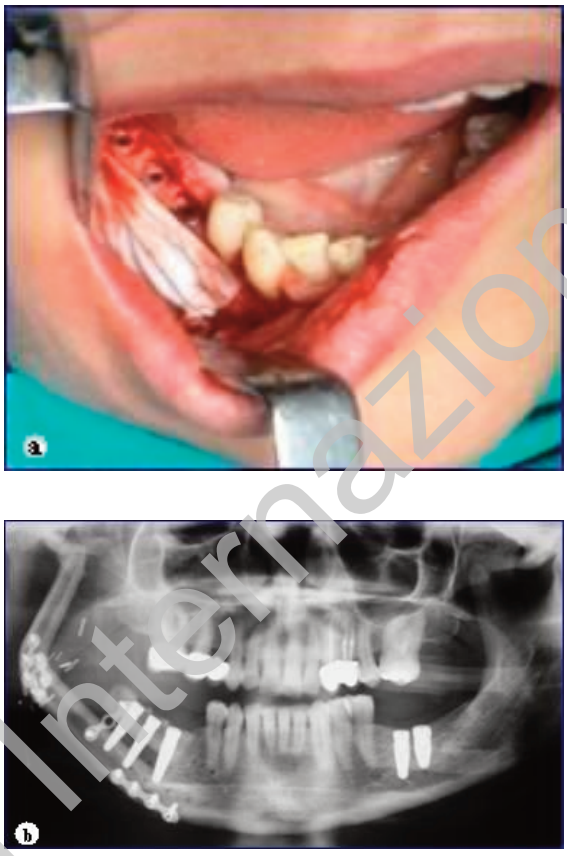


Figure 11 - Implant placement
- a Intraoperative view
- b Panoramic radiograph after implant placement

decubiti. Therefore, it is very difficult to apply the same therapy for each patient. Moreover, the reconstruction, even if it is the best choice, cannot always guarantee morphology similar to the patient's natural pre-operative condition, particularly after large reconstructions. In these cases, a removable solution can be the best choice both for aesthetic and functional results because of the use of acrylic resin in removable prosthesis.

Prosthetic rehabilitation in patient after ablative oral surgery is finalizzated to restore both oral function and facial contour form, in order to enable the patient to recover physically and psychologically to the fullest and hence regain a normal life and employment. It would seem logical to use endosseous implants in conjunction with free flap reconstructive techniques, to achieve the goal of complete oral rehabilitation (Chan 1997, Goiato 2009).In bone reconstructed patients either with free vascularized or non vascularized grafts, implants can be inserted at the moment of the first surgery (1-stage surgery) or after 6-8 months (2-stage surgery). Therefore, we call the first technique a primary insertion and the second a postponed insertion (Chang 1998) (Chiapasco 2000; Zlotolow 1992; Antony 1996; Cuesta-Gil 2009).

Especially for free revascularised flaps, the primary insertion allows better access to the bone structure, reducing the time of prosthetic rehabilitation and eliminating a second time surgery and accidental lesions of the vascular peduncle. On the other hand, the primary insertion does

Figure 12 - Intraoral view after rehabilitation

not allow to establish a correct inclination of the implants, with high failure risks. The primary insertion was associated with a major loss of marginal bone, due to an early premature load force (Chiapasco 2006). The biomechanics of the implant load, the mechanical stress moved to the bone interface and the subsequent reaction of the bone to the stress, may increase if the implants are placed in the wrong way. Excessive non-axial implant loads may damage the bone interface surface, causing loss of margi-

nal bone and implant failure. The secondary insertion, also used by our school, may take place 4-6 months later, after bone callus formation if the patient does not need to undergo a post-surgical radio therapy treatment. Such a period allows bone integration of the flap and of the bone callus in the osteotomy areas. Thus, better osteointegration and reduction of the flap stress are possible.
However, the patient needs to undergo one more surgery. This may turn out to be a benefit for the cosmetic and functional result of the reconstruction, since it would allow to reshape the flap if necessary. It is possible to study the models, to build diagnostics wax-ups for the production of surgical stent. The use of a surgical stent directing implant position as dictated by the diagnostic wax-up aided in the correct three-dimensional positional for the prosthetic platform. Such waxing would guide the surgeon, according to the prosthetic requirements of each case. This is not the case of primary insertions.
According to some authors, the long-term rates implant prognosis, both for the autologous grafts and the revascularised flaps, are similar to the long-term rates of native bone implants (Albrektsson 1986; Arvidson 1998; Buser 1997; Garrett 2006). Despite the different quantity of bone, no significant differences for the implants survive expectancy have been reported between the fibula (D1 bone formed by the cortical and a tiny part of the medulla) and the iliac crest (D2 bone formed by the bone cortical with a minor thickness and a considerable spongious component), according to Misch classification.
Such results confirm the prosthetic rehabilization with endosseous implants on those patients and the positive role of the prosthetic load on the metabolism of bone transplant. (Hotz 1996; Chiapasco 2001; Garrett 2006).
A different consideration must be made for those patients who have undergone radiotherapy or must undergo it; in these patients, in fact, to minimize the failure possibilities, it is suggested to wait almost 12 months from the end of radiotherapy (Chiapasco 1999).
According to letterature, in the case of reconstruction using implants in non-revascularised bone, it is better to place the implants with an interval of time of 3-6 months from the reconstruction phase, in order to allow an adequate revascularization of the graft and to reduce the bone resorption which, in bone grafts, is higher during this first period (Goga 1999; Kovacs 2000; Chiapsco 2000; Cuesta-Gil 2009). In those cases, the percentages of implants failure are similar to those of implants placed in the native bone (~10%) (Chiapasco 1999; Hotz 1996; Garrett 2006). The percentages of failure were significantly higher (about 30%) for the implants placed contestually to reconstruction (Chiapasco 1999; Cuesta-Gil 2009).
Ideally, a strip of adherent keratinized oral mucosa thinner than 2 mm should be used, in order to reduce the risks of periimplants socket and in order to facilitate the dental care operations (Sieg 1999).
Some remarks are needed regarding the choice of fixed or removable prosthesis.
The psychological reasons are very important: for example, the patient has to agree on a removable prosthesis. Technical reasons, however, are fundamental for the final choice.
A fixed implant supported prosthesis would be better, rather than a removable option, considering the ankylosis relation established between the implant and the bone (Rohner 2002; Snauwaert 2000; Garrett 2006).
After one year, the implant rates failures due to resorption of the marginal bone of the implants, as far as fixed prostheses are concerned, are around 2.5% for the upper jawbone and 1% for the mandible. On the other hand, failure rate, for overdenture (removable prostheses fixed to the implants), attained 4.5% for the jawbone and 2% for the mandible (Snauwaert 2000).
It would also be interesting to evaluate the overdentures anchored to the implants using a solidifying bar between the implants, the “dolder bar” and those anchored to single implants. The bar would reduce micromotions and would facilitate the success of the implants. According to some authors, just 24.4% of the ball-retained prostheses have not met any accident versus 57.1% of those fixed to the bar; the difference is significant (Nedir 2006). As far as the ball retained is concerned, 72.5% of the prostheses have not met any accident one year after the location of the implants; 2 or 3 years later, the percentages were around 52.5% and 37.5%. Three years later, the percentages of prostheses supported by the bar one year after the location that have not met accidents varied from 92.9% to 71.4% (Nedir, 2006; Chan 1997).
It is not always possible to choose a fixed rehabilitation since the bone quantity, as well as its quality and the financial aspects are essential.

Conclusions

In the case of carcinoma resection of the oral mucosa, the removable prosthesis guarantees a simplification in dental care operations. On the other hand, it may cause mechanical stimulus due to contact with soft tissues, with subsequent local irritation and ulcer.
As for prosthetic rehabilitations of the irradiated patients, the removable prostheses implant-retained (overdenture) seem to expose those patients to a higher risk of mucosa ulceration caused by the continous inflammatory condition of the tissues. A fixed prosthesis operation that would fix on to the implants would be better than a removable option, considering the ankylosis relation established between the implant and the bone (Rohner 2002; Snauwaert, 2000; Garrett 2006).
After one year, the implant failures rates due to a resorption of the marginal bone of the implants, as far as fixed prostheses are concerned, are around 2.5% for the upper jawbone and 1% for the mandible. On the other hand, the percentages of failure, in case of overdenture (mobile prostheses anchored to the implants), attained 4.5% for the jawbone and 2% for the mandible (Snauwaert 2000; Cuesta-Gil 2009).
A removable prosthesis after oral mucosa cancers ensures good control of the mucosa by the operator and, at the same time, good hygiene control by the patient, who usually is a alcoholist, a smoker and does not pay great attention to hygiene; factors which can simply cause periimplatitis and even oncological relapses. On the other hand, the soft tissues touch, that causes mechanical courting, can bring about local irritation and ulcer.
Therefore, it is very difficult to apply the same therapy for each patient. In our school, according to all exposed reasons, we prefer the implant supported overdenture prosthesis (Weischer, 1996). This combination suits the need of reducing unfavourable micromotions with the periodical control requirements by an oncological patient.

References

1. Albrektsson T., Zarb G., Wuorthington P., Eriksson A.R " The long-term efficacy of currently used dental implants: A review and proposed criteria of success" Int.J.Oral Maxillofac.Implants 1986 ;1 :1-25

2. Anthony JP., Foster R.D., Sharma A.B., Kerns G.J., Hoffman W.Y., Pogrel MA. "Reconstruction of a complex midfacial defect with the folded fibular free flap and osseointegrated implants" Ann Plast surgery 37: 204-210, 1996

3. Arvidson K., Bystedt H., Frykholm A. "Five year prospective follow up report of astra tech implants system in the treatment of edentulous mandibles" Clin.Oral Implants 1998; 9: 225-234

4. Buser D., Mericske-Stern R., Beranrd J.P. "Long term evalutation of nonsumerged ITI Implants" Clin.Oral Implants Res. 1997 ; 8 : 161-172

5. Chan M.F., Hayter J.P., Cawood J.I., Howell R.A. "Oral rehabilitation with implant-retained prestheses following ablative surgery and reconstruction with free flaps" Int J. Oral Maxillofacial Implants 1997; 12: 820-827

6. Chang Y.M., Santamaria E., Wei F.C., Chen H.C., Chan C.P., Shen Y.F., Hou S.P. "Primary insertion of osseointegrated dental implants into fibula osteoseptocutaneous free flap for mandible reconstruction" Plast. Reconstr. Surg. 102: 680-687, 1998

7. Chiapasco M. "Implants for patients with maxillofacial defect and following irradiation: Proceedings III European Workshop on Periodontology" In: NL.Lang, T.Karring, J.Lindhe:"Quintessence Books"; Berlin 1999: pag.557-607

8. Chiapasco M, Abati S, Ramundo G, Rossi A, Romeo E, Vogel G "Behavior of implants in bone grafts or free flaps after tumor resection" Clin Oral Impl Res 2000; 11: 66-75,

9. Chiapasco M., Romeo E., Vogel G. " Vertical distraction osteogenesis of edentulous ridges for improvement of oral implant positioning: Clinical report of preliminary results" Int.Journal of Oral and Maxillofac.Implants 2001; 16: 43-51

10. Chiapasco M., Biglioli F., Autelitano L., Romeo E., Brusati R. "Clinical outcome of dental implants placed in fibula-free flaps used for the reconstruction of maxillo-mandibular defects following ablation for tumors or osteoradionecrosis" Clin.Oral Impl. Res. 17, 2006 ; 220-228

11. Cuesta-Gil M, Ochandiano Caicoya S, Riba-García F, Duarte Ruiz B, Navarro Cuéllar C, Navarro Vila C. Oral rehabilitation with osseointegrated implants in oncologic patients. J Oral Maxillofac Surg. 2009 Nov;67(11):2485-96. PubMed PMID: 19837322.

12. Garrett N, Roumanas ED, Blackwell KE, Freymiller E, Abemayor E, Wong WK, Gerratt B, Berke G, Beumer J 3rd, Kapur KK. Efficacy of conventional and implant-supported mandibular resection prostheses: study overview and treatment outcomes. J Prosthet Dent. 2006 Jul;96(1):13-24. PubMed PMID: 16872926.

13. Goga D. et al. Microvascular mandibualr reconstruction and implantology. A Study of the stability of long term results, apropos of 2 cases followed for 8 years. Rev Somatol Chir Maxillofac 1999; (5-6):231-234.

14. Goiato MC, Ribeiro AB, Dreifus Marinho ML. Surgical and prosthetic rehabilitation of patients with hemimandibular defect. J Craniofac Surg. 2009 Nov;20(6):2163-7. Review. PubMed PMID: 19884838.

15. Hotz G. "Reconstructione of mandibular discontinuity defect with delayed nonvascularized free iliac crest bone graft and endosseous implants: a clinical report" Prosthet t 1996; 76: 350-355

16. Kovacs AF. Influence of the prosthetic restoration modality on bone loss around dental implants placed in vascularised iliac bone grafts for mandibular reconstruction. Otolaryngol Head Neck Surg 2000; 123(5):598-602.

17. Nedir R, Szmukler-Moncler S, Belser UC, Samson J. Prosthetic complications with dental Implants: from an Up-to-8-year Experience in private practice. The International Journal of Oral and Maxillo-facial Implants 2006; 21:6.

18. Rohner D et al. Treatment of severe atrophy of the maxilla with the prefabricated free vascularized fibula flap. Clin Oral Implant Res 2002; 13:44-52.

19. Sieg P, Hasse A, Zimmermann CE. Versatility of vascularised fibula and soft tissue graft in the reconstruction of mandibulofacial region. Int J Oral Maxillofacial Surgery 1999; 28:356-361.

20. Snauwaert K, Duyck J, Van Steenberghe D, Quirynen M, Naert I. Time dependent failure rate and marginal bone loss of implant supported prostheses: a 15- year follow-up study. Clin Oral Invest 2000;4:13-20.

21 Watzinger F et al. Endosteal implants in the irradiated lower jaw. Journal Cranio-Maxillofac Surgery 1996; 24: 237-244.

22. Zlotolow IM et al. :Osseointegrated implants and functional prosthetic rehabilitation in microvascular fibula free flap reconstructed mandibles. The American Journal of Surgery 1992; 165:677-681.