Case study

Prosthetic rehabilitation in carcinoma of the tongue and oral pelvis: Presentation of a clinical case and literature review

Abstract

Objectives

With this paper, the authors want to describe a case of prosthetic rehabilitation on a 50 years old woman with an anamnesis of smoking and alcohol consumption, who has undergone a removal surgery of neoplastic lesion that involved the oral pelvis and the lingual border. The inherent literature regarding the prosthetic rehabilitation in post irradiated bones is also evaluated.

Materials and methods

The patient's clinical, radiological and anamnestic data enabled the preoperative staging of the neoplasm of the oral cavity, which has been treated with a transmandibular conservative surgical resection of the lesion associated with a functional and bilateral neck dissection, this was then followed by an immediate surgical recostruction with a radial antebrachial bundle-cutaneous free flap.

Results and conclusions

One year after surgery, excluding the presence of recurrences through MR with contrast, a removal of the dental residues and rehabilitation by an implanted prosthesis has been done. The aesthetic outcome was remarkable. Both, preoperative multi-specialistc evaluation and the definition of a common rehabilitation program represent an essential prerequisite in order to avoid some possible and serious complications of the treatment. Postoperative radiotherapy in oral cancer is now universally associated with implant-prosthetic rehabilitation therapy.

Key words: Oral cancer, Forearm free flap,Reconstruction,Radiotherapy, Oral implantology

1.Introduction

Oral cavity reconstruction secondary to removal surgery of neoplastic lesion has undergone significant changes over the last twenty years (Chandu, 2002) this because the purpose of this kind of surgery is not only to preserve patient's life, but it has also the achievement of granting an acceptable quality of life in terms of oral functionality and facial aesthetics, especially for what concern the three main functions of the oral cavity: phonation, chewing and swallowing. Surgical reconstruction and prosthetic rehabilitation in patients affected by oral cavity cancer tend to restore, to the best possible levels, the patient anatomy, aesthetic and physiological function. In order to reach this important objective, the introduction of two main factors surely have an important role: revascularized free flaps and the use of osseointegrated dental implants.

Radial antebrachial bundle-cutaneous free flap represents one of the most

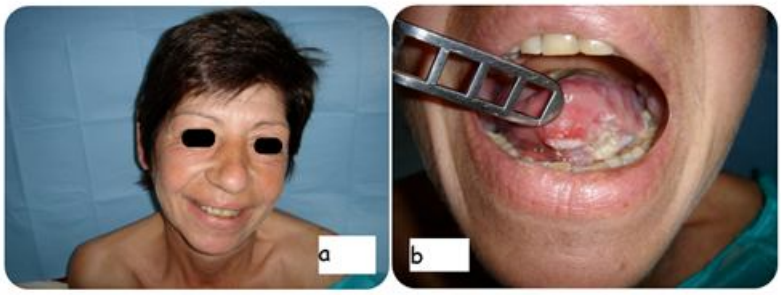
used revascularized free flap for oral cavity reconstruction (Avery, 2010 part 1 and 2). This flap was first described by Yang et al. in 1981 (Yang, 1981), but only in 1983 Soutar et al. (Soutar, 1983) defined it as a versatile solution for reconstruction of soft tissues and mucosal defects of the oral cavity. This kind of flap has gained popularity over the years (Genden, 2004; Dean, 2012) due to the fact that it provides a large amount of thin skin, that also results in being well vascularized and plicable with minimum encumbrance and can also be used as an osteocutaneous flap if a radial segment of 10-12cm is associated, with even the possibility of anastomosing a receiving sensory nerve with the lateral antebrachial cutaneous nerve (Urken et al., 1990; Bigliol, 2006) the latter method which, however, did not give a good level of reliability.

Prosthetic rehabilitation following oral cancer surgery is often difficult without using endosseous implants which are able to ensure stabilization and retention of the prostheses. This is a very important point, because after the surgical approach the patient undergoes radiotherapy treatment which may compromise salivary production, that is one of the main mechanisms that allow an adequate prosthesis retention. Endosseous implants are also very useful because the resections themselves often amputate in whole or in part important regions of bone or oral mucosa that may be used for prosthetic anchorage. The use of dental implantology during the reconstructive phase in oral cancer surgery can be divided into two categories: retention of a removable prosthesis or steady prosthetic rehabilitation with or without maxillary bone reconstruction. Reliability of dental implantology in irradiated bone has been a major point of debate in the recent literature.

Authors propose a paradigmatic clinical chase of oral cancer carcinoma that has been treated with surgical ablation associated with adjuvant radiotherapy, reconstruction with radial antebrachial free flap and steady prosthetic rehabilitation on implants, by doing an accurate research of recent inherent literature.

2. Clinical case

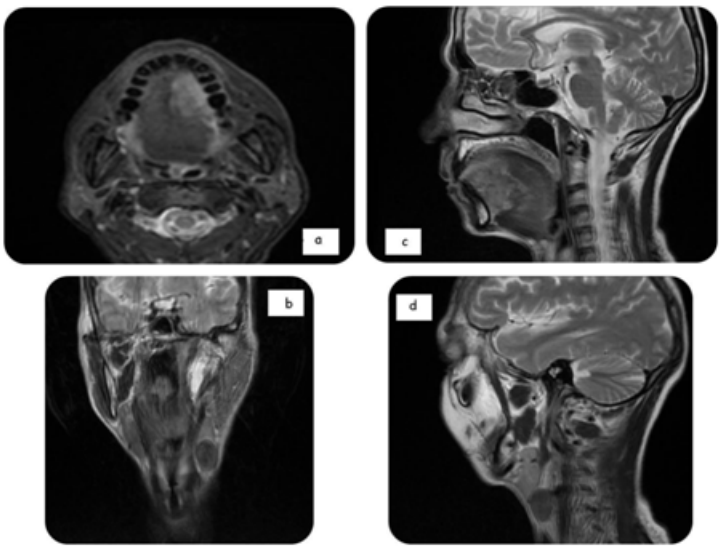
A 50 years old caucasian woman, with an history of smoking (20 cigarette per day) and alcohol consumption (less than 1l per day), has come to our attention, at the Complex Structure of Otorhinolaryngology and Maxillo-faccial surgery of San Giovanni Bosco Hospital of Turin, with an ulcerative lesion of the left lingual pelvis (Fig. 1 a e 1b). This lesion involved also the left lingual border eliciting pain and functional impotence due to a block of lingual body, which was also infiltrated deeply up to involve the cortical bone of the mandibula.



- Fig. 1. a) preoperative aesthetic appearance of the patient and b) view of the oral lesion

Through RM (Fig. 2) is clearly visible the involvement of hyoglossus muscle, the whole left part of the tongue and the presence of an homolateral lymphnodes lesion with a diameter smaller than 3 cm. Thanks to radiological imaging and clinical history it was possible to define a preoperative staging T4N1M0.

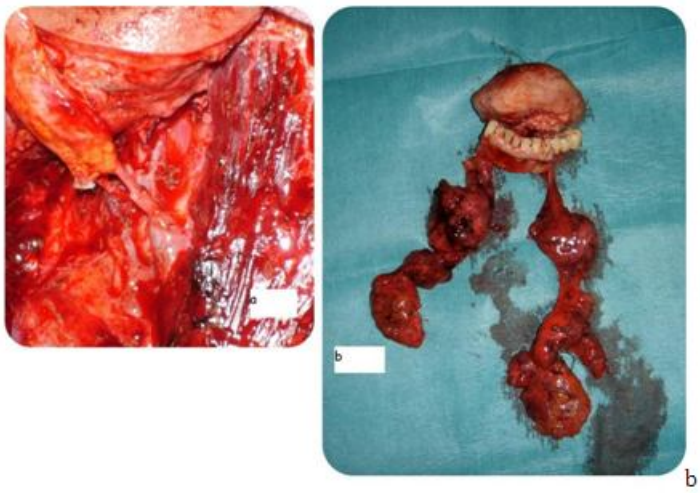
Comment [MF1]: MR



- Fig. 2. Preoperative MR examination: a) axial view, b) coronal view, c and d) sagittal view.

Patient's neoplasm has been treated with a conservative transmandibular removal surgery, through translabiotomy approach with an *en bloc* hemiglossectomy associated with a bone mandibular dowel and bilateral mRND (lv I to III).

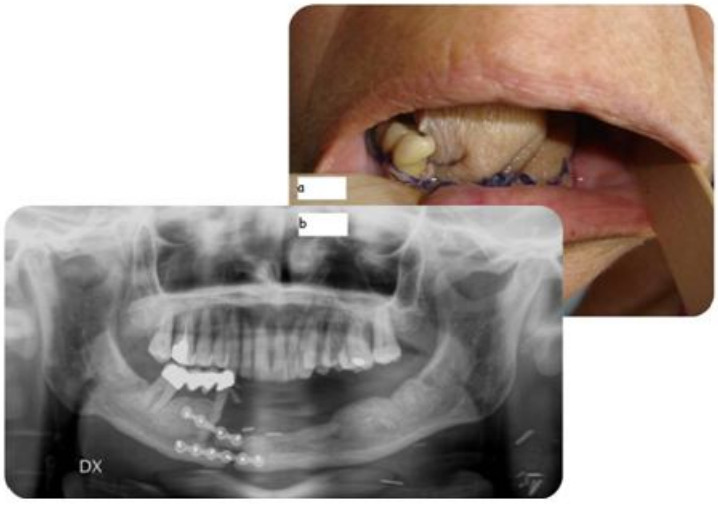
Reconstruction has been performed by using an antebrachial bundle skin flap vascularized from radial artery and it's *venae comitantes* and cefalic. Arterial and venous anastomosis were performed between the facial and radial arteries and between the brachial venous axis and the internal jugular vein on the left, respectively (Fig. 3a). Before doing osteotomy, preplating was performed, i.e. the positioning of the synthesis plates before performing the osteotomy in order to facilitate the reconstruction. The osteotomy was performed in steps to increase the bone facing surface and improve the stability of the subsequent fixation. Furthermore, the dentition not related to the lesion was partially preserved in order to have an extra occlusal reference. The resection monoblock includes the hemitongue, the ipsilateral oral floor, the mandibular plug and the laterocervical dissections



b

- Fig. 3. a) vascular anastomoses; b) exeresis monoblock..

The examination of the surgical specimen confirmed the clinical staging and indicated the postoperative RT (67Gy about one month after the operation). Fig. 4a shows the result of the surgery in the immediate post-operative period with x-ray control (Fig. 4b) which highlights the bone plug and the reconstruction. The postoperative period was regular.

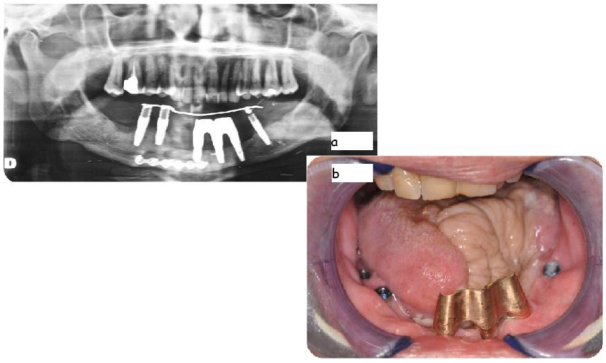


- Fig.4. Post operative outcome b)Control X-Ray.

12 months after surgery, an MR with contrast study has been done (Fig. 5a) which confirmed the absence of recurrences, the removal of the residual dental elements was performed, followed by the removal of most coronal synthesis plate in order to obtain a gain in available bone height. Six submerged implants for prosthetic purposes were than positioned.

- Fig.5. a) RMN che e videnzia stato NED a 12 mesi; b) posizionamento di 6 fixture.

An x-ray control was performed at 5 months (Fig. 6) and eventually the second surgical time for uncovering the implants. The prosthetic load was performed after about 1 month, in order to permit an adequate recovery of the soft tissues around the healing abutments (Fig. 6b).



- Fig.6. a) X-ray after 5 months from fixture placement; b) Oral cavity

In Fig. 7 it is possible to observe the presence of provisional prosthesis in the patient's mouth, with large cleaning spaces.

In this case we opted for a fixed prosthesis without mucosal support screwed onto the posterior implants and cemented on a metal structure screwed to the three anterior implants which are therefore joined together. In this way it was decided to obtain a better distribution of the prosthetic load across the osteotomy, a particularly critical point following the administration of postoperative radiotherapy treatment.

- Fig.7. Provisional prosthesis with large cleaning spaces.

In Fig. 8 we can appreciate the good esthetical outcome (a) with the preservation of the vertical dimension and good projection of the lips in spite of the translabiotomy access (b).

- Fig.8. a) Facial aesthetic; b) Oral aesthetic

3. Discussion

In literature, success in the surgical treatment of oral carcinomas with dental rehabilitation associated with the use of free tissue grafts and radiotherapy treatment presents variable percentages. Among main factors that oppose an effective prosthetic rehabilitation are: a clear reduction of the neutral zone, a reduced lingual functionality, which is difficult to compensate by remaining soft tissues, mandibular bone and a reduced salivary production. Using these endosseous implants can partially reduce the impact of these factors, it also promotes an adequate stabilization of the prostheses and intercepting the main part of occlusal loss, thus determining a considerable improvement in quality of life of these patients (Schoen, 2008). One of the main problems encountered during literature review arises from the difficulty of determining the exact placement of implants considering the site of radiotherapy and from differences in the various studies regarding: the length of the follow-up, the implant systems used, retention mechanisms and prostheses used, as well as other variables such as systemic diseases, smoking, advanced age, inadequate number of implants and other variables related to implant success.

Results are better in the mandible than in the maxilla, probably due to differences in bone structure (Schoen, 2004). Recent reports find higher success rates from native bone (90%) then grafted bone (70-80%) (Granstrom, 2005; Klein, 2009; Dholam and Gurav, 2012). According to some authors (Nelson 2007) the high percentage of implant survival failures would be related to high percentage of patient mortality, rather

than the loss of osseointegration. Implant failure in radiation-treated patients is related to radiation-induced changes in both soft and hard tissues. At the bone level, vessels of the Haversian canals may become obliterated and the periosteum could lose cellularity, vascularization and osteoid formation. The hematopoietic proliferation becomes scattered in the bone marrow and the sinusoids assume irregular configuration and distribution (Knospe, 1966). The late effects of radiotherapy may cause a prevalence of the catabolic processes over the anabolic ones in bone formation, with a clear reduction of the mineral content in the radio-treated bone (Finston, 1966). On the other hand, at the soft tissue level, the main problem seems to be related to the reduction of salivation and therefore to a reduced ability to cleanse the oral cavity.

There is debate in the literature about the optimal timing of implant placement in patients requiring radiotherapy. A systematic review (Colella, 2007) over a period of 16 years demonstrated a comparable failure rate between implants placed before or after radiotherapy treatment (3.2% versus 5.4%, respectively). Most of the failures were recorded between 1 and 12 months after surgery. Substantial failure rates are related to radiation therapy doses exceeding 45GY (Kanchan, 2012).

Some authors believe that the implants should be placed immediately after the ablative procedure, in the same surgical session, in order to obtain a better osseointegration before irradiation, thus eliminating the need for further surgery or additional therapy with hyperbaric oxygen and enabling an adequate rehabilitation of speech and swallowing (Chang, 1998; Korfage, 2010). Combined surgical approach in a single stage seems to be, according to these authors, easy and effective, allowing total mandibular rehabilitation. Another advantage of this approach is the wide access to bone segment with considerable surgical exposure, which allows for accurate alignment of implants with the corresponding maxillary dentition (Chim, 2010). This approach cannot be done without a meticulous presurgical examination and a careful multidisciplinary evaluation, with a well-defined treatment planning (Schoen, 2003). The major disadvantage of the immediate insertion of the implants is given by the risk of improper positioning in case of gross anatomical alterations with a negative influence on rehabilitation. It is also necessary to consider the risk of interference or delay of cancer therapy, including radiotherapy, in the event of the development of postoperative complications related to the

implants and also the risk that an early tumor recurrence could render implants useless.

Other Authors are against the placement of implants in the first phase of surgery. Oral reconstruction and rehabilitation could be divided into primary and secondary reconstruction. Patients who have undergone partial mandibulectomy without bone reconstruction may require secondary reconstruction before implant placement in the site of bone defect. Due to the frequency of recurrences and metastasis in the first two years following the primary treatment, it has been suggested to carry out costly treatments only after this period of high risk, since it is not appropriate to implant patients with uncertain prognosis in the first instance (Werkmeister, 1999). Proponents of this approach believe that blood supply to bone flap may be compromised during the first stage of surgery, due to osteotomies, thus implant placement is less accurate in this time, as bone and soft tissue healing is not yet complete (Gurlek, 1998). Others have proposed to delay implants placement from 6 to 12 months after radiotherapy and than to observe an integration period of 5 to 6 months before the second surgical stage and prosthetic loading (Brogniea, 1998; Oelgiesser, 2004, Kanchan, 2012). This period seems necessary to achieve an appropriate osseointegration after the administration of radiotherapy. There are Authors who, on the other hand, favor short healing times for implants in order to substantially prevent bone resorption (Shirota, 1991).

It has also been proposed to use hyperbaric oxygen therapy in order to promote bone and tissue healing, but the results in literature are not clear. Hyperbaric oxygen therapy inhibits leukocyte adhesion to endothelium, reducing tissue damage and improving leukocyte motility, with an increase in microcirculation (Mortensen, 2008). In the early stages, there is vasoconstriction, reduction of edema, activation of phagocytes and anti-inflammatory effect (Spiegelberg, 2010), while in long term, neovascularization, osteogenesis and stimulation of collagen production by fibroblasts are obtained, which favors wound healing. Marx in 1983 had proposed a protocol consisting of 20 sessions before and 10 after therapy with osteointegrated implants, supported by Larsen in 1997. Some Authors have shown themselves in favor of hyperbaric therapy as an aid to the osseointegration of the implants (Barber, 1995; Arcuri, 1997; Granhstrom, 2006), while others (Keller, 1997) have opposed this practice for economic

reasons or potential complications. A single randomized trial (Schoen, 2007), reported in a Cochrane review (Couldthard, 2008), does not show substantial interferences of hyperbaric therapy on implant’s success rate.

In the case under examination, the choice made was a result of a mindful multidisciplinary preoperative evaluation associated with the patient's requests. It would have been possible to carry out a rehabilitation with a removable prosthesis on implants, but this prosthesis would have given considerable mucosal support with mechanical interference from the antebrachial flap which, although pliable and thin, does not have the typical characteristics of oral cavity mucosa. Furthermore, this problematic mucosal support could probably have led to decubitus either on the residual mucosa or on the flap itself, both due to the mechanical interference with the flap and irregularities of the residual bone surface after the surgery, which are difficult to compensate prosthetically, these two factors are also associated with increased occurrence of oral cancer. Radiotherapy basically determines a salivary reduction with gingival tissue damage that is badly suited to mobile prosthesis. In our case, a large cleansing space was left between the posts in order to facilitate cleaning and make the implants last longer, avoiding dangerous peri-implantitis. Furthermore, the patient wanted a fixed prosthesis at all costs in order to consolidate a new aesthetic appearance associated with modified voluptuous habits (smoking and alcohol cessation) in the context of a total improvement in the overall quality of life.

4. Conclusion

In case of surgical success in maintaining or reconstructing a sufficient amount of bone in order to obtain a favorable anatomical set and rehabilitation on implants is, in our opinion, the best solution for patients with oral cavity neoplasms even following combined radio- surgical. Up until a few decades ago, prosthesis on implants with radiotreated bone was considered incompatible, while today it is known that it is relatively reliable to insert endosseous implants after a suitable waiting period or even at the same time as ablative surgery. Present dental problems must be eliminated before oncological surgery in order to avoid osteonecrosis and infections. After the surgeon has completed the initial surgical demolition phase, it is the dentist's task to deal with an optimal prosthetic rehabilitation, but a strong integration between the two professional figures

is necessary in the preparatory phase of evaluation in order to obtain a personalized treatment plan which aim is to maintain the swallowing, masticatory and phonatory functions at the highest possible level without neglecting the cosmetic-aesthetic aspect in the context of attention to the patient's quality of life.

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