

Implant-supported denture rehabilitation on a hemimandibulectomized patient: a case report

Fabrizio Carini, MD, DMD¹
 Giambattista Gatti, MDS²
 Vito Saggese, MDS²
 Dario Monai, MDS²
 Gianluca Porcaro, MDS²

¹ Research Professor, University of Milan-Bicocca, Monza (MB), Italy

² Oral Surgery specialist, School of Oral Surgery, University of Milan-Bicocca, Monza (MB), Italy

Corresponding author:

Gianluca Porcaro
 Oral Surgery specialist, School of Oral Surgery
 University of Milan-Bicocca, Monza (MB) Italy
 Phone and Fax: +39 (0) 2333482
 E-mail: porcarogianluca@libero.it

Summary

Aim of the study: the treatment of oral cancer requires different surgical approaches such as marginal or segmental mandibular resection in order to allow a safe removal of the neoplastic lesion. The aim of this work is to evaluate the efficacy of an implant-supported denture rehabilitation for restoring oral function and facial appearance on a hemimandibulectomized patient.

Materials and methods: the patient was a 64 years old man, hard smoker and moderate drinker. Due to a jaw neoplastic lesion, he underwent a hemimandibulectomy, followed by the insertion of 4 implant fixtures at the chin cap symphysis site. The denture rehabilitation consisted in an over-denture mounted onto a bar furnished by a condylar eminence in articulation with the glenoid fossa of the upper denture.

Results: this type of implant-supported denture rehabilitation allows the recovery of the masticatory function and the mandibular reposition with a satisfactory restoration of the proper facial symmetry and appearance.

Conclusion: in the edentulous patient implant-supported denture with artificial condyle allows the recovery of the masticatory function without the need of additional operations to re-establish the temporomandibular joint anatomy. It is currently considered as a low invasive technique with very low risk of side effects.

Key words: hemimandibulectomy, condylar prosthesis, implant-supported denture.

Introduction

The management of neoplasm of the head-neck, both benign and malignant, often requires a partial mandibular resection to an extent proportional to the observed cancer extension (1). Cancer resection may sacrifice also muscles, soft tissues, articular disc and condyle, leading to facial deformity with abnormal curvatures, mandibular dysfunctions and deficits in the oral functions.

The abnormal curvature degree depends on several aspects: the involvement of hard and soft tissues, the type of resection adopted, the level of impairment in tongue physiology, the number of residual dental elements, the entity of loss of nervous networks both sensory and motor and also the residual traction force exerted by the contralateral muscles.

The mandibular reconstruction allows improvements of the oral functions and of the occlusion (2).

The condyle reconstruction by denture implant has been adopted for many years for other diseases such as ankylosis, degenerative diseases, condyle related cancers, osteomyelitis, displasia, congenital malformations and trauma (3).

In the literature a great variety of techniques and materials employed for mandibular reconstruction and/or repositioning is described.

Traditional reconstruction methods using revascularised flaps, not revascularised bone grafts and costochondral grafts are widely documented together with the related pros and cons (4), while the denture reconstruction of the temporomandibular joint is still on debate (5).

Free fibula graft reconstructions are described in the most recent publications where aesthetic and functional success has been reached in all cases treated with the exception of one who presented an open-bite deformity, although this survey don't specify the type of masticatory rehabilitation performed (6, 7). In hemimandibulectomy patients, success achievement should not be limited only to the recovery of facial contour and to the maintenance of speech but should also consider the restoration of masticatory function.

In the literature case records are reported related to partial movable rehabilitations that make use of metallic flanges to restore the centric occlusion (8-10). On the other hand, rehabilitations for edentulous patients are extremely rare and make use of handmade dentures that take advantage of occlusal contacts to compensate the mandibular curvature (11). Alternatively, rehabilitation has been obtained applying the Neutral Zone technique, a method that acts on the horizontal and vertical forces generated from the tongue and the lips, which tend to dislocate the denture. The main limit of these rehabilitations is that they are not always feasible: to create a balanced

denture, a minimum bone-mucous support is always required, which should hold the denture at its base. The neutral zone technique is not always feasible because often in these patients the muscular flaps utilized to coat the resected/reconstructed portions are not responding normally to general dislocation movements encountered by the dentist (8,12-14).

Clinical case

The patient D.M. was a 64 years old man, hard smoker and moderate drinker. He was visited in spring 2007 at the dentistry section of the San Gerardo Hospital - School of Oral Surgery, University of Milan-Bicocca (Monza). On February 2006, he had been subjected to emptying of the right lateral-cervical side, right side hemimandibulectomy due to pathological fracture and extirpation of the muscles of the infratemporal fossa followed by a myocutaneous pectoralis flap. The histological analysis revealed the presence of a squamous carcinoma at the right mandibular ramus (T1-N1-

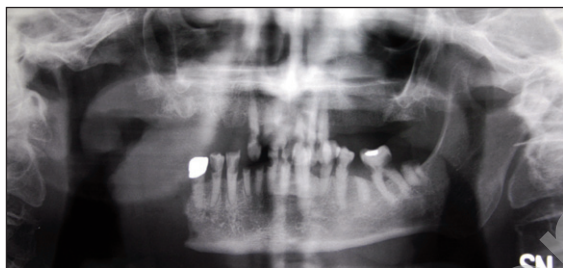


Figure 1. Pre-operative orthopantomography.

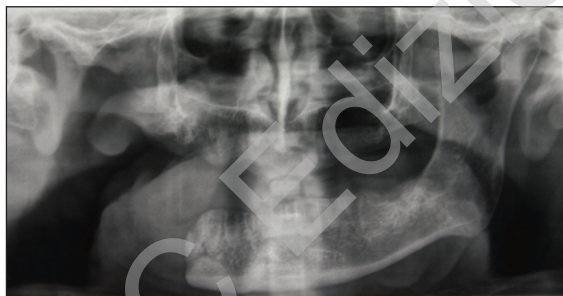


Figure 2. Post-operative orthopantomography.



Figure 3. Extraoral vision.

M0). At the physical examination the patient presented several unrecoverable root residues (Fig. 1), which were cleared up (Fig. 2). At the extra-oral inspection the patient presented an evident lateral right curvature with the loss of the normal facial appearance (Fig. 3). In February 2008, four implant fixtures with length and diameter respectively equal to 11,5mm and 4,5mm were inserted at the chin cap symphysis site (Conix – Prodent) (Figs. 4,5). Fixtures insertion has been preceded by a pre-surgical phase for patients declared suitable to implant rehabilitation.

Pre-operative phase

This step was essential to define the following aspects:

- Interview with the patient in order to illustrate the method of treatment, make known advantages and disadvantages of implant restoration and any associated hazards;
- Administration of antibiotic prophylaxis in order to minimize the risk of superinfections (Amoxicillin associated Clavulanic Acid).

Intra-operative phase

Surgical procedures have been performed after rinsing with pure chlorhexidine 0,2% for 60 seconds and under local anesthesia with mepivacaine 2% (without epinephrine).

The insertion of implant fixtures took place after a crestal incision and the subsequent preparation of a mucoperiosteal flap to expose the alveolar bone.

The subsequent preparation of implant sites was conducted in the less traumatic manner by means of a micro-motor with an induction motor and equipped with a display that allows a constant assessment of bone density due to a localized mechanical scanning.

Once the preparation is carried out by means of cylindrical cutters with increasing diameter, the fixtures were placed.

All implant fixtures adoperate within our protocol are characterized by a self-tapping profile in order to simplify implant insertion, minimize the increase of bone temperature and search for the maximum implant stability upon insertion. Their surface is obtained by a double chemical attack, achieving an increased implant surface and thickness of the oxide layer in order to facilitate biological response. The primary stability was measured by analysis of resonance frequency (Osstell).

Then, the mucoperiosteal flap has been closely repositioned around the neck of the implant and was sutured (3/0 suture) in order to obtain a healing by first intention.

Post-operative phase and follow-up

After verifying the achievement of hemostasis, patients were given the post-operative instructions in order to obtain the best possible healing and minimize post-surgical discomfort. The indications were as follows:

- Continuation of antibiotic therapy started earlier;
- Assumption of analgesic drugs;
- Topical application of chlorhexidine 1% to the wound to ensure a good disinfection.

Patients were encouraged to return to the Oral Clinic after a week to remove the sutures and to perform the first check on the status of healing tissues.

During periodic inspections, proper healing and implant

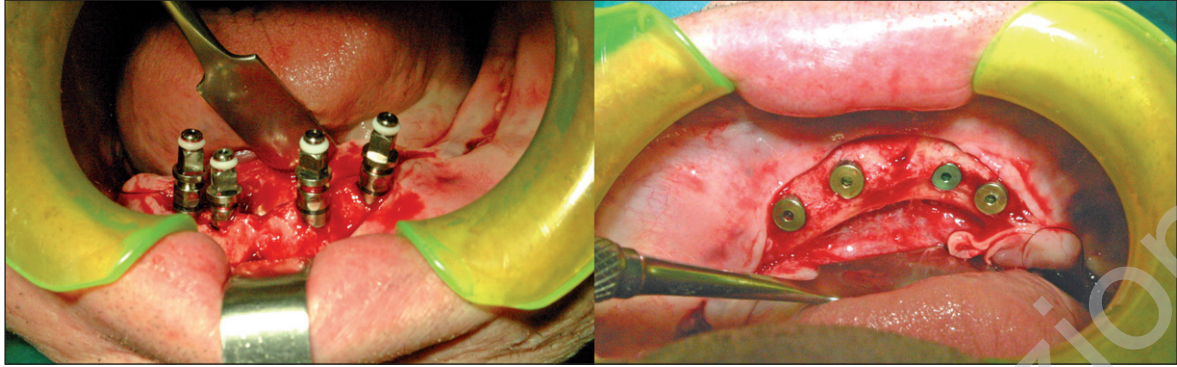


Figure 4. Intraoral vision implants positioning.

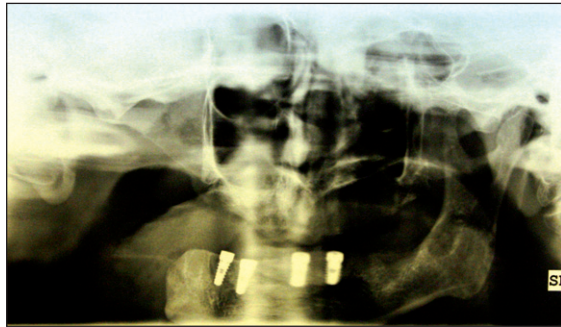


Figure 5. Post-operative orthopantomography.

osseointegration were evaluated by referring to the first three criteria defined by Albrektsson (1986), namely:

- Absence of mobility and presence of primary and secondary stability;
- Absence of peri-implant radiolucency;
- Absence of pain, infection, paresthesia, neuropathies.

After 6 months, the patient was subjected to the implant-supported denture rehabilitation, which consisted of an over-denture on the lower bar and of a total denture on the upper side. The lower denture presented a resin condyle in articulation with a fossa joint created in the upper denture. The rehabilitation process started with the cephalometric values of the patient (Fig. 6); it proceeded by positioning



Figure 6. Measurements with facial arch.



Figure 7. Operative phases of denture creation.



Figure 8. Final denture.

of jointed models and by the creation of the denture bases with the condylar eminence and the glenoid fossa in acrylic resin to achieve best biomechanical solution for the final denture (Figs. 7,8). To be able to evaluate masticatory movements, dynamic tests were performed using T-Scan III – Tekscan Inc. – DL Medica S.P.A. system (Fig. 9).

Discussion

Depending on the position and extent of the neoplastic lesion, several surgical approaches may be adopted: marginal resection, segmental resection, hemimandibulectomy, subtotal and total resection. In case of hemimandibulectomy with the extirpation of the temporomandibular joint, without graft reconstruction, in edentulous patients, it is very difficult to have a satisfactory rehabilitation. By losing the tongue-vestibular space and the presence of scar residues it is not possible to obtain either denture stability or the masticatory function. In the literature it has been proposed a denture technique named Neutral Zone. This method may be advantageous for hemimandibulectomized and reconstructed patients. The main limit of such method is in the fact that the masticatory load should be driven only on the untreated region (8,12): this implies a uneven distribution of masticatory loads, as shown by the exam carried out by T-Scan III method where it's apparent that the maximum load expresses itself in correspondance with the left posterior group.

Another proposed technique makes use of flange guides, allowing the repositioning of the hemimandibulectomized side: this method requires anchoring dental elements in order to give stability to the handmade denture, so that

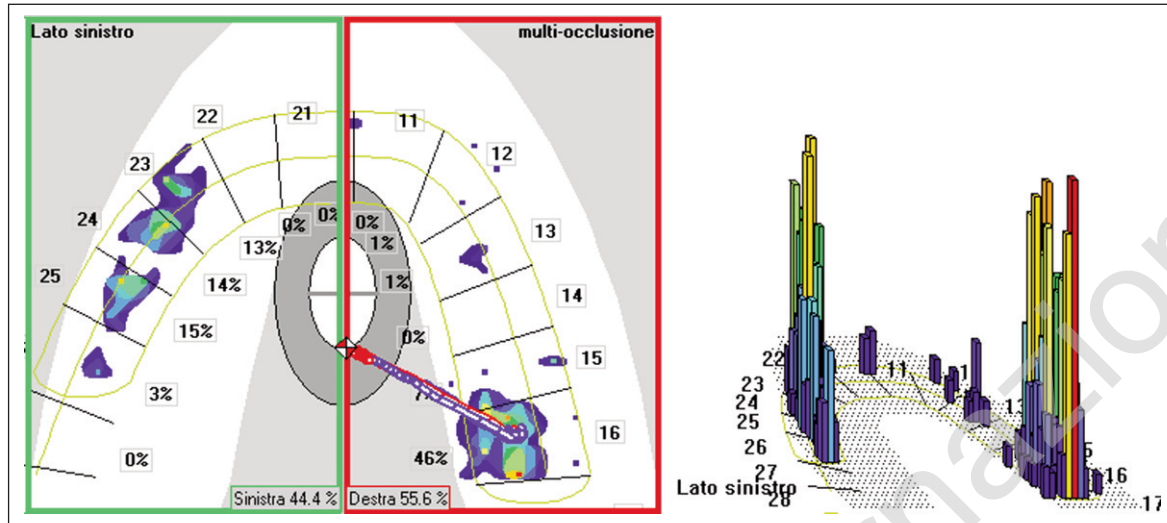


Figure 9. Masticatory forces development measured by T-Scan III.

the flanges may play their role as occlusal guides (5,8). The proposed implant-supported denture rehabilitation is able to re-establish the patient masticatory function on the entire dental arch without the need to reconstruct the missing tissues and allowing a better management of the residual tissues.

Conclusion

The proposed method presents several advantages compared to other rehabilitation techniques reported in the literature. The patient undergoes low invasive surgical-denture operations, allowing the recovery of the masticatory function, of the central occlusion and with a satisfactory re-establishment of face appearance (Fig. 10). Future perspectives on this rehabilitation technique aim at a possible denture solutions at the artificial joint level that is less prone to wear and less cumbersome.

The application of guide-flanges to reduce the mobility of joint movements is a further improvement to develop about the rehabilitation performed: this will make more ef-

fective masticatory movements and will ensure a uniform distribution of the forces applied.

The behavior of muscle forces involved, using dynamic models for the analysis of biomechanical forces, should be assessed to achieve a more proper rehabilitation (15). This would allow us to analyse all the components that contribute to the realization of the masticatory movements and, thereby, a more correct and efficient rehabilitation.

Source of Funding

No funding were received for the present study.

Acknowledgements

We thank the Dr. Giovanni Isella for their kind cooperation.

Conflict of interest

For all the authors, none were declared.

Informed consent

The present study was made in agreement with the "Declaration of Helsinki" ethical principles.

References

1. Engroff SL Fibula flap reconstruction of the condyle in disarticulation resections of the mandible. A case report and review of the technique. *Med Oral Pathol Oral Radiol Endod* 2005; 100:661-665.
2. Tang W, Long J, Feng F, Guo L, Gao C, Tian W. Condyle replacement after tumor resection: comparison of individual pre-



Figure 10. Facial appearance and occlusion recovery.

- fabricated titanium implants and costochondral grafts. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2009; 108:147-152.
3. Patel Maisel A. Condylar prostheses in head and neck cancer reconstruction. *Arch Otolaryngol head neck Surg* 2001; 127: 842-846.
 4. Saeed Nr, Kent Jn. A retrospective study of the costochondral graft in TMJ reconstruction. *Int J Oral Maxillofac Surg* 2003; 32:606-609.
 5. Sidebottom AJ. UK TMJ replacement surgeon, British association of oral and maxillofacial surgeons. Guidelines for the replacement of temporomandibular joints in United Kingdom. *Br J Oral Maxillofac Surg* 2008; 46:146-147.
 6. Sxahin N, Hekimoglu C, Aslan Y. The fabrication of cast metal guidance flange prostheses for a patient with segmental mandibulectomy: a clinical report. *J Prosthet Dent*. 2005; 93: 217-220.
 7. Patil PG, Patil SP. Guide flange prosthesis for early management of reconstructed hemimandibulectomy: a case report. *J Adv Prosthodont*. 2011; 3: 172-176.
 8. Nakajima J. Application of the palatal ramp in a reconstructed mandibulectomy patient. *Nihon Hotetsu Shika Gakkai Zasshi*. 2008; 52: 388-391.
 9. Hasanreisoglu U, Uçtasli S, Gurbuz A. Mandibular guidance prostheses following resection procedures: three case reports. *Eur J Prosthodont Restor Dent*. 1992; 1: 69-72.
 10. Pekkan G, Hekimoglu C, Sahin N. Rehabilitation of a marginal mandibulectomy patient using a modified neutral zone technique: a case report. *Braz Dent J*. 2007; 18: 83-86.
 11. Patil PG. Conventional complete denture for a left segmental mandibulectomy patient: a clinical report. *J Prosthodont Res*. 2010; 54(4): 192-197.
 12. Krunic NS, Aleksov LV, Kostic M, Pesic Z, Petrovic DM. Significance of neutral zone registration in the rehabilitation process of a patient with partial mandibulectomy: a case report. *Stomatologia* 2011; 90(3): 66-69.

© CIC Edizioni Internazionali