

THE USE OF TITANIUM IN THE FORM OF TITANIUM RECONSTRUCTION SPLINT IN RESTORING THE CONTINUITY OF THE MANDIBLE AFTER RADICAL NECK DISSECTION. CLINICAL CASE

ALBERTINA STĂNILĂ¹, IRINA PALADA², DAN SABĂU³, IULIAN FĂGETAN⁴,
MARIANA SABĂU⁵

^{1,2,3,4,5}“Lucian Blaga” University of Sibiu

Keywords: titanium, splint reconstruction, radical neck dissection

Abstract: The titanium draws the attention of the medical world through its particular advantageous properties, such as biocompatibility, low thermal conductivity, low density, corrosion resistance, odourless and tasteless and costs four times lower than that of gold. Therefore, due to its properties titanium is an ideal biomedical material for oral implantology and for restoring the continuity of the mandible after radical neck dissection in Oral & Maxillofacial (OMS) surgery.

INTRODUCTION

Titanium alloys for use in medical practice are-Ti-Al-V, Ti-Al-Mo-Al-Ti, Cr, Ti-Al-Cr-Co.

In terms of physical and chemical properties, titanium possesses the following properties:

- melting point approximately at 1600° C.
- strength and stiffness are comparable to those of stainless steel, titanium hardness is much higher than that of the cortical bone and dentine. Titanium is also flexible, which makes it resistant to shock applications.
- Ti is acting as a cathode and draws the calcium ions around it, favouring the appearance of the hydroxyapatite cores (a cathode effect).
- Ti oxide has a neutral ph-7.
- He presents low thermal conductivity, electrical resistance and weight and low density.

From the point of view of biological tissue reaction in

Ti:

- Another very important feature of Ti is that it covers his surface spontaneously with a titanium oxide film that continually regenerates. These stable oxides from the titanium surface determines –monoxide, dioxide, trioxide-gives him a very high resistance to corrosion (400 times greater than that of the stainless steel). Corrosion resistance can be increased by alloying with rhenium, zirconium, molybdenum, manganese, chromium, niobium.(1)
- Ti has not a magnetic effect, it does not produce magnetic field that can disrupt the cell activity.
- Ti oxide has a healing quality, for that it is used in dermatological treatments.
- Biological compatibility.
- Between the Ti splint for reconstruction recons and the bone surrounding is established a solid connection through the growth of the bone on the rough surface of the of the metal and tying it, supporting a mechanical, rigid, anchor, equivalent to some authors with osteointegration.(2)

The titanium splint for reconstruction was used initially for the permanent restoration of the mandible in order to ensure stability and to maintain outstanding anatomical position of the fragments. Currently, the titanium splint for reconstruction is used for the fixation of the corticospongios blocks or for the fixation of bone grafts to the mandibular bone

fragments. Reconstruction of the mandibular tray usually comes in ready-made shapes and their remodelling may not be easy due to their thickness and stiffness. The titanium splint for reconstruction must have a minimum of 2.7 mm thickness and must be fixed with three to four bicortical screws on either side of the fault to ensure absolute immobility and stability of the entire bone.

CASE REPORT

Patient, V.I, aged 59, was admitted to the Department of OMS Surgery within Sibiu Clinical County Emergency Hospital with the diagnosis of malignant tumour formation at the mandibular left angle, T2 N2b Mx, with submandibular and left laterocervical adenopathies for specialist investigation and treatment.

The treatment was surgical, in orotracheal intubation under general anesthesia intervention. After disinfection and covering of the operator field, there was practiced a submandibular left incision, on the edge of the prolonged anterior SCM left muscle; there were dissected in anatomical plans, the cervical triangles III, IV and V, according to the modified radical neck dissection (MRND) technique type III.

Figure no. 1. Intraoperative appearance



There was practiced the discontinuity of the inferior lip on the midline lining, discovering the mandibular bone and the left cheek mucosa. There was practiced the resection of mandible continuity from 3.4 level until the upper half level of the mandibular ascending ram. Together with the mandibular bone, there were removed the retromolar trigon mucosa and the cheek mucosa within 1.5 cm from the edges of the visible clinic tumour.

¹Corresponding author: Albertina Stănilă, Str. Aleea Mirăslău, Nr. 13, Şelimbăr, România, E-mail: sas_albertina@yahoo.com, Phone: +40757 060347
Article received on 12.09.2015 and accepted for publication on 04.11.2015
ACTA MEDICA TRANSILVANICA March 2016;21(1):77-78

CLINICAL ASPECTS

Figure no. 2. Interruption of the mandible continuity



Figures no. 3 and 4. The operating piece



Figures no. 5 and 6. Intraoperative appearance

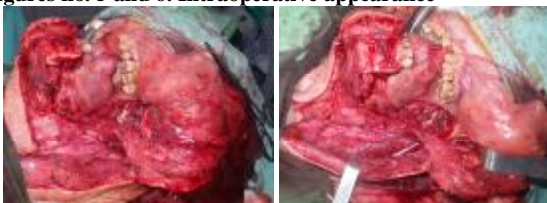


Figure no. 7. Intraoperative appearance. Modelling and fixing the titanium splint for reconstruction of the mandibular bone



The operating piece is sent for histopathological analysis. The titanium splint was shaped for reconstruction and fixed to the mandibular bone with five osteosynthesis screws. The titanium splint for reconstruction was covered in the upper level with lingual muscle from his own tongue and the inferior level being covered with the anterior part of the digastric muscle. After checking hemostasis, there was practiced the surgical toilet of the wound and there was performed a suture in anatomical planes after applying in advance a drainage aspirative tube type Redon. The surgeon applied a sterile dressing.

The patient was discharged surgically cured, with the following recommendations:

- maintaining a rigorous oral hygiene;
- returns after 7 days for the suppression of the suture wires;
- returns after three weeks for lifting the histopathologic result and for oncological speciality treatment.

DISCUSSIONS

The purpose of the mandible reconstruction after radical neck dissection is to maintain mandible's functions and restore a cosmetically acceptable appearance, allowing a good quality of life.(3,4) Restoring an aesthetic acceptable appearance, along with the resumption of speaking and swallowing, constitutes desires no easy to reach taking into account the technical difficulties associated with a general precarious status of the patient. A solution to shorten the duration of the surgery and get at the same

time good postoperative results definition is the use of titanium reconstruction splint.

One of the indications for the use of the titanium reconstruction splint is to reduce morbidity from the donor region and to reduce at the same time the duration of the surgery. To lessen the chances of removal of the titanium reconstruction splint and increase the quality of the outcome after surgery, the titanium reconstruction splint can be associated with a free transferred flap.(5,6)

The big drawback of the modelling challenge of the titanium reconstruction splint is represented by three-dimensional titanium splint models that allow the "ideal" preoperative modelling of the titanium reconstruction splint (7) if they are used in conjunction with a free bone flap but also when they are used as a single solution for restoring the mandibular continuity. This way, the duration of surgery is reduced, and at the same time, increasing the quality of the reconstruction by restoring the initial symmetry.(8)

CONCLUSIONS

Titanium reconstruction splint is especially useful in restoring the continuity of the mandible in some tumour pathologies after radical neck dissection, being used in two situations: single or in combination with a free transferred flap from fibula.

The experience of the past few years has highlighted the achievement of superior results when the titanium splint for reconstruction is protected through the use of musculocutaneous flaps from latissimus dorsi, freely transferred.

REFERENCES

1. Textor M, Sittig C, Frauchiger V, Tosatti S, Brunette DM. Properties and Biological Significance of Natural Oxide Films on Titanium and Its Alloys, Chapter, Titanium in Medicine, Part of the series Engineering Materials. 2004; p. 171-230.
2. Brunette DM. Titanium in medicine: material science, surface science, engineering, biological responses, and medical applications; 2001.
3. Schusterman MA, Kroll SS, Weber RS, Byers RM, Guillamon de gui O, Goepfert H. Intraoral soft tissue reconstruction after cancer ablation: A comparison of the pectoralis major flap and the free radial fore arm flap. *Am J Surg.* 1991;162(4):397-399.
4. Irish JC, Gullane PJ, Gilbert RW, Brown DH, Birt BD, Boyd JB. Primary mandibular reconstruction with the titanium hollow screw reconstruction plate: Evaluation of 51 cases. *Plast Reconstr Surg.* 1995;96(1):93-99.
5. Blackwell KE, Buchbinder D, Urken ML. Lateral mandibular reconstruction using soft-tissue free flaps and plates. *Arch Otolaryngol Head Neck Surg.* 1996;122(6):672-678.
6. Shpitzer T, Gullane PJ, Neligan PC, et al. The free vascularized flap and the flap plate options: Comparative results of reconstruction of lateral mandibular defects. *Laryngoscope.* 2000;110(12):2056-2060.
7. Balan M, Popescu E, Dumitraş CG, Ciofu M,Boişteanu M, Costan VV. Valoarea modelului tridimensional în reconstrucția pierderilor de substanță segmentare ale mandibulei. *Observații pe marginea unui caz clinic. Rev Med Chir Soc Med Nat Iasi.* 2011;115(1):227-231.
8. Schusterman MA, Reece GP, Kroll SS, Weldon ME. Use of the AO plate for immediate mandibular reconstruction in cancer patients. *Plast Reconstr Surg.* 1991;88(4):588-593.