

Bone Addition to Partial Edentulism in the Frontal Area of the Mandible

Cornelia Liana Micula-Cociuban¹, Teodor Traian Maghiar², Alexandru Spînu³, Ramona Amina Popovici⁴, Liana Todor¹, Raluca Iurcov¹, Mihaela Dana Pogan¹

¹University of Oradea, Faculty of Medicine and Pharmacy, Department of Dental Medicine, Oradea, Romania

²Department of Morphological Disciplines, Oradea, Romania

³Spînu Dental Clinic, Oradea, Romania

⁴Victor Babes University of Medicine and Pharmacy, Faculty of Dental Medicine, Department of Management, Legislation and Communication in Dental Medicine, Timisoara, Romania

CASE REPORT

Abstract

The teeth in the frontal area have an important role in aesthetics, speech and phonation. Uni-dentary edentulism and partial edentulism appear at ever younger ages. After tooth loss, the phenomenon of bone resorption appears. For a functional and aesthetic oral rehabilitation, we use dental implants. The dental implant represents the optimal solution for the prosthetic treatment, and offers solutions for replacing any missing teeth. Bone resorption is an obstacle to the insertion of a dental implant under normal conditions. Restoring the amount of bone in the frontal mandibular area can be done by bone augmentation using an autograft. The quality and quantity of the bone are of great importance for the success of the implant insertion and for the duration of the prosthetic work.

Aim and objectives: To present one of the surgical techniques that ensure the necessary amount of bone for a successful dental implant insertion and a functional, aesthetic and long-lasting prosthetic work.

Materials and methods: One stage in implant-prosthetic therapy is bone augmentation. As a bone addition technique we use autograft bone augmentation, fixed with osteosynthesis screws.

Results: Postoperatively, the patient has mild postoperative edema in the frontal area of the mandible, clean wounds, no serosanguinous secretions, moderate pain in the area of surgery.

Conclusions: Long time partial edentulism and its consequent bone atrophy and resorption, ever more frequent among adult patients, raised our interest to study methods that

can be employed to increase the amount of bone in order to reestablish oral functionality and aesthetics.

Keywords: bone augmentation, autograft, partial edentulism, ridge augmentation

I. INTRODUCTION

Tooth loss is a situation a large part of the population is confronted with, and it has consequences on the functions of the stomatognathic system, eg mastication, facial appearance and speech. In recent years, it has been noteworthy and individuals of ever younger age show single tooth or partial edentulism.

After tooth loss, the phenomenon of bone resorption appears. Both at the mandibular and at the maxillary level, where there are no teeth, the bone will suffer an atrophy process, it will resorb. The more time passes since having lost the tooth (or teeth), the more advanced the bone resorption will be. Frequently, after a year since the tooth's being pulled out, the amount of bone decreases by 25% compared to the initial amount of bone, while after three years, one can notice a resorption rate ranging between 40 and 60 percent, and, after five years, the bones achieve a thickness of less than 3 mm [2-12].

The dental implant represents the optimal solution for the prosthetic treatment and provides an appropriate replacement for any missing teeth. In order to improve the amount and quality of the bone, there are a number of techniques for bone addition to the area receiving the implant.

In the last three decades, treatment using partially fixed prosthetic works with implant support became a standard procedure for the prosthetics physician, the oral surgeon, the periodontist, or the general practitioner. Oral implantology is a combination of surgery, prosthetics, and gnathology, which revolutionized dentistry in general, and prosthetics in particular, in the past decades, especially through the new possibilities it offers in terms of prosthetic restoration. The quantity and quality of the bone in the area receiving the implant has a particular importance in the successful insertion of the dental implants and the duration of the prosthetic work [6-14].

The physician must evaluate the local and general status of the patient. A clinical examination and paraclinical investigations must be performed. Radiograms and tomograms need to be captured to evaluate the bone offer and to establish a treatment plan.

Losing one or more teeth leads to discomfort, eating difficulties, damage to adjacent teeth, damage to the aesthetics, facial appearance and phonation.

With implant-based prosthetic reconstruction, the treatment is preservative, compared to a traditional prosthetic work, by means of a bridge, because the dental implant eliminates the need of sacrificing healthy teeth bounding the toothless breach, through manual procedures like nerve extraction, root canal obturation, refurbishing the teeth. Thus, the patient needs to sacrifice healthy teeth to anchor prosthetic works like dental bridges. Patients who use mobile dentures, that permanently create discomfort, can receive a fixed denture, anchored on implants that have the look and feel of natural teeth.

A dental implant has the capacity to restore a tooth or more teeth to an almost perfect previous function.

The teeth in the frontal area have an important role in aesthetics, speech and phonation. Losing a tooth or several teeth in the frontal mandibular or maxillary area renders the patient's impossibility to smile and to pronounce certain words. In the front mandibular area, the teeth are only partially visible, but together with the teeth in the frontal maxillary area they participate in uttering some of the consonants. Consequently, in the frontal mandibular area, phonetic, aesthetic requirements prevail, and also the stabilization of occlusion and backward drive of the mandibula. Therefore, the appearance of frontal mandibular partial edentulism raises several issues with the patient. If the partial edentulism is not recent and the bone resorption is highlighted on the X-ray scan, we have to consider implant-based prosthetic reconstruction and, of course, rebuilding the deficit bone through various bone addition techniques to ensure the necessary quantity and quality of the bone required for a successful implant [8-15].

The dental implant is a piece of high purity (99.4%) titanium, usually shaped like a screw, designed to create an artificial root in the maxillary or mandibular bone, where there is edentulism [3-9]. The reconstruct of the bone deficit can be grafted, augmented, using various additive materials, such as autografts, allografts, xenografts and using several addition techniques. The autograft is the most recommended

augmentation material because, being own to the patient's organism, it contains its own proteins and growing factors. The autograft is a bone fragment that can be taken from the chin, the mandibular ram, the maxillary tuberosity, or the palate [10-12].

Aim and objectives

The main objectives of this paper were to confirm that in the case of a partial frontal edentation with severe bone resorption, the most indicated functional and aesthetic oral rehabilitation is achieved through prosthetic works with exclusive implant support. A second objective was to confirm that in order to improve the quality and bone volume of the dental implant receptor area, bone addition is needed. The most beneficial bone addition technique is the monobloc bone graft, using autograft. Autograft is the most suitable augmentation material because it contains the growth factors and the patient's own proteins. For a functional, aesthetic and long-lasting oral rehabilitation, the bone supply of the receiving area must be sufficient, both in height and thickness. A third objective was to confirm that purpose of this paper is to present one of the surgical techniques that ensure the necessary amount of bone for a successful dental implant insertion and a functional, aesthetic and long-lasting prosthetic work.

II. MATERIAL AND METHODS

One stage in implant-prosthetic therapy is bone augmentation. As a bone addition technique, we use autograft bone augmentation, fixed with osteosynthesis screws.

Autograft is best for augmentation because it contains its own proteins and growth factors. Autograft can be harvested from the chin, palatal arch, mandibular ramus, maxillary tuberosity. The autograft is a small fragment of bone that will be fixed after modeling in the area with resorbed bone, by fixing with titanium screws for the osteosynthesis.

We also use additive materials, xenogrefe (Bio-oss) - bone granules to accelerate the healing, Megagen Anyridge dental implants and special membranes.

Surgical procedure

Clinical and radiographic examination revealed severe vertical and horizontal resorption of the ridge. In mandibular anterior region. The complete treatment procedure was explained to the patient and he signed consent according. Bone augmentation in the area where bone resorption had occurred on mandibular frontal level, implant insertion and prosthetic reconstruction upon implants will be done in two clinical stages.

In the first stage, preoperatively, after disinfection of the oral cavity with Chlorhexidine 0.2%, by rinsing the mouth for one minute and perioral disinfection with povidone-iodine solution 5%, we perform the anesthesia using Lidocaine 2%. Then the autograft is harvested – a bone fragment from the mandible branch, retromolar, the bone autograft is fixed to the receiving area with two titanium screws. The two Megagen Anyridge dental implants are inserted in the same clinical

stage, after which the receiving area is completed with bone addition material in the form of BIO-OSS granules. To accelerate healing, the bone granules are mixed with natural growth factors enriched with platelet rich fibrin (PRF) which are obtained by processing the patient's blood in special devices. Then we cover the entire bone reconstruction with resorbable membranes, after which everything is covered with a muco-gingival flap. It is sutured both at the level of the receiving area and at the level of the donor area. Postoperatively, the patient is trained in oral hygiene, rinsing for one minute 3-4 times a day with Chlorhexidine 0.2%. They also receive a general antibiotic treatment (Amoxicillin 500 mg, three times a day for 7 days) and a nonsteroidal anti-inflammatory drug (Ibuprofen two times daily for 5 days). [14-18]

In the second clinical stage, after 6-8 months, after clinical and radiological examination, the cover screws are removed from the level of the two implants, the prosthetic abutments are mounted and the prosthetic work is performed.

III. CASE REPORT

Patient: L. R., male, 53 old

General clinical status: HTA, controlled by means of prescription drugs

Diagnosis: Frontal mandibular partial edentulism at 4.1, installed five years prior (Figure 1). Ridge with a very low height and thickness. Incisors 4.2 and 3.1 manifest a significant mobility and gum retraction.



Figure 1: Frontal mandibular edentation at 4.1, installed three years before, accompanied by bone resorption

Treatment

We extract 4.2 and 3.1. Postoperatively, the patient has partial mandibular edentulism (3.1, 4.1, 4.2). After that, the bone augmentation is performed by means of autograft, which is being fixed using two titanium screws. At the same time, the insertion of two Megagen Anyridge implants was performed surgically (Figure 2). The whole area surrounding the autograft is being filled with BIO-OSS additive material — granules mixed with the patient's blood to accelerate healing. (Figure 3) Also for the purpose of accelerating the healing process, the bone granules are being mixed with natural growing factors, enriched with fibrine (PRF), which is obtained by processing the patient's blood using specific devices.

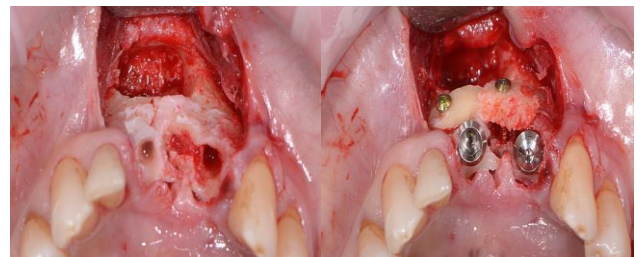


Figure 2: Surgical insertion of two Megagen Anyridge implants; simultaneous addition of the autograft, fixed with two titanium screws



Figure 3: The whole area surrounding the autograft is being filled with BIO-OSS additive material mixed with the patient's blood to facilitate healing

The entire reconstructed bone is covered with special membraned that fill the role of a barrier that avoids proliferating the gum tissue in the bone graft. Everything is then covered with the gum which is then sutured. After 6-9 months, the bone will be capable of receiving and supporting dental implants and their crowns.

Results

Postoperatively, the patient has mild postoperative edema in the frontal area of the mandible, clean wounds, no serosanguinous secretions, moderate pain in the area of surgery. General treatment with antibiotics, nonsteroidal anti-inflammatory drugs and analgesics is indicated. The sutures are removed 7 days after surgery. In the first month, a weekly control is performed, after that at one month. The patient is under observation, with a favorable evolution towards healing.

IV. DISCUSSION

Autograft does not produce immunological reactions, but determines revascularization and quick regeneration of the bone. [12]

Vertical and horizontal bone augmentation at the level of frontal maxillary bone atrophies by using autograft as the bone addition technique, together with bovine bone addition material in the form of BIO-OSS granules and membranes and the insertion of dental implants in the same clinical stage yielded satisfying results, leading to a both functional and aesthetic prosthetic reconstruction. [13] In a study on alveolar reconstruction using autogenous bone, that took place over seven years, the autograft technique has proven a success rate of over 93%, with only 6.6% of cases having failed. [11]

The usage of platelet rich fibrin (PRF) is a procedure that has proven beneficial in the bone regeneration process. [10] Currently, PRF is being promoted as a regenerative tool in many studies. [9]

Autogenous bone grafts have been used frequently for mandibular reconstruction [15]. On the long term, autograft have proven a highly satisfactory rate of success and survival, while minimizing bone resorption. [9] The most common donor sites for free bone tissue transfer are: fibula, scapula, iliac crest and radius [16,17].

New techniques are tested to eliminate need for bone harvesting from a donor site [18-20].

V. CONCLUSIONS

Longtime partial edentulism and its consequent bone atrophy and resorption, ever more frequent among adult patients, raised our interest to study methods that can be employed to increase the amount of bone in order to reestablish oral functionality and aesthetics.

The advantages of bone augmentation by means of the autograft allows us to repair oral bone damage, to rebuild and increase the amount of bone, which gives way to performing functionally and aesthetically relevant high standard implant and prosthetic-based therapy afterwards.

Dental implants can remove the need of total or partial prosthetics, reduce bone loss, improve the health of the gum and adjacent teeth, preserve the remaining natural teeth and provide extra comfort and higher level of aesthetic.

ACKNOWLEDGMENT

Thanks to the help of Col. Liliana Moraru, MD, PhD, from Central Military Hospital, Bucharest, primary doctor in OMF surgery and dentistry.

REFERENCES

- [1] Denissen HW, Kalk W, Veldhuis H, et al. Anatomic considerations for preventive implantation. *Int J Oral Maxillofacial Implants*. 1993.
- [2] <http://www.cliniciimplantdentar.ro/>
- [3] Jan Lindhe et al. *Clinical Periodontology and Implant Dentistry*. 5th Ed. Blackwell Munksgaard. 2008.
- [4] Misch CE. Maxillary sinus Augumentation for aendosteal Implants: Organized Alternative Treatment Plans. Introduction *J. Oral Implant*. 1987.
- [5] Ganuta N, Bucur A, Ganuta A. *Tratat de implantologie orală*. Ed. Național. 1998.
- [6] Sarbu I, Stoienescu M, Tanase G, Marinescu A, Gheorghe S, Carabela M, et al. *Curs practic de implantologie orală*. Ed. Romprint SA, București. 2004.
- [7] <http://www.implantodent.ro/>
- [8] Corinaldesi G, Pieri F, Sapigni L, Marchetti C. Evaluation of survival and success rates of dental implants placed at the time of or after alveolar ridge augmentation with an autogenous mandibular bone graft and titanium mesh: A 3 to 8 year retrospective study. *Int J Oral Maxillofac Implants*. 2009;24:1119–124.
- [9] Miron RJ, Zucchelli G, Pikos MA, Salama M, Lee S, Guillemette V, Fujioka-Kobayashi M, Bishara M, Zhang Y, Wang HL, Chandad F,

- Nacopoulos C, Simonpieri A, Aalam AA, Felice P, Sammartino G, Ghanaati S, Hernandez MA, Choukroun J. Use of platelet-rich fibrin in regenerative dentistry: a systematic review. *Clin Oral Investig*. 2017 Jul;21(6):1913-1927.
- [10] Blinsein B, Bojarskas S. Efficacy of autologous platelet rich fibrin in bone augmentation and bone regeneration at extraction socket. *Stomatologija*. 2018;20(4):111-118.
- [11] Rabelo GD, de Paula PM, Rocha FS, Jordão Silva C, Zanetta-Barbosa D. Retrospective study of bone grafting procedures before implant placement. *Implant Dent*. 2010 Aug;19(4):342-50.
- [12] Desai AJ, Thomas R, Tarun Kumar AB, Mehta DS. (2013). Current concepts and guidelines in chin graft harvesting: A literature review. *Int J Oral Health Sci*. 2013;3(1):16-25
- [13] Deshpande S, Deshmukh J, Deshpande S, Khatri R, Deshpande S. Vertical and horizontal ridge augmentation in anterior maxilla using autograft, xenograft and titanium mesh with simultaneous placement of endosseous implants. *J Indian Soc Periodontol*. 2014;18(5):661-665.
- [14] Bratu D, Nussbaum R, Bazele clinice și tehnice ale protezării fixe. 2003;1111–1129.
- [15] Genden E, Haughey BH. Mandibular reconstruction by vascularized free tissue transfer. *Am J Otolaryngol*. 1996;17:219–27.
- [16] Urken ML, Weinberg H, Vickery C, Buchbinder D, Lawson W, Biller HF. Oromandibular reconstruction using microvascular composite free flaps. *Arch Otolaryngol Head Neck Surg*. 1991;117:733–44.
- [17] Burkey BB, Coleman JR Jr. Current concepts in oromandibular reconstruction. *Otolaryngol Clin N Am*. 1997;30:607–30.
- [18] Costantino PD, Johnson CS, Friedman CD, Sissons GA Sr. Bone regeneration within a segmental human mandible defect. A preliminary report. *Am J Otolaryngol*. 1995;16:56–65.
- [19] Warnke PH, Whiltfang J, Springer I, Acil Y, Bolte H, Kosmahl M, et al. Man as living bioreactor: fate of an exogenously prepared customized tissue-engineered mandible. *Biomaterials*. 2006;27:3163–7.
- [20] Goh BT, Lee S, Tideman H, Stoelinga Paul JW. Mandibular reconstruction in adults: a review. *Int J Oral Maxillofac Surg*. 2008;37:597–605.