ACTA FACULTATIS MEDICAE NAISSENSIS

UDC: 616.314-089

Scientific Journal of the Faculty of Medicine in Niš 2011;28(3):183-188

Case report ■

Rehabilitation of Severely Resorbed Mandible Treated With Mini Dental Implants and Iliac Crest Bone Grafts: Case Report

Marija Bubalo[1], Zoran Lazić[1], Radomir Milović[1], Anika Ćuković[2]

[1]*Department of Implantology, Clinic of Maxillofacial, Oral Surgery and Implantology, Military Medical Academy, Belgrade, Serbia*

[2]*Faculty of Dentistry, Pančevo, Serbia*

SUMMARY

Severe pathologic resorption of the mandible may result in weakening of the jaw, unstable dentures, abnormal functions of mastication and speech, and a marked reduction of the facial and vertical dimension. This clinical report describes the rehabilitation of a severely resorbed mandible treated with mini dental implants and an iliac bone graft. A bone graft harvested from the iliac crest was used for the reconstruction of a severely resorbed mandible in a female patient aged 59 years. Six months after graft remodeling, four mini dental implants were inserted. The patient was prostheticaly rehabilitated using an implant retained denture. This treatment was considered to be a beneficial treatment choice in the maintenance of satisfactory functional and esthetic results in patients with severely atrophied alveolar ridges.

Key words: **atrophy, mandible, iliac crest, iliac graft, reconstruction, alveolar ridge augmentation, mini dental implant**

Corresponding author:

Marija Bubalo•

tel. 064/ 1404448•

e-mail: bubalom@sezampro.rs •

INTRODUCTION

Bone resorption in the upper and lower jaws occurs primarily as the consequence of edentulousness. Atrophy of the lower jaw is a progressive process, and with time the functions of mastication and speech can be markedly compromised, especially as the result of reduction of supporting tissues (both osseous and soft tissues) (1).

Extreme resorption of the lower alveolar ridge and basis of the lower jaw commonly produce problems with wearing of the lower total denture. This involves the height and width of the lower jaw of less than 5 mm in the interforaminal region (Class VI according to the Cawood and Howell classification) with completely resorbed alveolar ridge. The problems are related to the inability of wearing stable total denture (due to insufficient retention), reduced functions of speech and mastication, reduced support with perioral soft tissues, impossibility of placement of not only dentures of standard dimensions, but also of the implants with reduced length and width, and those with a wedge (2).

In patients with moderate to severe resorption of the edentulous lower jaw ridge, in whom dental implants with standard dimensions cannot be placed due to the lack of available bone, other options should be considered instead. The following approaches have been utilized up to the present: use of short implants (6 mm in length and 3 mm or even less in width) (3), wedge-shaped implants (4), alveolar distraction osteogenesis (5), guided bone generation (6), use of transmandibular staple implants, use of intra- and extraoral autogenous bone grafts (7).

Autogenous bone grafts possess an osteogenic character, i.e. the ability to form bone tissue in the absence of non-differentiated mesenchymal cells. There are free and revascularized autogenous bone grafts. Extraoral donor sites for free bone grafts are the crista iliaca, calvaria, tibia, and ribs. Literature data have demonstrated that crista iliaca is the donor site of choice if larger amounts of jaw bone have to be replaced. The external portion of the iliac graft is compact, with spongious bone structure beneath, making feasibe graft shaping and adaptation to the recipient region. (8). The shortcoming of the graft is its resorption, from 30% to 90% if the patient is managed prosthetically with a total denture, but the resorption rate could be significantly reduced if implants are placed in the graft (usually six months after graft remodeling) (9).

Dental implants can be a reliable way of achieving successful prosthetic rehabilitation. However, implant placement requires adequate bone quantity and quality. Mini dental implants are the treatment choice in the cases of spatially limited anatomic regions. These are the implants the diameter of which ranges from 1.8 mm to 2.4 mm. Their original purpose was temporary prosthetic stabilization during the period of osseointegration of standard-sized implants. The field of indications for their use later expanded from orthodontic supports, to retainers and stabilizers of fixed and mobile prosthetic devices. They were indicated especially in the cases of reduced width of the alveolar ridge as retention devices for the lower total dentures. They are made of titanium-alluminum-vanadium alloy, which gives them sufficient strength for long-term use. Their survival rate amounts to 94.2%, depending on the implant diameter and recipient region diameter (10).

The aim in this report was to present the prosthetic rehabilitation of a severely atrophic lower edentulous jaw using mini dental implants placed into the alveolar ridge previously augmentated with an iliac graft (Figure 1).

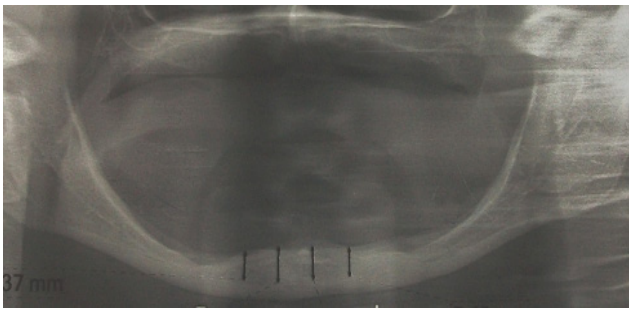

Figure 1. *Original orthopantomogram*

CASE REPORT

A 57- year-old female patient was admitted at the Department of Implantology of the MMA at the beginning of 2009, complaining of her inability to wear the lower total denture. She had lost her teeth in earlier years as the consequence of parodontopathy. She was referred for orthopantomographic x-ray and tomographic measurement of the bone tissue in the regions 41, 43, 31, and 33, and the suggested treatment was implant placement which would stabilize her lower total denture. The analysis of the sections indicated a severe atrophy of the lower jaw. The height of the measured regions ranged from 5.28 mm to 6.10 mm, and the width was 3.83 mm to 4.09 mm. The lower jaw in the radiogram had the appearance of a pencil, and resorption was especially severe in the lateral portions, which indicated a threatening pathologic fracture.

Laboratory blood tests were performed to exclude osteoporosis. Blood analyses indicated that the parameters of interest (Ca, P, alkaline phosphatase, etc.) were within the reference limits. After all the necessary analyses, the patient was hospitalized in the clinic.

Under general anesthesia, after the elevation of the mucoperiosteal flap, the jaw bone was exposed, which intraoperatively confirmed the lack of bone in the regions planned for implant placement. Four auto-grafts were taken from the crista iliaca and placed in the four areas of the lower jaw in the infraforaminal region, and in the lateral regions on both sides. These autografts were fixated with mini plates. The lateral regions were

augmented in order to prevent the possibility of pathologic fractures. The patient's postoperative period passed without any complications (Figure 2, Figure 3).

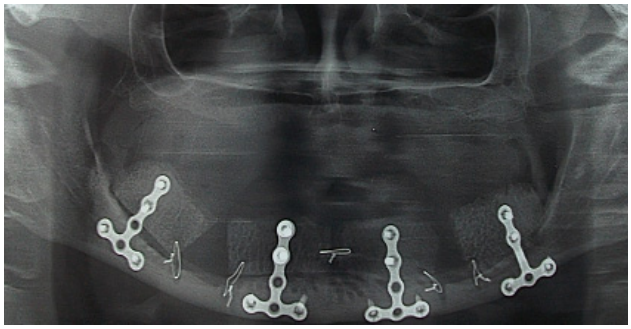

Figure 2. *Augmentation by way of an iliac graft*

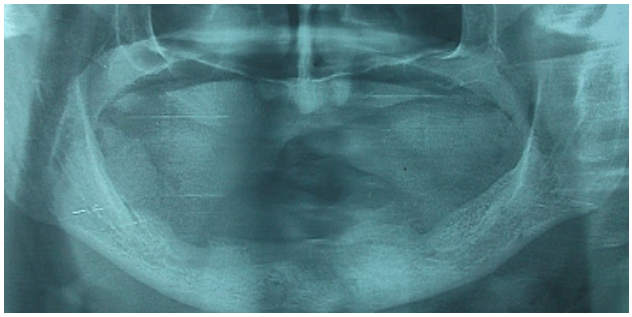

Figure 3. *Orthopantomography after graft remodeling*

Six moths later, after the iliac graft remodeling, mini plates were removed. The patient was referred again for tomographic measurements. The analysis of the new orthopantomogram demonstrated that the alveolar ridge height was increased by about 10 mm, and that width was not increased that much - partial transplant resorption perhaps took place. In local infiltration anesthesia, after the elevation of the mucoperiosteal flap, 4 mini dental implants were placed (3M IMTEC, MDI Collared Intermediate O-Ball 2.1 mmx13 mm) in the regions 31, 33, 41, 43. It should be mentioned that we made the decision in favor of mini dental implants as the result of wish and need of the patient to stabilize her lower total denture and her limited financial resources as well. A month after the placement, an implant-retained lower total denture was fabricated for the patient, achieving a satisfactory prosthetic result (Figure 4, Figure 5, Figure 6).

Figure 4. *Placed mini dental implants*

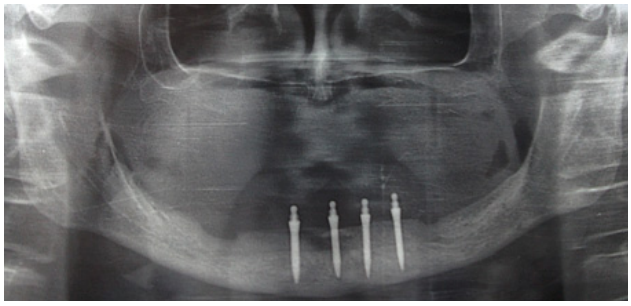

Figure 5. *Orthopantomography with placed implants*

Figure 6. *Appearance of the patient after prosthetic rehabilitation*

DISCUSSION

Dental implants have created the possibility for a reliable basis to be fabricated for fixed and mobile prosthetic devices, and reconstructive pre-prosthetic surgery, with the original aim to provide satisfactory osseous and soft tissue support for conventional prostheses, has shifted towards the provision of enough bone tissue which would enable implant placement in the most optimal position from the prosthetic point of view. The procedure has gained wide acceptance in the cases of moderate and very severe resorption of an edentulous lower jaw. Nevertheless, the use of implants for extremely resorbed mandibulas and the choice of reconstructive surgery approach which would facilitate implant placement into the resorbed mandibula is still a matter of debate in the literature (11).

Extreme atrophy of the lower jaw can be successfully managed by short implants, as the literature data have documented. The approach is indicated in patients with the interforaminal region at least 6 mm high and wide (3, 12, 13).

However, more extreme cases require the implementation of bone grafts, autogenous, allogeneic, and xenogeneic, which has been documented as successful in many instances. Severely resorbed lower jaw requires the reconstruction with free bone grafts, vascularized grafts, or distraction osteogenesis. If a large amount of the bone has to be replaced, the grafts from the iliac bone, calvaria, or ribs are used (14). In our case, an

iliac graft was used since a large amount of the bone had to be replaced and all the complications were considered, such as soft tissue dehiscence, graft exposure, or post-operative infections, which could have caused a partial or total graft loss.

The iliac graft is not very predictable in view of bone resorption, as has been noted in numerous studies. This is one of the principal problems in its utilization. Literature data have been very variable. It is believed that vertical resorption is most pronounced in the first year after the reconstruction, ranging from 12% to 60% in the period from the first to the fifth year after implant loading, with significant reduction in subsequent years (15, 16). A significantly smaller number of papers has indicated the presence of horizontal resorption, ranging from 10% to 50%, which was present in our case as well, requiring the use of mini dental implants instead of conventional-sized ones (17, 18).

Analysis of the studies comparing the resorption of various grafts has indicated that membranous grafts (calvarial) are characterized by a lower resorption rate compared to endochondral ones (iliac) (19, 20).

In the period from 1997 to 1999, Brian Bell et al. (2005) retrospectivelly measured the percentage of resorption of iliac grafts used to augment atrophic lower jaws in 14 patients, before and after implant placement. The median vertical bone loss was 33% after augmentation, i.e. 4-6 months before implant placement. After implant placement and 12 months after that, the vertical bone loss was negligible, i.e. 11% (21).

In the study of Verhoeven et al. (2002), augmentation of extremely atrophic mandibles with iliac grafts with simultaneous implant placement was performed in 13 patients. The resorption rate in the vertical dimension was 36% during the first year, with different degrees of individual variation. Three years after that there was no resorption at all (22).

In the study of Moses et al. (2007), iliac grafts simultaneously stabilized with enosal dental implants were used in the treatment of extremely atrophic mandibles. With this mono-phase approach the second phase, i.e. implant placement, was avoided, with simultaneous reduction of the percentage of iliac graft resorption (23).

In the retrospective study by Van der Meij et al., 17 patients with extreme mandibular atrophy were analyzed. Iliac grafts were utilized, and implants were placed after 4-6 months. Implant survival rate was 88.2%. Vertical bone loss after 4-6 months was 33%, and after implant placement dropped to less than 11% in the implanted regions, confirming the previous study that implant placement significantly reduced graft resorption (24).

There are still controversies about the timing of implant placement. Authors have generally suggested the period of graft healing of 5-6 months, after which implant placement is possible. However, depending on the type of reconstruction and graft type, the period between augmentation and implant placement may range from 3 to 8 months (25, 26).

The advocates of simultaneous augmentation and implant placement justify their opinions that with simultaneous implant placement autotransplant resorption is significantly reduced, as well as the time required for prosthetic rehabilitation. However, one of the major shortcomings is the impossibility to achieve the proper implant position and angulation from the prosthetic point of view (22, 27-29).

Those who advocate delayed implant placement argue that simultaneous placement can bring about certain risks, such as wound dehiscence, graft exposure, infection, partial or complete necrosis and loss of the graft (20, 30-32).

Considering all these different opinions, the conclusion about the proper timing of implant placement is still far away.

The percentage of success of implants placed in the transplants is also very important. According to the data obtained by Keller et al., the percentage of success of implants placed in the transplants ranges from 60% to 70% (33).

The rate of implant survival related to their surface, indicates that significantly longer survival characterizes the implants with rough surface in contrast to smooth surface implants (34). The surface of mini dental implants is also the SLA surface, increasing the implant-bone contact surface. The advantage of mini dental implants is reflected by the fact that immediate implant loading is made possible, shortening the overall period of rehabilitation. They are placed without flap elevation, which is less invasive for the patient, they make use of already present total denture as the final prosthetic device, and are especially indicated in the cases of atrophy of the alveolar ridge, where their placement requires minumum 10 mm of bone height and 4 mm of bone width (as in our own case after the use of autogenous bone transplant) (35).

The use of mini dental implants placed in the alveolar ridge of the lower jaw previously augmented with an iliac bone autotransplant and fabrication of the lower total denture retained with mini dental implants, represents a successfull therapeutic choice in the reconstruction of severely atrophic lower jaws, restoration of occlusion and normal functions of mastication and speech, which can all together improve the self-esteem and quality of life of our patients.

References

1. Carlsson GE, Haraldson T. Fundamental aspects of mandibular atrophy. In Warthington P, Branemark PI . Advanced osseointegration surgery. Chicago: Quintessence 1992, 109 -18.
2. Chiapasco M, Romeo E, Coggiolo A, Brusati R. Long - term outcome of dental implants placed in revascularized fibula free flaps used for the reconstruction of maxillo-mandibular defects due to extreme atrophy. Clin Oral Impl Res 2011; 22: 83–91.
3. Keller EE. Reconstruction of the severely atrophic edentulous mandible with endosseous implants: a 10 years longitudinal study. J Oral Maxillofac Surg 1995; 53: 305–20.
4. Aparicio C, Parales P, Rangert B. Tilted implants as an alternative to maxillary sinus grafting: a clinical, radiologic and periotest study. Clin Implant Dent Relat Res 2001; 3: 39–49
5. Chiapasco M, Romeo E, Vogel G. Distraction osteogenesis for improvement of oral implant positioning: preliminary results. Int J Oral Maxillofac Implants 2001; 16: 43–51.
6. Buser D, Ingimarsson S, Dula K, Lussi A, Hirt HP, Belser UC. Long-term stability of osseointegrated implants in augmented bone: a 5-year prospective study in partialy edentulous patients. International J of Periodontics Restorative Dentistry 2002; 22: 109–17.
7. Chiapasco M, Gatti C. Immediate loading of dental implants placed in revascularized fibula free flaps: a clinical report on 2 consecutive patients. Int J Oral Maxillofac Implants 2004; 19: 906–12.
8. Misch CE, Dietsh F. Endosteal implants and iliac crest graft to restore severely resorbed totally edentulous maxillae–a retrospective study. J Oral Implantol 1994; 20(2): 100 – 10.
9. Misch CE. Contemporary implant dentistry. (Chapter 33). Mosby, St Louis, Missouri1999,: 521–38.
10. Shatkin TE, Shatkin S, Oppenheimer B, Oppenheimer A. Mini Dental Implants for long-term fixed and removable prosthetics: a retrospective analysis of 2514 implants placed over a five year period. Compendium 2007; 28(2): 36–41.
11. Stellingsma C, Vissink A, Meijer HJA, Kuper C, Roghoebar GM. Implantology and the severely resorbed edentolous mandible. Crit Rev Oral Biol Med 2004; 15(4): 240–48.
12. Misch CE, Steigenga J, Barboza E, Misch-Dietsh F, Cianciola LJ, Kazor C. Short dental implants in posterior partial edentulism: a multicenter retrospective 6-year case series study. J Periodontol 2006; 77: 1340 –7.
13. Malo P, De Araujo N, Rangert B. Short implants placed one-stage in maxillae and mandibles: a retrospective clinical study with 1 to 9 years of follow up. Clin Implant Dent Relat Res 2007; 9: 15–21.
14. Tolman DE. Reconstructive procedures with endosseous implants in grafted bone. A reiew of the literature. Int J Oral Maxillofac Implants 1995; 10: 275 - 94.
15. Astrand P, Nord PG, Branemark PI. Titanium implants and onley bone graft to the atrophic edentolous maxilla. Int J Oral Maxillofac Surg 1996; 25: 25–9.
16. Vermeeren JIJF, Wismeijer D, van Waas MAJ. One step reconstruction of the severely resorbed mandible with onley bone grafts and endosteal implants. A 5-year follow-up. Int J Oral Maxillofac Surg 1996; 25: 112–5.
17. Chiapasco M, Abati S, Romeo E, Vogel G. Clinical outcome of autogenous bone blocks or guided bone regeneration with e PTFE membranes for the reconstruction of narrow edentulous ridges. Clin Oral Implants Res 1999; 10: 278–88.
18. Jemt T, Lekholm U. Measurements of buccal tissue volumes at single-implant rstorations after local bone grafting in maxillas: a 3 year clinical prospective study case series. Clin Implant Dent Relat Res 2003; 5: 63 –70.
19. Chiapasco M, Gatti C, Gatti F. Immediate loading of dental implants placed in severly resorbed edentulous mandibles reconstructed with autogenous calvarial grafts. Clin Oral Implants Res 2007; 18: 13–20.
20. Lizuka T, Smolka W, Hallemann W, Merickse Stern R. Extensive augmentation of the alveolar ridge using autogenous calvarial split bone grafts for dental rehabilitation. Clin Oral Implants Res 2004; 15: 607-15.
21. Bell RB, Blakey GH, White RP, Hillebrand DG, Molina A. Staged reconstruction of the severely atrophic mandible with autogenous bone graft and endosteal implants. J Oral Maxillofac Surg 2002; 60(10): 1135 -41.
22. Verhoeven JW, Cune MS, Terlou M, Zoon MAOW, de Putter C. The combined use of endosteal implants and iliac crest onlay grafts in the severely atrophic mandible: a longitudinal study. Int J Oral Maxillofac Surg 1997; 26(5): 351–57.
23. Moses O, Nemcovsky CE, Langer Y, Haim T. Severely resorbed Mandible treated with iliac crest autogenous bone graft and dental implants: 17-year follow up. J Oral Maxillofac Implants 2007; 22: 1017–21.
24. Van der Meij H, Blankestijn J, Berns RM, Bun RJ, Jovanovic A, Oland JM, Schoen J. The combined use of two endosteal implants and iliac crest onlay grafts in the severely atrophic mandible by a modified surgical approach. Int J Oral Maxillofac Surg 2005; 34(2): 152–7.
25. Misch CM, Misch CE, Resnik RR, Ismail YH. Reconstruction of maxillary alveolar defects with mandibular symphisis grafts for dental implants: a preliminary procedural report. Int J Oral Maxillofac Surg 1992; 7: 360–6.
26. Misch CM, Misch CE. The repair of localized severe ridge defects for implant placement using mandibular bone grafts. Implant Dent 1995; 4 : 261–7.
27. Van Sreenberghe D, Naert I, Bossuyt M et al. The rehabilitation of the severely resorbed maxilla by simultaneous placement of autogenous bone grafts and

implants: A 10 year evaluation. Clin Oral Investig 1997; 1: 102–8.
28. Keller EE, Tolman DE, Eckert S. Surgical prosthodontic reconstruction of advanced maxillary bone compromise with autogenous onlay block bone grafts and osseointegrated endosseous implants: a 12 year study of 32 consecutive patients. Int J Oral Maxillofac Implants 1999; 14: 197–209.
29. Lekholm U, Wannfors K, Isaksson S, Adelsson B. Oral implants in combination with bone grafts. A 3 year retrospective multicenter study using the Branemark implants system. Int J Oral Maxillofac Surg 1999; 28: 181–7.
30. Bahat O, Fontanessi RV. Efficacy of implant placement after bone grafting for three-dimensional reconstruction of the posterior jaw. Int J Periodontics Restorative Dent 2001; 21: 221-31.
31. Raghoebar GM, Schoen P, Meijer HJA, Stellingsma K, Vissink A. Early loading of endosseous implants in the augmented maxilla: a 1 year postoperative study. Clin Oral Implants Res 2003; 14: 697–702.
32. Levin L, Nitzan D, Schwartz-Arad D. Success of dental implants placed in intraoral block bone grafts. J Periodontol 2007; 78: 18–21.
33. Keller EF, Van Rockel NB, Desjardins RP, Tolman DE. Prosthetic-surgical reconstruction of the severely resorbed maxilla with iliac bone grafting and tissue integrated prosthesis. Int J maxillofac Implants 1987; 2: 155–6.
34. Shliephake H, Neukam FW, Wichmann M. Survival analysis of endosseous implants in bone grafts used for the treatment of severe alveolar ridge atrophy. J Oral Maxillofac Surg 1997; 55: 1227-33.
35. Bubalo M, Milović R, Lazić Z. Primena implantata kod pacijenata sa rascepom nepca. Pons (in press) (serb).

PRIMENA MINI DENTALNIH IMPLANTATA I ILIJAČNOG GRAFTA U REHABILITACIJI ATROFIČNE DONJE VILICE: PRIKAZ SLUČAJA

Marija Bubalo[1], Zoran Lazić[1], Radomir Milović[1], Anika Ćuković[2]

[1]Odeljenje za implantologiju Klinike za maksilofacijalnu, oralnu hirurgiju i implantologiju, Vojnomedicinska akademija Beograd, Srbija
[2]Stomatološki fakultet u Pančevu, Srbija

Sažetak

Atrofija donje vilice je progresivan proces, pa vremenom, sposobnost da se održe funkcije žvakanja i govora može biti značajno ugrožena, naročito zbog smanjenja potpornog tkiva.

Cilj rada je da prikaže protetsku rehablitaciju izrazito atrofične donje bezube vilice primenom mini dentalnih implantata ugrađenih u alveolarni greben donje vilice koji je prethodno augmentiran ilijačnim transplantatom.

Bolesnici staroj 59 godina, zbog izrazite atrofije donje vilice, učinjena je augmentacija donjoviličnog alveolarnog grebena primenom autotransplantata sa ilijačne kosti. Nakon 6 meseci ugrađena su četiri mini dentalna implantata. Bolesnica je zbrinuta totalnom protezom retiniranom implantatima. Primena mini dentalnih implantata ugrađenih u ilijačni graft predstavlja uspešan terapijski izbor za rekonstrukciju ekstremno atrofične donje vilice i ponovno uspostavljanje okluzije kao i normalnih funkcija žvakanja i govora.

Ključne reči: **atrofija, mandibula, ilijačna kost, ilijačni graft, rekonstrukcija, augmentacija alveolarnog grebena, mini dentalni implantat**