Case report

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

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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 prosthetically 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
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 interfbraminal 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 spongy bone structure beneath, making feasible 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-aluminum-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 augmented with an iliac graft (Figure 1).

![Figure 1. Original orthopantomomgram](image)

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 radiograph 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

![Figure 1](image)
augmented in order to prevent the possibility of pathologic fractures. The patient’s postoperative period passed without any complications (Figure 2, Figure 3).

Six months 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 mucope-riosteal 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).

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 mandibles and the choice of reconstructive surgery approach which would facilitate implant placement into the resorbed mandible 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 interferaminal 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, vascualrized 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) retrospectively 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 enosol 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 minimum 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 successful 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


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 187

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

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Sažetak

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

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


Ključne reči: atrofija, mandibula, ilična kost, ilični graft, rekonstrukcija, augmentacija alveolarnog grebena, mini dentalni implantat