Journal of
Periodontology
&
Implant Dentistry

Case Report

Reconstruction of Severely Atrophic Edentulous Maxilla with Implants Placed in Autogenous Iliac Bone Graft: A Modified Approach

Mohsen Dalband [1] • Bijan Heidari [2] • Mahdi Kadkhodazadeh [3]*

[1]Assistant professor, Department of Oral & Maxillofacial Surgery, Dental School, Hamadan University of Medical Sciences, Iran
[2]Assistant professor, Department of Prosthodontics, Dental School, Hamadan University of Medical Sciences, Iran
[3]Assistant professor, Department of Periodontics, Dental School, Shahid Beheshti University of Medical Sciences, Iran
*Corresponding Author; E-mail: kadkhodazadeh@umsha.ac.ir

Received: 11 September 2010; Accepted: 30 March 2011; Published online: 5 April 2011
J Periodontol Implant Dent 2011:e1
This article is available from: http://dentistry.tbzmed.ac.ir/jpid

Abstract

This clinical report describes a case of maxillary dental rehabilitation using five implants placed simultaneously in three cortico-cancellous iliac bone blocks and rigidly fixed to the residual bone with titanium mini-screws 2-mm in diameter and mini-plates. All "empty spaces" between the bone segments were filled with iliac bone chips harvested from the diploe of iliac bone mixed by Bio-oss. The second surgery was performed 5 months later, when all five implants were integrated, and one cover screw was exposed to oral cavity. Two months after the second surgery, abutments were connected to the implants and loaded with a fixed partial denture.

Key words: **Dental implant, iliac bone, reconstruction.**

Introduction

Conventional implant treatment is often not possible in patients with severe atrophied alveolar bone, especially in the maxilla, and it still represents a challenge for the dental rehabilitation of such edentulous patients. Maxillary anatomic structures such as the maxillary sinus, the nasal floor and the nasopalatine canal are among factors that limit the amount of available bone in cases with advanced resorption.[1]

The gold standard for bone reconstruction is the fresh autograft. Among different autologous sources, cancellous bone from the iliac crest has been considered the reference source due to its enhanced osteogenic properties.[2] Therefore, it has been widely used for major reconstructions in the maxillofacial area.[3,4] To avoid excessive resorption of the graft, some studies have recommended fixture installation no later than three months, with graft and implant placement done simultaneously if stability of both is guaranteed.[5,6] In this clinical report, a case of maxillary dental rehabilitation is described using five implants placed simultaneously in three cortico-cancellous iliac bone blocks.

Case Report

A 56-year-old female patient was referred to the Im-

plant Department of Dental School, Hamadan University of Medical Sciences, Iran, for prosthetic rehabilitation using dental implants to improve retention of a dental prosthesis. The patient was in good general health. Maxilla was edentulous and the patient wore a conventional complete denture, which had poor retention and stability.

Preoperative Radiographic Examinations

The patient was examined radiographically using a panoramic radiograph and CT-scan, which revealed an edentulous maxilla with distinct atrophy of the alveolar bone (Cawood and Howell Class V and VI).[7] The bone height under the nasal floor and the floor of the maxillary sinuses was insufficient for endosseous implant placement (Figure 1).

The surgical procedure was performed under general and local anesthesia, and the "trap door technique" was used to achieve the iliac bone blocks. Five implants (9.5mm height, 4.5mm diameter, SPI, Switzerland) were placed in three cortico-cancellous iliac bone blocks and then rigidly fixed to the residual bone with titanium mini screws 2-mm diameter and mini plates horizontally. The implants had no anchorage of residual bone and all "empty spaces" between the bone segments were filled with iliac bone chips harvested from the diploe of iliac bone mixed by Bio-oss (Geistlich Biomaterials, Wolhusen, Switzerland) (Figure 2).

The patient was hospitalized 3 days postoperatively, and given phenoxymethyl penicillin (1 g × 3) for the 7 days following the operation. Vacuum drainage at the donor site was used until the patient was mobilized. Analgesics (paracetamol and nonsteroid anti-inflammatory drugs) were prescribed 7 to 10 days postoperatively. Chlorhexidine mouthwash was prescribed twice daily for 15 days following surgery. The flap sutures were removed 12 days postoperatively.

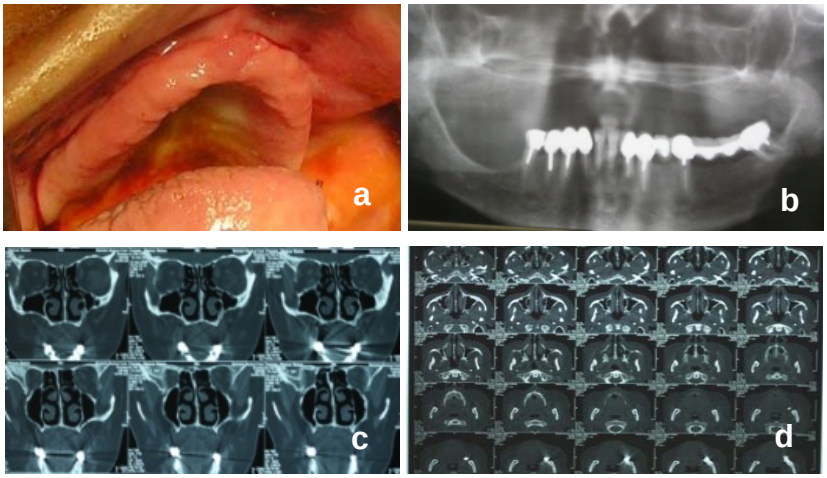

Figure 1. Preoperative intraoral view (a); preoperative panoramic radiographic (b) and CT-scan assessments (c,d).

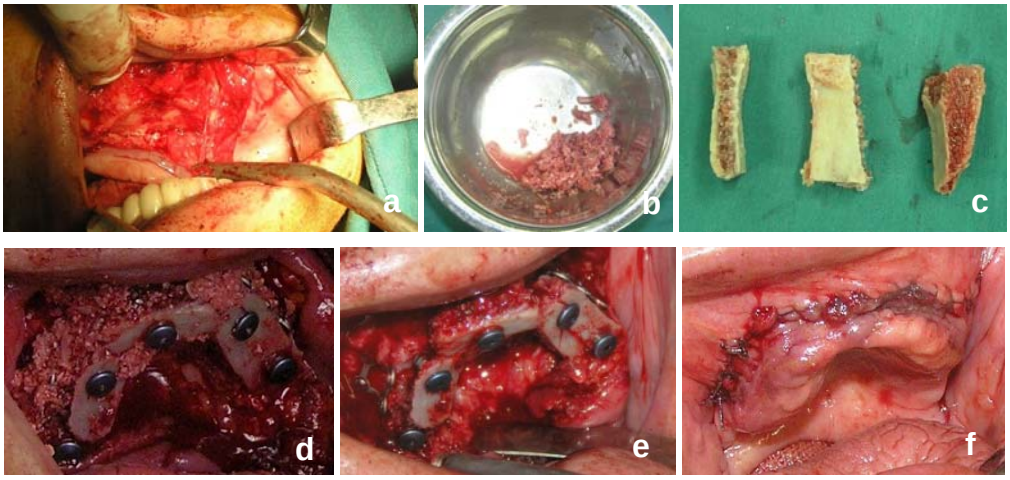

Figure 2. First Surgical Procedure. Incision (a); the bone chips with Bio-oss (b); iliac bone graft (c); implants placed in bone graft (d); empty spaces filled with bone chips and Bio-oss (e); sutures in place (f).

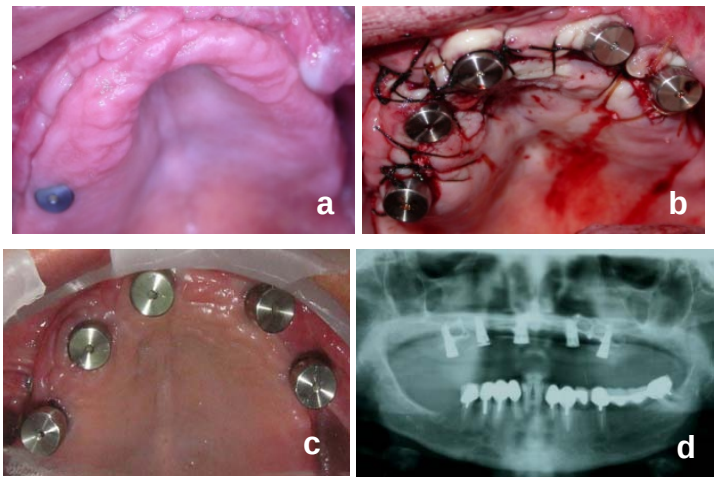

Figure 3. Maxillary ridge five months after first surgery (a), during the second surgery session for uncovering the implants (b), and two months after second surgery (c). Radiographic appearance at 5 months after first surgery (d).

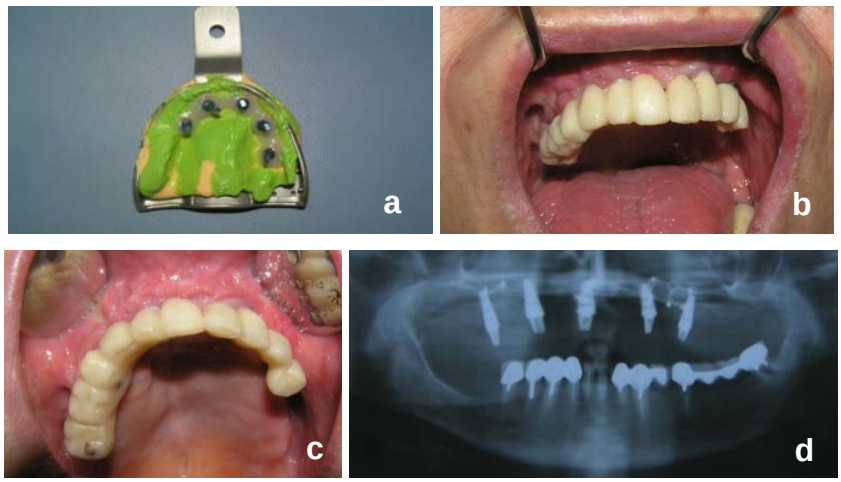

Figure 4. Open tray technique used for impression (a); intraoral view of temporary restoration 12 months after first surgery (b, c); radiographic appearance at 12 months after first surgery (d).

Uncovering

After 5 months all implants had been integrated and one cover screw was exposed to the oral cavity (Figure 3a). Under local anesthesia, all implants were uncovered (apically position technique and rotational pedicle graft) and healing abutment placed on to them. Bio-oss (0.5 mm) was used to treat two threads of two implants which were not covered by bone (Figure 3b). Eight weeks after second surgery (Figure 3c,d), abutments were placed on to the implants and temporary fixed restorations were made for them (Figure 4).

Prosthetic Procedures

The patient was instructed not to wear removable dentures for eight weeks following initial surgery. Thereafter, the patient was supplied with a new denture. During the healing period after the grafting procedure, the patient was recalled for individual checkups and the denture was relined with a soft tissue relining material or with a permanent relining. The temporary bridge was then used for the additional healing period of approximately 5 months.

Follow-up

One year after implants placement, final bridge was delivered to the patient. Oral hygiene instructions were given to the patient and an individual recall program was set up.

The following clinical parameters were checked: pain, occlusion, prosthesis mobility, and plaque and bleeding indices. Success criteria for implant survival were (1) presence of implant stability, (2) absence of radiolucent zone around the implants, (3) no mucosal

suppuration, and (4) no pain. Extra radiographic examinations were made at baseline, 6 months, and 12 months after first surgery. A radiologist measured the changes in marginal bone height over time (Panoramic and long-cone parallel-technique periapical radiographs). In the 12-month follow-up period, all five implants were stable and had no pain, suppuration, redness or increasing bone loss (Figure 4d). All of the mini-screws and mini-plates were integrated to the cortical bone on the buccal surface of the bony grafts. In order to avoid cutting the screws for removal, all mini-screws but one were left in the site.

Discussion

Following tooth extraction, and the resulting resorption and atrophy of the edentulous alveolar ridge,[8,9] jaw reconstruction is often necessary.[10] Several techniques have been suggested and evaluated for preservation and reconstruction of alveolar ridge,[11-16] and a variety of bone graft materials and barrier membranes have been suggested to enhance bone formation.[17,18]

Autogenus bone graft is one such technique that bares advantages such as osteogenic potential, form and shape maintenance by using of bone blocks, ability to correct any size or shape deformity, and elimination of the possibility for an immunogenic reaction. The disadvantages of this technique include the need for second surgical intervention, morbidity associated with the donor site, unpredictable bone resorption, longer recovery period, difficulty in managing soft tissue coverage, increased treatment time, and increased risks and side effects.

With the development of implant therapy, new possibilities in the use of bone graft were created and different methods for the combination of augmentation and implant placement were developed.[19-23] Some investigators suggest using short/low diameter implants or titanium reinforced membranes in the severe atrophy cases.[24-27] However, autogenus bone grafts are considered to be the ideal material for the reconstructive procedures.[28] Several donor sites are suggested for the bone graft, but the anterior iliac bone crest is the most commonly used,[29] as a large quantity of bone is required for reconstruction of the atrophic maxilla. In the clinical studies, most of the planned implant positions had to be reconstructed regarding both height and width. The iliac bone can offer large quantities of bone and it is a rather safe donor site.[30] These parameters make the anterior iliac crest the first choice for a grafting site.

Some authors indicate that the one-stage surgery is the most commonly used technique; however, the two-stage technique results in higher survival rates: 79% versus 88%, respectively. One reason for this difference is probably that with two-stage surgery, the revascularization of the bone graft is better and the surgical trauma from placing the implants stimulates an immediate healing response. The two-stage technique also has the advantage that it allows for the correct positioning of the implants. The implant survival rate in the present case, according to the literature concerning the two-stage technique, is comparable with the results after 3 years of loading, 90% versus 88%, respectively. On the other hand, the failure rate of 10% in the present case can be further considered, as the literature concerning implant therapy is gradually shifting from reports of success rates to analysis of complications and identification of risk factors associated with implant failure.[29]

In the previous studies, bone blocks and implants have been used to reconstruct severely atrophied ridges, and thus, some treads of fixtures have always had their primary stability from the alveolar ridge. In the present case the whole length of the implants was placed in the iliac bone blocks which were then fixed to maxilla by means of mini-plates and mini-screws.

Although two threads in two implants were not covered by bone after five months due to bone resorption, one-year follow-up of this case revealed that implants placed in blocks of autogenous iliac bone graft can have predictable results for reconstruction of atrophic maxillary bone. However, additional follow-up is needed to evaluate this method.

Conclusion

Simultaneous maxillary reconstruction with autogenous iliac bone graft and implants placed in the graft can be a predictable treatment modality in patients with severe atrophied edentulous alveolar ridges.

References

1. Naström E, Ahlqvist J, Legrell PE, Kahnberg KE. Bone graft and implant success rate in the treatment of the severely resorbed maxilla: a 5-year longitudinal study. *Int J Oral Maxillofac Surg* 2002;31:158-64.
2. Collins M, James DR, Mars M. Alveolar bone grafting: A review of 115 patients. *Eur J Orthod* 1998;20:115-20.
3. Cordeiro PG, Santamaria E, Kraus DH, Strong EW, Shah JP. Reconstruction of total maxillectomy defects with preservation of the orbital contents. *Plast Reconstr Surg* 1998;102:1874-87.
4. Porgrel MA, Podlesh S, Anthony JP, Alexander J. A comparison of vascularized and non vascularized bone grafts for reconstruction of mandibular continuity defects. *J Oral Maxillofac Surg* 1997; 55:1200-6.
5. Johansson B, Wannfors K, Ekenbäck J, Smedberg JI, Hirsch J. Implants and sinus-inlay bone grafts in a 1-stage procedure on severely atrophied maxillae: surgical aspects of a 3-year follow-up study. *Int J Oral Maxillofac Implants* 1999;

14:811-8.

6. Listrom RD, Symington JS. Osseointegrated dental implants in conjunction with bone grafts. *Int J Oral Maxillofac Surg 1988*;17:116-8.
7. Cawood JI, Howell RA. A classification of edentulous jaws. *Int J Oral Maxillofac Surg* 1988;18:232-6.
8. Bays RA. The pathophysiology and anatomy of edentulous bone loss. In: Fonseca RJ, Davis WH, eds. *Reconstructive Preprosthetic Oral and Maxillofacial Surgery*. Philadelphia: W.B. Saunders; 1986:1-17.
9. Cardaropoli G, Araujo M, Hayacibara R, Sukekava F, Lindhe J. Healing of extraction sockets and surgically produced – augmented and non-augmented – defects in the alveolar ridge. An experimental study in the dog. *J Clin Periodontol* 2005;32:435-40.
10. Howell TH, Fiorellini J, Jones A, Alder M, Nummikoski P, Lazaro M, et al. A feasibility study evaluating rhBMP-2/absorbable collagen sponge device for local alveolar ridge preservation or augmentation. *Int J Periodontics Restorative Dent* 1997;17:124-39.
11. Artiz Z, Tal H, Dayan D. Porous bovine bone mineral in healing of human extraction sockets. Part 1: histological morphometric evaluation at 9 months. *J Periodontol* 2000; 71:1015-23.
12. Artiz Z, Nemcovsky CE. The application of deproteinized bovine bone mineral for ridge preservation prior to implantation. Clinical and histological observations in a case report. *J Periodontol* 1998;69:1062-7.
13. Ashman A, Lopinto J. Placement of implants into ridges grafted with bioplan HTR synthetic bone: histological long-term casereports. *J Oral Implantol* 2000;26:276-90.
14. Froum S, Orlowski W. Ridge preservation utilizing an alloplast prior to implant placement – clinical and histological case reports. *Pract Periodontics Aesthet Dent* 2000;12:393-402.
15. Froum S, Cho SC, Rosenberg E, Rohrer M, Tarnow D. Histological comparison of healing extraction socket implanted with bioactive glass or demineralized freeze-dried bone allograft: a pilot study. *J Periodontol* 2002;73: 94-102.
16. Wang HL, Kiyonobu K, Neiva RF. Socket augmentation: Rationale and technique. *Implant Dent* 2004; 13:286-96.
17. Nevins M, Mellonig JT. Enhancement of the damaged edentulous ridge to receive dental implants: combination of allograft and the Gore-Tex membrane. *Int J Periodontics Restorative Dent* 1992; 12:96-111.
18. Iasella JM, Greenwell H, Miller RL, Hill M, Drisko C, Bohra AA, et al. Ridge preservation with freeze-dried bone allograft and acollagen membrane compared to extraction alone for implant site development: a clinical and histologic study in humans. *J Periodontol* 2003;74:990-9.
19. Sailer HF. A new method of inserting edentulous implants in totally atrophic maxilla. *Int Oral Maxillofac Surg* 1989;17:299-305.
20. Boyne PJ, James RA. Grafting of the maxillary sinus floor with autogenous marrow and bone. *J Oral Surg* 1980;38:613-6.
21. Kent JN, Block MS. Simultaneous maxillary sinus floor grafting and placement of hydroxyapatite-coated implants. *Int J Oral Maxillofac Surg* 1989;47:238-42.
22. Mointaghavi A, Radvar M, Arab HR, Kadkhodazadeh M. Clinical and radiografical evaluation of maximus implants, with immediate non-functional loading. Poster presented in 18th International Conference on Oral and Maxillofacial Surgery (ICOMS 2007), Bangalore, India; 2007.
23. Trombelli L, Farina R, Marzola A, Calura G. GBR and autogenous cortical bone particulate by bone scraper for alveolar ridge augmentation: a 2-case report. *Int J Oral Maxillofac Implants* 2008;23:111-6.
24. Keller EE. Reconstruction of the severely atrophic edentulous mandible with endosseos implants. A 10-year longitudinal study. *Int J Oral Maxillofac Surg* 1995;53:305-20.
25. Anitua H, Orive G, Aguirre JJ, Andia I. Five-year clinical evaluation of short dental implants placed in posterior area. *J Periodontol* 2008;79:42-8.
26. Cornelini R, Cangini F, Covani U, Andreana S. Simultaneous implant placement and vertical ridge augmentation with a titanium-reinforced membrane: a case report. *Int J Oral Maxillofac Implants* 2000;15:883-8.
27. Fugazzotto PA. Shorter implants in clinical practice: rationale and treatment results. *Int J Oral Maxillofac Implants* 2008;23:487-96.
28. Schallhorn RG. The use of autogenous hip marrow biopsy implants for bony crater defects. *J Periodontol* 1968; 39:145-7.
29. Sjöström M, Sennerby L, Nilson H, Lundgren S. Reconstruction of the atrophic edentulous maxilla with free iliac crest grafts and implants: a 3-year report of a prospective clinical study. *Clin Implant Dent Related Res* 2007;9:46-59.
30. Cricchio G, Lundgren S. Donor site morbidity in two different approaches to anterior iliac crest bone harvesting. *Clin Implants Dent Relat Res* 2003; 3:161-9.