Severely Resorbed Mandible Treated with Iliac Crest Autogenous Bone Graft and Dental Implants: 17-Year Follow-up

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Severe bone atrophy in the mandible may result in weakening of the jaw, unstable dentures, and dysfunction of the inferior alveolar nerve. These conditions were diagnosed in a 65-year-old woman who presented with a severely resorbed mandible. The interforaminal region of the mandible was augmented with an onlay graft harvested from the iliac crest. Four dental implants stabilized the graft by anchoring it inferiorly to the residual mandibular basal bone. Implants later served as abutments for a fixed 12-unit implant-supported prosthesis. The patient was followed for 17 years, during which the mandibular prosthesis was replaced twice. Despite the initial questionable prognosis, oral rehabilitation was successful, with no detectable clinical signs of bone loss over the 17-year follow-up period. Int J Oral Maxillofac Implants 2007;22:1017–1021

Key words: *dental implants, iliac bone graft, mandibular severe resorption*

Severe pathologic resorption of the inferior alveolar process and basal bone may result in weakening of the jaw, unstable dentures, abnormal function of the inferior alveolar nerve, and marked reduction of the facial and vertical dimensions. Complete removable dentures may be unsuitable for these patients due to insufficient retention, reduced support, and lack of stability.[1] Vestibuloplasty and bone grafting procedures may improve these qualities by providing an enlarged denture-bearing area[2–8]; however, the benefits are only temporary.[9] Augmentation techniques for the severely atrophic mandible using autogenous bone grafts,[10] interpositional bone grafting in conjunction with Le Fort I osteotomy,[11,12] and distraction osteogenesis[13,14] have been previously described.

Donor sites such as the external oblique ridge, the mandible symphysis, the tibia, and the calvaria have been suggested as sources for limited amounts of bone.[15] Free autogenous iliac crest bone grafts are indicated for extensive alveolar ridge reconstruction but are associated with complications such as postoperative infection, which causes transplant loss and late graft resorption.[16]

The present study describes the long-term follow-up of a patient who suffered from extremely severe mandibular resorption but was successfully rehabilitated using an autogenous iliac bone graft stabilized with dental implants.

CASE REPORT

A 65-year-old woman complained of loose nonfunctional removable complete dentures and "periodical episodes of anesthesia in the lower lip." The patient was fully edentulous from her late twenties and received 2 blade implants in the intermental zone when she was about 40 years old. These served as abutments for a 10-unit fixed restoration for 3 years until they were removed due to continuous periimplant infection and severe bone loss. Several sets of removable complete dentures were made; however, all were unsatisfactory. The patient eagerly sought a permanent fixed prosthetic solution.

Clinical examination using a 3-dimensional computerized tomographic (CT) scan revealed extreme atrophy of both the mandible and maxilla. In the mandible, only 2 to 3 mm of peripheral cortical bone anterior to the mental foramina was evident (Figs 1 and 2). The geniohyoid process was prominent, and the mental foramina were located lingual and inferior to the residual ridge of bone (Fig 3). A large amount of bone augmentation was required for the rehabilitation of the mandible with an implant-supported prosthesis.

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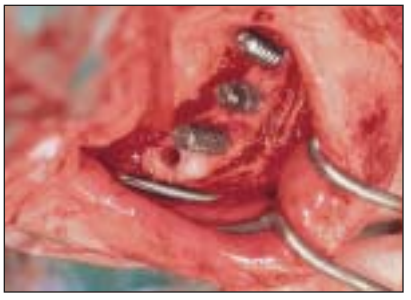
Fig 1 Preoperative lateral radiograph. Note the coronal location of the genial tubercle compared to the anterior border of the mandible.

Fig 2 Preoperative 3-dimensional aspect of the mandible. Note the lingual location of the mental foramina and the extreme bone resorption.

Fig 3 CT scan of the mandible.

Fig 4 *(left)* Surgical template placed over the bone graft harvested from the ileum.

Fig 5 *(right)* Trimmed bone graft fitted into a tin foil stent copying the recipient site.



Figs 6a and 6b Bone graft in situ during implant site preparation.

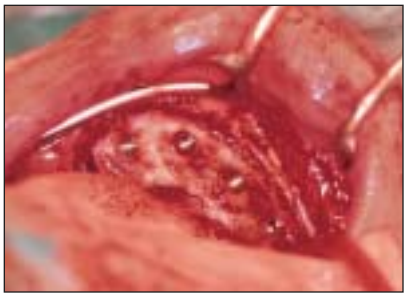


Fig 7 Graft stabilized by 4 threaded Brånemark dental implants.

Surgery

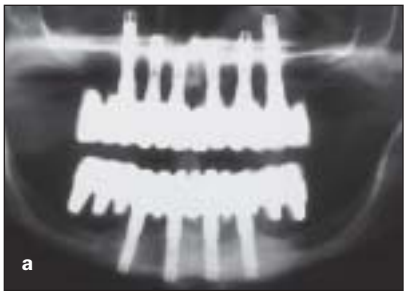
Both jaws were surgically treated at the same session under general anesthesia. Six Brånemark implants (Nobel Biocare, Göteborg, Sweden) were placed with minimal bone augmentation. In the mandible, the bone was denuded and completely exposed, and the mental bundles were mechanically protected. The bone was partially decorticated under copious saline irrigation using rotating handheld instruments.

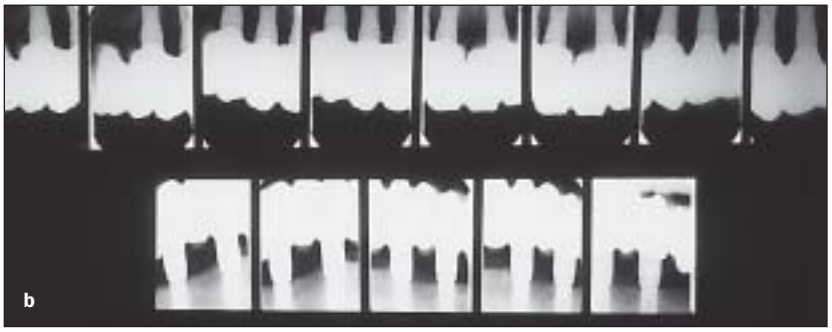
The bone required for augmentation was estimated by measuring the CT scan and preparing a metal template corresponding to the actual bony defect in the exposed mandible. The template was placed on the lateral surface of the iliac bone and used as a guide to harvesting the bony block. An oscillating saw was used to remove a horseshoe-shaped monocortical block graft (Fig 4). Additional particulated cancellous bone was curetted and collected from the bone defect. Bone graft was trimmed for precise fit to achieve good adaptation to the recipient site (Fig 5). Final reshaping by minor corrections was carried out in situ before the graft was fixed in place.

Graft stabilization and intimate adaptation were achieved by inserting 4 threaded Brånemark implants, 18 mm long and 3.75 mm in diameter, through osteotomies simultaneously prepared in the graft and inferior mandibular base (Figs 6a, 6b, and 7). Implants were anchored in the inferior cortical mandibular bone plate. Trabecular bone chips were compressed between the bony block and mandibular bone. Flaps were approximated, and primary soft tissue closure was achieved through suturing with absorbable sutures in layers. Antibiotics were administered (clindamycin 900 mg/d) for 2 weeks. The patient was discharged after 7 days. Visible sutures were removed after 2 and 3 weeks.

At 1 month postsurgery, a new set of removable complete dentures was made. The patient was seen regularly once a month for 10 months, and minimal denture adjustments were made where needed.

Fig 8 Mandibular 12-unit fixed partial denture in the patient's mouth.





Figs 9a and 9b Panoramic and periapical radiographs 6 months postsurgery.

Figs 10a and 10b Mucositis including swelling. Peri-implant granulation tissue can be noticed 2 years after prosthetic work was completed.

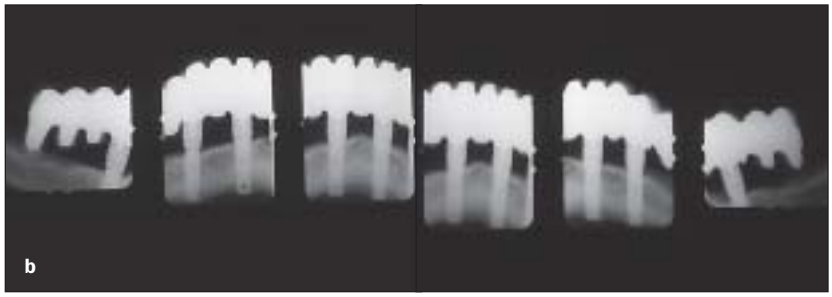
After 11 months, the implants were exposed, and healing abutments were placed. Clinical examination at this stage revealed no detectable peri-implant bone loss. A fixed 12-unit ceramic complete denture with 2 bilateral distal cantilever pontics was placed in the mandible (Fig 8). Panoramic and periapical radiographs 6 months later revealed stable bone support (Figs 9a and 9b), and Periotest (Siemens, Bensheim, Germany) examination indicated good implant stability in both jaws.

After 2 years, the denture was functionally, phonetically, and esthetically pleasing, with no noticeable bone loss apparent in panoramic radiographs. Periotest examination showed no significant change in implant stability. However, in spite of careful oral hygiene instructions, moderate mucositis and tissue overgrowth developed (Figs 10a and 10b). To improve access to the implants and establish better oral hygiene, excessive mucosa was surgically removed and a new prosthesis was constructed.

The patient was seen once a year for another 10 years, during which she presented with satisfactory oral hygiene and increased measured implant stability. A recent radiograph showed noticeable increase of radiographic crestal bone density after 16 years compared with the radiographic appearance at 2 years. Seventeen years after bone grafting and implant placement, the maxillary and mandibular prostheses were again replaced at the patient's request to ease home-care practice and further increase access to the implants. Clinical and radiologic evaluations were satisfactory, and the patient was pleased (Figs 11a, 11b, and 12).

DISCUSSION

Long-term edentulism can result in severe bone loss. Implant-supported rehabilitation is an excellent treatment option. While there are several options for jaw reconstruction,[17–19] for this patient, an onlay autogenous graft was considered to be the best choice because of the extent of the bone loss and the architecture of the residual jaw. Osseous augmentation prior to endosseous implant placement has been proposed in severe atrophy of the edentulous mandible.[9,20,21] Bone grafts, such as autogenous bone, allogenous bone, and xenografts, especially bovine bone mineral alone or in combination with other materials, have proved successful in ridge augmentation procedures.[9,20,21]



Figs 11a and 11b *(above)* Panoramic and periapical radiographs revealed a stable level of bone around the implants 16 years postsurgery.

Fig 12 *(left)* Clinical aspect, 16 years after implant placement. Note absence of gingival signs of inflammation.

Mild to moderate bone loss may predictably be augmented with guided bone regeneration procedures, minor monocortical bone blocks, or distraction osteogenesis.[18] Implant placement in the extremely resorbed jaw requires reconstruction of the jaw either by free bone grafts, vascularized grafts, or distraction osteogenesis.[22] For the case presented, the extensive and severe bone atrophy required a relatively large continuous autogenous bone graft. The risk and disadvantages of soft tissue dehiscence, graft exposure, and postoperative infection, which may lead to partial or total loss of the bone graft, were taken into consideration.[23,24]

In the present case, the graft was fitted to the recipient site and stabilized with the implants. Implant placement at the time of grafting eliminates the need for a second surgical procedure and enhances graft stabilization. A significant disadvantage is that the exact positioning and angulation of the implant are more difficult to achieve.[25] In both 1-stage and 2-stage protocols, unpredictable resorption of the grafted bone around the implants may compromise results.[26–28] Success rates of 64% to 100% have been reported for implants placed in reconstructed maxillary or mandibular defects.[29,30] A bone graft placed in the intermental foramina region simultaneously with endosseous implants in a 1-stage procedure results in less graft resorption[26,31] than a 2-stage procedure.[25,32,33]

There are still unanswered questions regarding the sequence of the biologic process after the placement of an iliac bone block graft. What, for example, happens to the osseous tissue cells that are part of the mineralized bone? Do they remain viable after transplantation or die due to lack of blood supply during the early healing period? Recently, grafted bone from the iliac crest was found to integrate with native maxillary bone as early as 4 months after grafting, with sufficient stability to allow implant placement.[34]

Simultaneous placement of endosseous implants and autogenous onlay grafts has been carried out with acceptable clinical results and implant survival rates.[34–37] However, only limited histologic evidence is available regarding graft remodeling and cellular kinetics in implant-to-graft integration.[38,39] In the present case, formation of a radiographic appearance of dense bone was detected, similar to that reported in animal studies[38,39] and in humans.[40,41] Within the limitations of the present case report, it is evident that implants placed simultaneously with an onlay autogenous graft in anatomically severely compromised patients may provide an acceptable and predictable surgical alternative.[42]

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