

Dental Rehabilitation Using an Implant-Supported Overdenture After Repair of a Fracture in a Severely Resorbed Edentulous Mandible: A Case Report

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Treatment of mandibular fracture in senior citizens with severely resorbed edentulous mandibles is extremely difficult. Such treatment must achieve successful osteosynthesis and restore functional mastication. A severely resorbed (Class V) mandible was successfully reconstructed with an autogenous bone graft on the inferior border of the mandible and a titanium mesh plate after a failed attempt to fix the fracture. After the placement of endosseous implants in the mandible, the patient was rehabilitated with an overdenture to restore masticatory function. INT J ORAL MAXILLOFAC IMPLANTS 2004;19:749-752

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In recent years, as the population of senior citizens has increased, many elderly persons have suffered from unstable dentures based on severely resorbed (Cawood and Howell Class V) mandibles.¹ Even slight force, such as that experienced in an otherwise minor accident, could result in mandibular fracture. Once the mandible has been fractured, it is extremely difficult to reconstruct with titanium

plates. Furthermore, complications, including infection, malunion, plate fracture, and nonunion, occur more frequently in the atrophic edentulous mandible than in the dentate mandible.^{2,3} Osteosynthesis or grafting of autogenous bone onto the alveolar ridge are well-accepted treatments for fracture of the edentulous mandible.⁴⁻⁷ However, with both plating osteosynthesis and bone grafting, it is difficult to restore the mandible enough to enable satisfactory denture function. Even after successful bone grafting, resorption of the grafted bone is usually a persistent problem.

Use of osseointegrated implants is now accepted as a safe, predictable method for rehabilitating patients with edentulous mandibles.⁸ In addition to supporting prostheses, implants can help preserve the grafted bone. This article describes the reconstruction of a severely resorbed edentulous mandible using autogenous rib and iliac particulate cancellous bone and marrow combined with a titanium mesh plate. After grafting, dental implants were placed and restored with an overdenture.

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Fig 1 The dislocated fracture. Note the severely atrophic edentulous mandible.



Fig 2 This fracture was treated with rib bone fitted to the inferior border of the mandible. The space between the rib bone graft and the titanium micromesh plate was filled with particulate cancellous bone and marrow.

CLINICAL REPORT

A 69-year-old woman presented to the Second Department of Oral and Maxillofacial Surgery, Kyushu Dental College Hospital, in May 2000 with a 2-month history of swelling and pain in the left mandibular body. She had been undergoing treatment for anemia and undernourishment. Intraoral examination showed generalized mandibular atrophy, and the superior surface of the alveolar ridge was flattened. The patient had worn mandibular and maxillary complete dentures for 5 years. Panoramic radiographs revealed an edentulous mandible with distinct atrophy from the mental region through the bilateral mandibular body and extreme bone loss. The patient's mandibular bone was Class V according to Cawood and Howell's classification system.¹ The radiographs also revealed a simple fracture of the left mandibular body (Fig 1).

The initial treatment plan was to achieve osteosynthesis with a titanium mesh plate and a titanium miniplate. Under general anesthesia, the

mandible was exposed via a left submandibular incision, and fixation was performed as planned. However, 2 months later, refracture of the left mandibular body occurred; the attachment sites of the titanium miniplate were fractured as well. It was decided to augment the inferior border of the refractured mandible with an autogenous graft of rib and iliac particulate cancellous bone and marrow. The graft material was enveloped by a titanium micromesh plate to recreate the form of the mandible.

In September 2000, under general anesthesia, a section of the right eighth rib approximately 16 cm long was harvested by a conventional subperiosteal technique. An incision was made in the submental region through the bilateral submandibular regions to the inferior border of the mandible, and the periosteum was stripped. Refracture was observed on the anterior side of the original fracture line, where bone reunion had begun. The titanium mesh plate and miniplate were removed. The harvested rib was divided into 2 pieces, which were adjusted to fit the inferior border and fixed to the mandible with 0.5-mm titanium wire. The mandible and the rib graft were enfolded and fixed with a plate of titanium micromesh (Stryker Leibinger, Frieberg, Germany) to recreate the natural form of the mandible.

Particulate cancellous bone and marrow taken from the iliac crest were used to fill the space between the mesh plate and the rib graft (Fig 2). Closure and pressure dressings were applied in the normal manner. The patient's recovery was uneventful, and no complications occurred at either the donor or recipient site. The patient was not allowed to use her dentures for 8 months postoperatively and was restricted to an essentially liquid diet.

Eight months later, under general anesthesia, the micromesh and the titanium wire holding it in place were removed. The graft showed little resorption, and a good amount of new bone formation had

Fig 3 Eight months postoperatively, the rib graft was almost completely unresorbed, and good bone union had been achieved.



Fig 4a Two implants and a bar-type connector were placed.



Fig 4b The definitive implant-supported overdenture.

Fig 4c Panoramic radiograph obtained 15 months after implant placement.



been achieved (Fig 3). Immediately after removal of the micromesh plate, two 3.5×13 -mm dental implants (Astra Tech, Göteborg, Sweden) were placed bilaterally in the canine regions of the mandible, according to the manufacturer's instructions. The wounds were closed in the normal manner, and there was no intraoral wound. Four months later, the abutments were connected, and an

implant-supported bar-retained overdenture was fabricated (Figs 4a and 4b). Fifteen months after implant placement, the clinical course remained uneventful, the reconstructed mandible was stable (Fig 4c), and there was no evidence of marginal bone loss around the implants. With the implant-supported overdenture, the patient resumed masticatory function and was quite satisfied.

DISCUSSION

Fracture of a severely resorbed Class V edentulous mandible occurs primarily in the elderly. Various factors, such as reduced vascularity, decreased blood flow, and loss of bone mass, may contribute to weakening of the mandible in this population.^{9,10}

Treatment by open reduction has the potential to further compromise the blood supply to the bone and soft tissue of the mandible. Furthermore, prolonged fracture healing may result from the unfavorable conditions produced by the reduced cross section and smaller contact area of the fracture ends and poor vascularization of the dense and sclerotic bone. Elderly patients are frequently medically compromised, which presents significant anesthetic and surgical dilemmas. Treatment modalities for these patients range from conservative to aggressive, depending on the patient's general condition and the fracture type.

In the case presented, the initial treatment plan was to fix the fracture with titanium mini- and mesh plates by open reduction using a left submandibular approach. However, another mandibular fracture occurred despite good healing of the first fracture site. The use of miniplates probably should not have been attempted for such an atrophic mandible. Under such circumstances, the plates should have been longer, fixed in the angle and chin areas, and capable of sustaining the load.¹¹ The weaker the bone, the stronger the plate should be. However, when using a longer plate such as a reconstruction plate, it is sometimes difficult to stabilize the prosthesis on the healed edentulous mandible. For this reason, the decision to augment the alveolar ridge by bone grafting was made. Autogenous bone grafting with rib or iliac bone is an acceptable treatment for severe mandibular atrophy or fracture of an atrophic mandible.

With the advent of microvascular surgery, vascularized bone grafting or vertical distraction osteogenesis of the edentulous alveolar ridge can be performed.^{12,13} Considering the patient's general condition, the method reported by Sanders and Cox¹⁴ of bone grafting to the inferior border of the mandible was the best approach for this patient. Several authors have previously advocated use of rib grafts inserted by an intraoral approach to treat a fractured atrophic edentulous mandible.^{4,5} How-

ever, Sanders and Cox's method of grafting to the inferior border of the mandible seems to decrease resorption, since no direct pressure from the prosthesis is placed on the grafts, and the risk of periosteal stripping is minimized.^{7,14}

In the present case, the treatment method was appropriate and effective for repair of a fracture of a severely edentulous atrophic mandible. However, long-term follow-up study will be necessary to monitor for the preservation of the grafted bone.

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