Dental Restoration with Endosseous Implants After Mandibular Reconstruction Using a Fibula Free Flap and TMJ Prosthesis: A Patient Report

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This patient report describes the secondary reconstruction of a hemimandibular and condylar defect and the dental restoration of a 56-year-old woman who had been subjected to radical ablative surgery 30 years earlier to remove a tumor. In the first phase, a fibula free flap was used in combination with a total TMJ prosthesis for the reconstruction of the hemimandible and condyle. Secondly, 3 endosseous implants were placed in the residual mandible. These implants were used to support an overdenture prosthesis that has remained in continuous function for a period of 2 years. (Case Report) Int J Oral Maxillofac Implants 2006;21:481–485

Key words: *dental implants, dental prostheses, fibular free flap, mandibular reconstruction, temporomandibular joint prostheses*

Complete reconstruction of a hemimandible, including the condyle, requires the combined use of diverse procedures to achieve the restoration of physiologic functions (speech, mastication, and deglutition) as well as esthetic appearance.[1] In addition, adequate movement of the temporomandibular joint (TMJ) is required.[2] Over the last 40 years, numerous articles have addressed different aspects of mandibular reconstruction. Until the 1980s, reconstruction techniques were limited to free bone grafts, alloplastic plates with particulated bone, and pedicled regional flaps.[3] Since then, the development of microsurgical techniques has resulted in a substantial step forward.[4] For the moment, the fibula free flap represents the state of the art in mandibular reconstruction,[5–7] as it provides a large volume and diversity of soft and hard tissue for the reconstruction of 3 complex dimensional defects. It can be combined with endosseous implants, which allow the stabilization of dental prostheses[8,9] and significantly improve mandibular function and facial harmony.[10]

TMJ reconstruction with a total prosthesis has been the subject of controversy.[11] It is particularly indicated in patients subjected to previous operations which have altered its anatomy and vascularization. There are no published articles that refer to the simultaneous use of a fibula free flap and a total TMJ prosthesis for the reconstruction of the hemimandible, followed by restoration of the dentition with an implant/tissue–supported prosthesis.

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CASE REPORT

Patient History and Clinical Evaluation

A 56-year-old woman presented to the Maxillofacial Surgery and Stomatology Department of the Virgen del Rocio University Hospital of Seville, Spain, regarding reconstruction of the left hemimandible. The patient described the radical ablative surgery she had had in 1971 to resect a giant cell tumor. The mandible

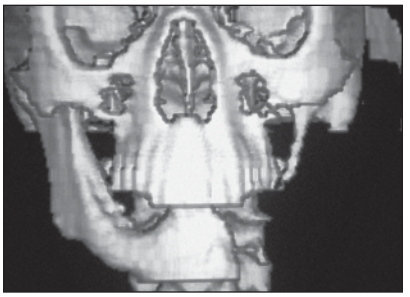


Fig 1 Computerized tomographic (CT) imaging of the bone defect 10 years ago, before the first reconstruction.

Fig 2a Intraoral view of the patient before the second reconstruction.

Fig 2b Extraoral view of the lower third of the face; the chin curvature and the sinking of the face can be seen.

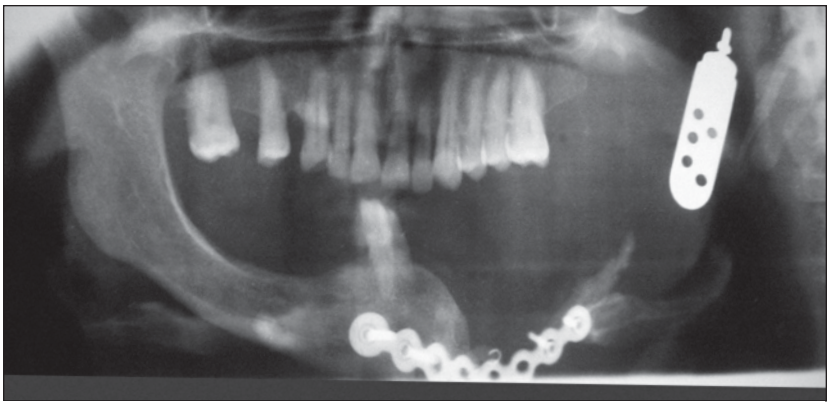


Fig 3a Panoramic radiograph obtained prior to reconstruction demonstrating complete resorption of the free nonvascularized graft.

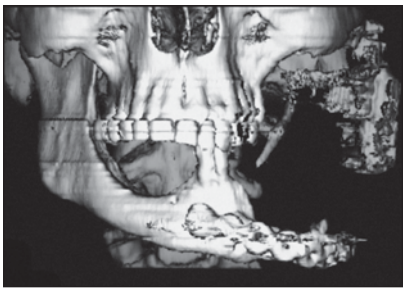


Fig 3b CT image showing the resorption of the graft, the displacement of the TMJ prosthesis, and the bone defect of the left hemimandible.

was not initially reconstructed (Fig 1). The patient received a removable mandibular prosthesis, but after 20 years, it became less satisfactory because of a severe alteration of the mandibular arch. This resulted in diminished comfort and function as retention and stability decreased. In 1995 reconstruction of the bone defect was attempted with a nonvascularized iliac crest graft, a mandibular reconstruction plate, and a total TMJ prosthesis. The reconstruction failed due to progressive resorption of the bone graft.

On clinical examination a curvature of the chin to the left side was observed, both in repose and on opening the mouth, with sinking of the left mandibular region due to shrinking of the soft tissue (Figs 2a and 2b). The range of oral aperture was limited to 20 mm. The patient had conserved only 2 mandibular incisor teeth; therefore, dental occlusion could not be evaluated. She reported an intense pain in the TMJ prosthesis area, which seemed to be displaced. A panoramic radiograph and CT imaging, although distorted due to the presence of the TMJ prosthesis and the reconstruction plate, demonstrated complete resorption of the graft, displacement of the TMJ prosthesis, and a residual bone defect corresponding to a left hemimandibulectomy (Figs 3a and 3b).

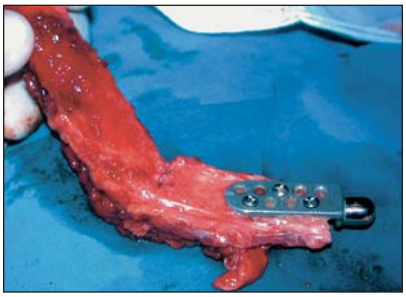
Treatment Plan

A simultaneous reconstruction with a microvascularized fibula free flap and replacement of the TMJ prosthesis was suggested to the patient. It was recommended that, after a healing period, endosseous implants be placed to support and retain a dental prosthesis.

Surgical Reconstruction

An extraoral approach was utilized to access the residual mandibular margin via a submandibular incision. Once exposed, the previous reconstruction plate was removed. The glenoid fossa prosthesis was exposed via a preauricular incision, and the condylar prosthesis by means of a blunt dissection. The condylar prosthesis, which was loose because of complete resorption of the previous graft, was removed. The glenoid fossa prosthesis was left in position after direct examination confirmed its stability.

A vascularized left fibula free flap of 16 cm was harvested without a cutaneous paddle. Two osteotomies were performed to recontour the fibula in 3 segments, which were fixed with 2 miniplates (Fig 4). Templates were not used to plan the reconstruction. A new condylar prosthesis (Christensen



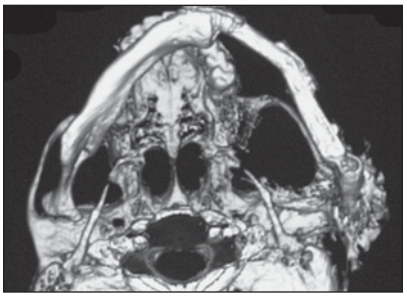


Fig 4 *(Left)* Three-dimensional adaptation of the fibula and fixation of the condyle prosthesis before microsurgical anastomosis.

Fig 5 *(Right)* CT image (caudal projection). The outline of the new mandible after reconstruction can be seen.

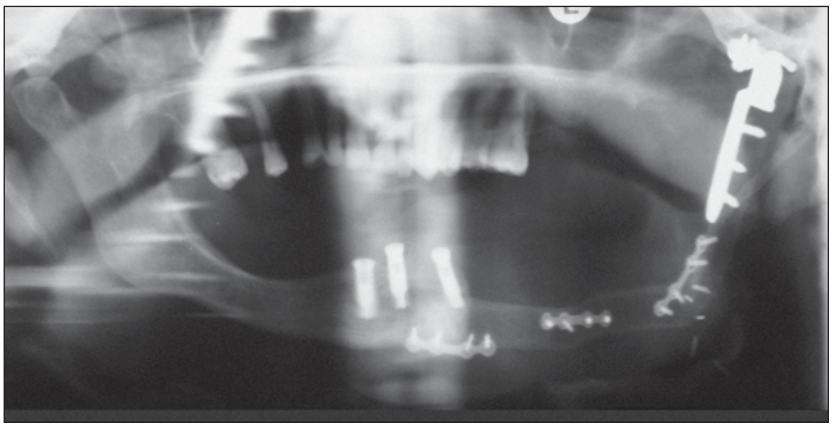


Fig 6 Postoperative panoramic radiograph of the 3 implants placed in the residual mandible.

TMJ Implant System; TMJ Implant, Golden, CO) was placed and was fixed with 3 screws to the extreme distal of the fibula to mimic the ascending ramus of the mandible. The flap, together with the condylar prosthesis, was transferred to the recipient bed, where it was fixed with another miniplate. Microsurgical anastomoses were created from the fibular artery to the external carotid artery and from the fibular vein to the thyrolinguofacial trunk. The donor site of the leg was closed directly, without a skin graft.

Postsurgical Care

The postsurgical course was uneventful. The flap was viable (Fig 5), and the donor area of the leg did not present complications. Active movement of the oral aperture began immediately in the postoperative period, although for 2 months only a soft diet was permitted to minimize the functional loads on the metal TMJ prosthesis. Maximum opening progressed from 30 mm 2 weeks following surgery to 45 mm at 3 months. The patient began walking with crutches on the fourth day postsurgery. Two months after the surgery, the patient could walk without pain.

Surgical Placement of Implants

At 6 months, after ensuring the healing of the flap, the intraoral soft tissues and the interarch space were examined to plan the prosthetic implant restoration and occlusal equilibration. A surgical template was made to ensure the most ideal position and angle for the implants. Under local anesthesia, the 2 remaining teeth were extracted, and an osteotomy was made in the crestal bone to level the occlusal plane of the residual mandible and the condyle. The miniplates were not removed. Three 4 × 13-mm endosseous implants (Osseotite; 3i Implant Innovations, Palm Beach Gardens, FL) were placed in the mandibular symphysis (Fig 6).

The implants were uncovered at 3 months. Stability was tested manually, and the transmucosal abutments were connected. No modifications of the peri-implant soft tissue were made.

Fabrication of the Mandibular Prosthesis

A modified Hader-type bar was connected to the 3 implants (Fig 7a), and a mandibular overdenture was made (Fig 7b). After 2 years of follow-up, the patient presented with an adequate occlusal relationship (Fig 7c), and there was no obvious peri-implant bone

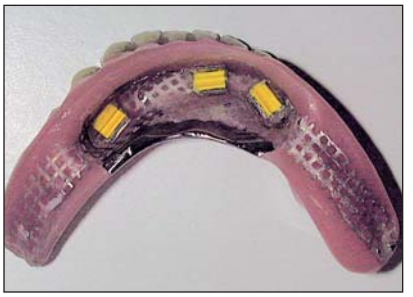


Fig 7a *(Left)* Intraoral view of the implants and the bar for the overdenture.

Fig 7b *(Right)* The removable overdenture.

Fig 7c *(Left)* Dental restoration with the overdenture and occlusion.

Fig 7d *(Right)* Aspect of the lower third of the face.

loss or inflammation around the implants. The TMJ prosthesis has not provoked any articular problems (Fig 7d).

DISCUSSION

If the integral reconstruction of the bone skeleton of a hemimandible, including the symphysis, ramus, and condyle, together with the TMJ and the teeth, is undertaken, an interdisciplinary approach is required to obtain optimum results for both the reconstruction of the segmental defect of the mandible and the function of the stomatognatic apparatus with stabilization of the occlusion in an efficient manner.[12,13] For these reasons, close cooperation between the head-and-neck surgical team, the implant surgeon, and the restorative dentist is necessary.

The superiority of microsurgical vascularized flaps over other methods for the reconstruction of mandibular segment defects has been established.[5–7] Of the methods available, the free fibula osteoseptocutaneous flap has become the principal flap for mandibular bone reconstruction, and it is the treatment of choice for patients in whom previous reconstruction attempts have failed.[14] It can also be employed for the repair of soft tissue defects, since it permits the inclusion of 1 or 2 cutaneous paddles.[15] Different technical possibilities have also been described for a wide range of defects, such as combining 2 free flaps simultaneously or using a free flap in association with the supramalleolar flap.[16] Even osteogenic distraction has been successfully applied to increase the height of a fibular free flap.[17] A long length of bone (up to 25 cm) can be used to carry out multiple osteotomies for 3-dimensional conformation, preserving a great resistance to the forces of mastication. Fibular blood vessels also have a length and diameter suitable for microsurgical anastomosis. Morbidity is minimal, and the long-term function of the leg is not affected.

The fibula free flap has been indicated in the reconstruction of the mandibular ramus, since the fibula is a narrow bone that is easy to introduce into a tunnel created in the fibrous tissues without injuring the facial nerve, although the TMJ cannot be reconstructed with fibular bone.[18] The combination of a fibula free flap and a TMJ prosthesis for the reconstruction of the mandible and the TMJ has not been described in the literature. Despite the significant anatomic alterations that this patient presented with, it was possible to complete the reconstruction in only 1 phase and achieve a satisfactory result while decreasing the treatment time.

Although the implants can be placed at the same time as the microsurgery, placement of the implants in healed bone allows more accurate implant positioning. In addition, delayed implant placement reduced the surgical time during the lengthy initial surgical procedure.[10,19,20] In the case presented, implants were placed in the mandibular stump rather than the fibula, since a more favorable length and number of implants could be used.[21] The correct position and emergence of the implants leads to a healthy occlusal relationship, which improves the transfer of mastication forces, optimizes the functioning of the TMJ and the distribution of TMJ loads, and increases the long-term success rate.[22,23]

The placement of implants in the nonsensory fibula bone can cause limitations in the masticatory function of the patient.[10] However, control of proprioceptive sensitivity and of occlusal force was assured in the case reported, since the implants were placed in the live mandible. The design of an implant/tissue-supported prosthesis on a bar can be an ideal solution for a patient with oncology sequellae, especially for a nonirradiated patient.[24,25] It requires fewer implants, facilitates occlusal adjustment against antagonist teeth, makes gingival hygienic maintenance easier, and distributes occlusal force better, avoiding stress on the implants, since it is also supported by the mucosa.[4]

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