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Case report

Mandibular reconstruction using a titanium mesh sheet processed by laser welding after segmental mandibulectomy for implant placement

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ABSTRACT

Segmental mandibulectomy is performed in cases of benign and malignant neoplasms of the mandible, and both functional and esthetic aspects must be taken into account during mandibular reconstruction when mandibular continuity has been lost. Titanium mesh may be used as one method of reconstruction following segmental mandibulectomy. Mandibular reconstruction with titanium mesh offers the advantage of simplicity, allowing completion of the operation in a short time, and has a wide range of applications. Postoperative morphology is also close to anatomical mandibular morphology, resulting in satisfactory esthetics. In addition, sufficient bone remains postoperatively for the use of dentures or implant prostheses. We used preoperative simulation with a craniofacial bone model and laser welding to process a flat mesh sheet to fit the individual mandibular morphology of the patient prior to surgery. After reconstruction, we performed occlusal reconstruction by inserting implants into the transplanted bone.

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1. Introduction

Restoration of both masticatory function and esthetic appearance is important after segmental mandibulectomy [1]. Prosthetic treatment with plate dentures or dental implants is required for the postoperative recovery of masticatory function, and conditions for the success of this treatment include maintenance of the correct positional relationship of the upper and lower jaws and sufficient post-reconstruction bone width, both vertically and buccolingually. Use of vascularized free bone flaps for mandibular reconstruction has had a high success rate in recent years [2]. Mandibular morphology is complex, however, and creating the specific curves of the mandible and correcting the buccolingual morphology are not easy when straight bone transplant is used [3]. In many cases, the amount and quality of bone after reconstruction are insufficient for prosthetic treatment with implants or plate dentures [4,5].

In light of these problems, titanium mesh supplemented by autologous bone has been one method of reconstruction enabling the simple recreation of anatomical mandibular morphology [6]. The DUMBACH TITAN-Mesh-System® (Leibinger, Freiburg, Germany) was formerly in wide used. This system comprised a

prefabricated “tray” modeled on mandibular morphology that could be filled with transplanted bone, enabling the future use of dentures or dental implants and enabling early occlusal reconstruction [7–9]. Surgical time was also short, making this a useful technique in elderly patients and those with underlying conditions. Today, however, the production line has been closed and this product is no longer available.

We report herein a case in which we preoperatively processed a flat titanium mesh sheet and used it for mandibular reconstruction, subsequently inserting dental implants into the reconstructed bone to achieve occlusal reconstruction. We utilized images of the patient from computed tomography (CT) to create a 3-dimensional craniofacial bone model, and preoperatively shaped the titanium mesh sheet to form the shape of the mandible [10,11]. We thus carried out preoperative simulation using the model, bending the mesh sheet into the shape of the mandible to ensure that the remaining mandible would stay in position. We also used laser welding to bend the mesh to fit the morphology of the mandible and increase its strength.

This method has the advantage of reproducing the individual morphology of the patient in a simple manner, enabling early occlusal reconstruction.

2. Case report

A 68-year-old woman was referred to our hospital complaining of swelling in the mandible. Mandibular ameloblastoma was diagnosed, and immediate reconstruction following segmental

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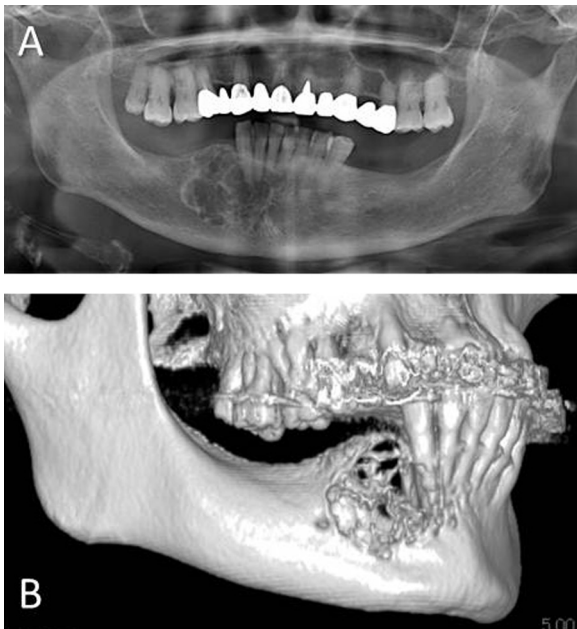


Fig. 1. (A) A panoramic radiograph taken on the initial visit. (B) Three-dimensional CT scan showing the mandibular ameloblastoma.

mandibulectomy was planned (Fig. 1). Before surgery, we created a model of the craniofacial bones and carried out a surgical simulation. A mesh sheet (OsteoMed, Texas, USA) was processed into the preoperative shape of the mandible. A Neolaser L laser welder (Girrbach Dental Systems, Pforzheim, Germany) was used to shape and strengthen the mesh sheet (Fig. 2). The vertical height of the

processed mesh was approximately half the width of the remaining mandibular bone, allowing the amount of bone used for filling to slightly exceed the mesh height. After segmental mandibulectomy under general anesthesia, the prepared mesh tray was fitted to the remaining bone and fixed with 5-mm screws. Autologous cancellous bone was harvested from the anterior iliac crest and used to fill the mesh tray to reconstruct the mandible. The jaw was immobilized for approximately 4 weeks postoperatively, after which oral ingestion of soft food was started. Six months after surgery, four HA implants (Zimmer Dental, USA) were inserted into the reconstructed bone and one into the remaining bone (Fig. 3). Secondary surgery was performed after a 4-month wait, and implant-supported dentures were produced to fit the maxillary dentition (Fig. 4). A functionally and esthetically satisfactory outcome was achieved.

3. Discussion

Reconstruction after loss of mandibular continuity must take full account of both esthetic and functional aspects, including mastication and swallowing [1]. Thanks to recent advances in microsurgical techniques, vascularized free bone flaps have now come into general use, and satisfactory results are being achieved. Vascularized free bone flaps from the fibula, ilium, and scapula in particular are frequently used for mandibular reconstruction, and implants are surgically inserted into these bone grafts [12]. Despite good results in terms of a high graft survival rate [2], the time required for graft production and vascular anastomosis [13,14] means that these methods are not always suitable as reconstruction materials for elderly patients and those with underlying conditions.

Mandibular reconstruction with titanium mesh and autologous bone grafting offers the advantage of using simpler surgical

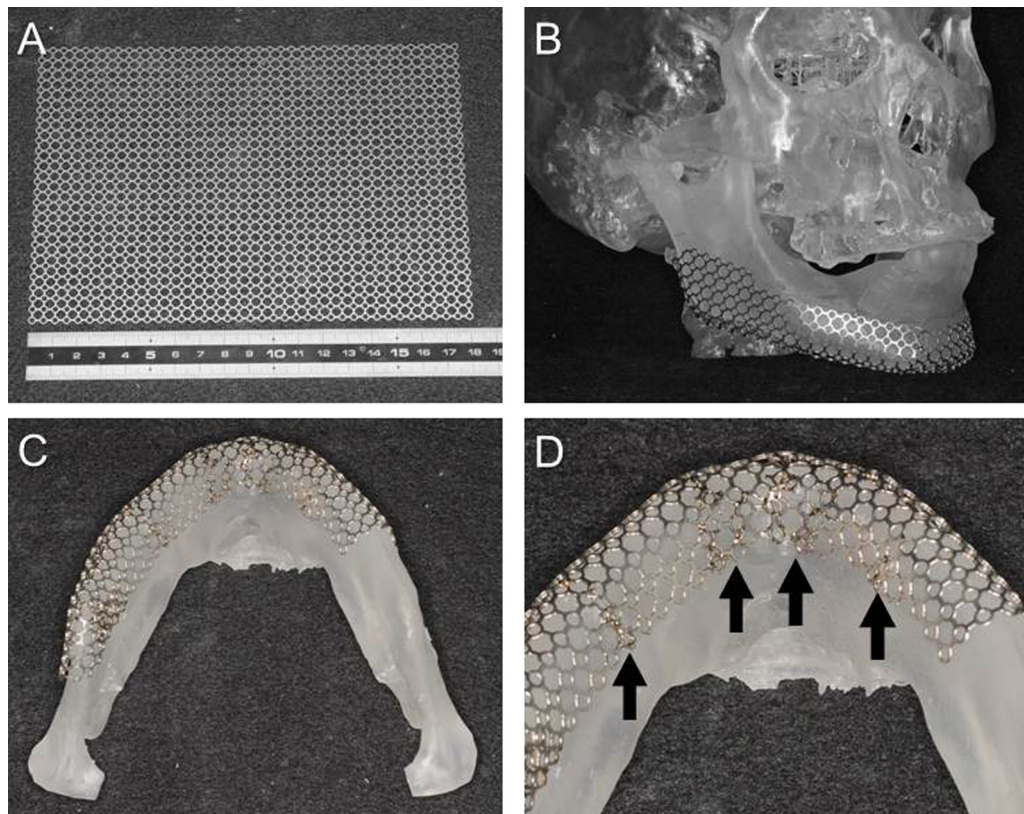


Fig. 2. Preparation of the titanium mesh tray. (A) Original shape of titanium mesh sheet. (B–D) Reinforced titanium mesh sheet shaped to match the craniofacial bone model (arrows: areas reinforced by laser welding).

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