Management considerations in reconstruction of postablative defects of the mandible: vertical distraction of a scapular bone flap and removable lip support: a case report

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Objective. To describe vertical distraction osteogenesis of a scapular flap and removable lip support for oral rehabilitation after surgical creation of an ablative defect of the mandible.

Case report. A 70-year-old man who was diagnosed with squamous cell carcinoma of the left lower gingiva underwent segmental mandibulectomy for tumor ablation and reconstruction with a scapular bone flap. To augment bone height of this flap, vertical distraction osteogenesis was performed. After denture fabrication, a removable lip support was placed between the implant-supported denture and the lower lip.

Results. The bone height of the scapular bone flap increased by 9 mm. Implants with adequate length could be placed in the distracted bone. The lip support was effective. Two years after masticatory loading, the implants remained stable.

Conclusion. Vertical distraction osteogenesis of the scapular bone flap was suitable to facilitate postoperative functional and esthetic restoration after tumor resection. A removable lip support was also useful as a supplementary tool for oral rehabilitation. (Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2008;106:e6-e9)

Like the fibula flap, the scapular bone flap is one of the standard methods of free vascularized bone transplantation for mandibular reconstruction. Because the maximum bone height of the scapular bone flap is 2-3 cm, a vertical gap forms between the residual mandible and the bone flap. This gap is unfavorable for oral rehabilitation with dental implants, because long suprastructures on implants cause esthetic problems and overloading of the implants. Therefore, secondary bone augmentation of the reconstructed bone is required to place dental implants.

Vertical distraction osteogenesis has been developed to gain sufficient alveolar bone height for placing dental implants. Recently, the procedure has been applied to the reconstructed mandible for secondary bone augmentation. Chiapasco et al. and Nocini et al. first reported vertical distraction osteogenesis of a fibular flap transferred to the mandible to gain sufficient alveolar bone height before implant therapy.

The lower lip can collapse into the oral cavity in patients who have lost the anterior part of the mandible. As such collapse could cause esthetic and functional problems, prosthetic management is often used for lip support after tumor ablative surgery.

This report describes distraction osteogenesis of a scapular free flap used for mandibular reconstruction. The distraction protocol after reconstructive surgery, the clinical course, and prosthetic management are presented.

CASE REPORT

A 70-year-old man had been diagnosed with squamous cell carcinoma of the left lower gingiva (T2N1M0; stage III). Segmental mandibulectomy was performed with left total neck dissection. One and one-half years after the ablative surgery, the mandible was secondarily reconstructed with a free osteocutaneous scapular flap. A bone graft measuring 2.5 cm in width and 1.2 cm in depth was taken from the lateral border of the left scapula. The harvested bone was selected to be suitable for grafting at the margin of the native bone and to cause minimal morbidity at the donor site. Thus, in the reconstructed area, bone height was 2.5 cm and bone thickness was 1.2 cm (Fig. 1, A). One and one-half years after the reconstruction, to gain sufficient bone height for dental implants, vertical distraction osteogenesis of the scapular flap was performed. Under general anesthesia, a skin incision was made on the margin of the scapular flap in the submandibular...
The labial and buccal periostea were reflected, but the lingual periosteum and soft tissue were not elevated. Anterior box osteotomy was performed, and an extraosseous vertical distraction device (KLS Martin, Jacksonville, FL) was placed on the vestibular surface of the scapular graft in the mandible. The direction of distraction was decided carefully to avoid labial or lingual inclination of the segment. The device was fixed with unicortical microscrews and was temporarily activated to ensure correct function. The surgical wound was closed in 2 layers, and the tip of the activating cylinder was displayed on the incision line. An antibiotic was administered intravenously for 4 days and continued orally for 3 days. The device was activated at a rate of 0.5 mm/day from the seventh postoperative day. An increase in bone height of 9 mm was achieved on orthopantomography (Fig. 1, B). Five implants (Bränemark System; Nobel Biocare, Göteborg, Sweden) were placed 4 months after distraction: 2 15-mm-long 3.75-mm-diameter implants at the medial position of the distracted scapula, 2 13-mm-long 3.75-mm-diameter implants at the distal position of the distracted scapula, and 1 13-mm-long 3.75-mm-diameter implant at the right side of the nonresected mandible. Initial stability of the implants was considered to be adequate. The implants were loaded 6 months after implantation, and an implant-supported fixed denture was fabricated (Fig. 1, C and D). Because the implant-supported denture impinged on the lower lip, a removable lip support was placed under the denture to maintain the lower lip in a suitable position (Fig. 2). The lip support was made of silicone-based soft denture liner material; Sofreliner (Tokuyama Dental, Tokyo, Japan). The final prosthesis was followed up to 2 years, with stable conditions evident on orthopantomography (Fig. 1, E).

DISCUSSION

Bone grafting is a reliable method for additional bone augmentation of reconstructed bone, but the pro-

Fig. 1. A, Orthopantomogram before vertical distraction. Many blood vessel clips used during tumor ablative surgery are seen as multiple opacities in the submandibular area. B, Three months after distraction, 9 mm of bone height was gained. C, Orthopantomogram taken immediately after insertion of the final prosthesis. D, Intraoral view of the final prosthesis. An implant-supported fixed denture is seen. E, Orthopantomogram 2 years after insertion of the final prosthesis. The condition of the distracted bone is the same as immediately after insertion of the final prosthesis.
The procedure has the risk of donor site morbidity. Moreover, bone grafting requires enough soft tissue to cover the graft tissue. Distraction osteogenesis enables soft tissue adaptation as well as bone augmentation to be performed. Vertical distraction has been used as secondary bone augmentation, allowing the placement of dental implants after mandibular reconstruction. The cross-section of the lateral border of the scapula is triangular. In Japanese individuals, the lateral border of the scapula is approximately 10 mm in depth and the width ~20-30 mm. Therefore, if mandibular reconstruction is performed with scapular bone, the distance from the bone margin to the occlusal plane is too long to place dental implants in the ideal position. In the present case, bone height was similar in each portion of grafted bone, but because the grafted bone had a triangular shape, the thickness was not sufficient at its upper part. Therefore, vertical distraction osteogenesis was performed as secondary surgery to gain bone height with sufficient thickness. It was necessary to vertically increase the thicker portion of the grafted bone.

The distraction protocol for reconstructed bone is under debate. Chiapasco et al. recommend a 0.5 mm daily distraction rate for a vertically deficient edentulous ridge to ensure uneventful recovery of the surgical wounds. Distraction rate and retention period have been addressed in earlier studies on the vertical distraction of grafted bone. Klesper et al. performed vertical distraction of a vascularized fibular bone flap grafted into the mandible at 1.0 mm/day followed by a 12-week retention period; that gained 9-12 mm bone height. Kunkel et al. performed vertical distraction of a free iliac bone graft in mandible at 0.5 mm/day followed by a 4-6-month retention period; that gained 6-9 mm bone height. In the present case, distraction was carried out at 0.5 mm/day and the retention period was 4 months.

The lower lip often collapses into the oral cavity in patients who lose the anterior part of the mandible. Generally, an implant-supported prosthesis can play an effective role as a lip support. However, as in the present case, resection including the anterior part of mandible can cause difficulty with chewing and lip support. Subsequent fabrication of a prosthesis is useful as a lip support for the resected area. To ensure oral hygiene, a removable prosthesis is considered to be

![Fig. 2. A, The position of the lower lip without the lip support. The lower lip has collapsed into the mouth (arrow). B, The space between the implant-supported denture and the soft tissue. C, The position of the lower lip with the lip support installed. The lower lip is in a suitable position (arrow). D, Intraoral view when installing the lip support. The device was installed in the anterior vestibule to fill the space between the denture and soft tissue (arrow). E, The lip support, which was made of silicone-based denture liner material.]
better than a fixed prosthesis. That is to say, an obturator-type prosthesis made of soft material could be suitable to restore tissue volume. An implant-supported removable denture appears to be effective for lip support. However, in the present case, because the patient had hoped for a fixed prosthesis, implant-to-suprastructure ratios were still not favorable. Therefore, a removable lip support was needed. Silicone-based denture liner material was used to produce the removable lip support. The material was easily fitted to the space between the implant-supported denture and the surrounding tissue. This enabled stability of the lip support during installation and use.

Oral rehabilitation techniques have been developed for oral cancer patients after tumor ablative surgery. Secondary tissue augmentation and/or prosthesis can improve quality of life after tumor treatment. In the present case, vertical distraction osteogenesis for effective dental implant therapy and a removable tissue prosthesis were important in oral rehabilitation.

REFERENCES


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