

Functional and esthetic reconstruction for a patient with mandibular osteosarcoma: A clinical report

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This clinical report describes a functional and esthetic treatment using an implant-supported fixed detachable prosthesis for a patient who underwent resection and skeletal reconstruction due to mandibular osteosarcoma. A four-stage protocol was used that included resection and rigid fixation with a reconstruction plate, autogenous bone graft, placement of osseointegrated implants, and prosthetic restoration. The patient required a second resection because of the positive margin of the first resection. An autogenous bone graft was placed after the negative margin of the second resection was confirmed. Six months after the iliac crest bone graft, five implants were placed in the defective areas of the mandible. These implants were restored with a fixed detachable denture fabricated with a cast gold alloy framework. This functional and esthetic prosthesis has performed favorably without any problems for one and a half year. (*Int Chin J Dent* 2005; 5: 91-95.)

Key Words: esthetics, function, osteosarcoma, reconstruction.

Introduction

Osteosarcoma is a rare and aggressive malignant bone tumor that occurs more frequently in young patients. Approximately 6-10% of all osteosarcoma arises in the maxillofacial region.¹⁻³ The main modality treatment for osteosarcoma is surgical resection with a wide margin to prevent recurrence.^{4,5} Subsequent skeletal reconstruction and oral rehabilitation are important to maintain oral functions such as mastication, deglutition and phonation.⁶ Reconstruction at the time of resection is commonly advocated to provide a favorable esthetic and functional result.⁷ In a previous report,⁸ a staged protocol was suggested for treatment and oral rehabilitation of patients with aggressive primary tumors of the jaws, especially in young children. The protocol consisted of four steps: 1) en bloc resection of the tumor and immediate placement of a rigid reconstruction plate across the mandibular defect; 2) skeletal continuity restored with an autogenous bone graft; 3) placement of osseointegrated implants; and 4) prosthetic restoration. This clinical report describes the functional and esthetic reconstruction of an adult patient with mandibular osteosarcoma using a four-stage treatment protocol.

Clinical Report

A 31-year-old female patient was diagnosed with osteosarcoma of a fibro-osseous lesion of the right mandible (Fig. 1). Mandibular resection and placement of a reconstruction plate was carried out in the patient's mouth (Fig. 2). Since the surgical pathology examination of the right mandibular partial resection indicated a central osteosarcoma with extension to the proximal bony margin, a further resection was required to achieve a negative resection margin. Fig. 3 shows the postoperative panoramic radiograph after mandibular resectioning. Three months after the resection and rigid fixation, an iliac crest bone graft (approx. 30x10x8 mm in size) was placed to repair the mandibular large resection defect. Figs. 4 and 5 present the frontal and occlusal views of the patient's mouth six months after the autogenous bone graft. Before the surgery for the implant placement took place, a surgical guide was fabricated on the master cast mounted on a semi-adjustable articulator. Five implants

(OSSEOTITE Ø3.75x13 mm; Ø3.75x10 mm, 3i Implant Innovation Inc., Palm Beach Gardens, FL, USA) were then placed in the grafted area. An AlloDerm (LifeCell Corp., Branchburg, NJ, USA) graft was also placed around the implants to create the crest of the ridge during the secondary surgery (Fig. 6). Fig. 7 shows the implant abutments ready for fabrication of the definitive fixed detachable prosthesis in the patient's mandible. A temporary partial denture was not used until the definitive prosthesis was placed. The metal framework for the implant-supported superstructure (Fig. 8) was first fabricated with cast gold alloy (Ney-Oro 60, Degussa-Ney Inc., Bloomfield, CT, USA) and gold cylinders. After the passive fit of the cast metal frameworks and wax dentures with artificial teeth (Trubyte IPN 30°, Dentsply, York, PA, USA) that match the maxillary posterior teeth was verified intraorally, the final fixed detachable dentures were fabricated according to conventional methods (Fig. 9). The definitive fixed detachable prosthesis was finally fixed with retaining screws in the patient's mouth (Fig. 10). The right maxillary premolar was also restored with a single stand implant and porcelain-fused-to-metal (PFM) crown. The definitive prostheses provided a group function occlusal scheme. The patient was satisfied with these functional and esthetic prostheses, which have performed favorably for one year without any visible radiographic bone resorption (Fig. 11).



Fig. 1. Preoperative panoramic radiograph. Right first premolar shows periapical radiolucency.



Fig. 3. Postoperative panoramic radiograph after mandibular resections.

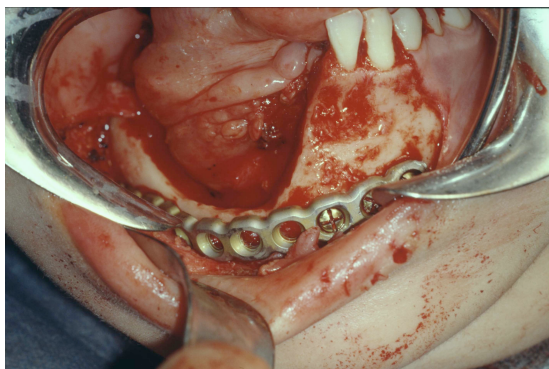


Fig. 2. Resection and placement of reconstruction plate.



Fig. 4. Frontal view with large mandibular defect.

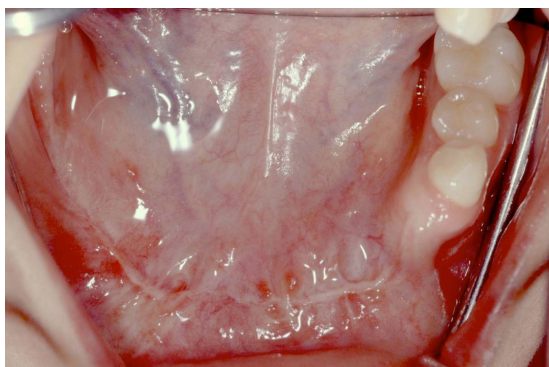


Fig. 5. Occlusal view of the patient's mandible.

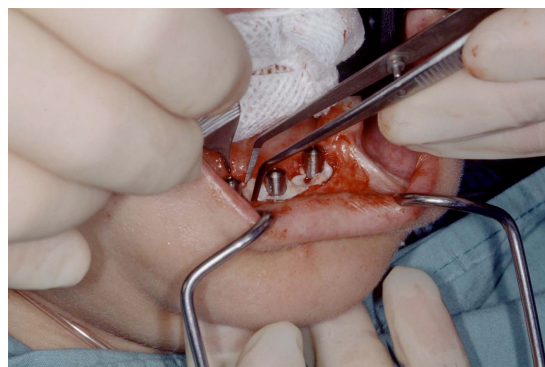


Fig. 6. AlloDerm graft during secondary surgery of the implant.



Fig. 7. Implant abutments placed in the patient's mandible.



Fig. 8. Cast gold alloy framework tried-in.



Fig. 9. Definitive fixed detachable prosthesis.



Fig. 10. Fixed detachable prosthesis placed in the patient's mouth.



Fig. 11. Postoperative panoramic radiographs after the restoration.

Discussion

A mandibular resection caused by aggressive malignant tumors can lead to malfunction of mastication, deglutition and/or phonation due to a combination of defects including bone, oral mucosa, muscles and teeth with a significant decrease in the quality of life. Functional and esthetic rehabilitation is therefore necessary for those patients who need mandibular resections. In this clinical case, a patient diagnosed with odontogenic osteosarcoma underwent large mandibular resectioning. The total treatment plan for this patient followed a staged protocol introduced in a previous report.⁸ The advantages of using a protocol in steps compared to protocols for immediate reconstruction (occurring at the same time as placement of a bone graft and immobilization with maxillomandibular fixation)⁹ are: 1) the rigid internal fixation technique allows the surgeon to accomplish the resection, align the segments, stabilize the jaw, and maintain the occlusion and facial esthetics without performing an immediate bone graft; and 2) this strategy also allows the surgeon to obtain definitive pathologic analysis of the resection margins before harvesting and placing an autogenous bone graft. Since the surgical pathology examination in this case indicated a positive margin of the first resection after the rigid reconstructive fixation was conducted, a further resection was required with wide margins. Before proceeding to the second stage, it was important to prevent recurrence of the osteosarcoma by confirming that none of the resection margins were positive in terms of malignant cells. In the second stage, the autogenous iliac bone graft was placed in the defective area. Six months later, the third stage of treatment was carried out when the osseointegrated implants were placed. At this stage, the AlloDerm graft,¹⁰ which provides support, strength and elasticity to the mucosa, was placed at the area of the crest of ridge (Fig. 6). The final stage of treatment was prosthetic restoration in which a definitive fixed detachable prosthesis was fabricated for the esthetic requirements and functional rehabilitation. Due to the large mandibular defect from resectioning, the metal framework as well as the definitive prosthesis possessed adequate vertical height to maintain the vertical dimension of occlusion (Figs. 8-10). The fabrication of prostheses with ideal anatomical shapes (adequate bucco-lingal width, alveolar arch and contour) is also important to assist deglutition and phonation. This functional and esthetic prosthesis has performed favorably without any problems for one and a half year. After the patient was successfully treated using the staged protocol for resection, reconstruction and oral rehabilitation, follow-up appointments to monitor the recurrence of osteosarcoma and the prostheses' function will continue.

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References

1. Tanzawa H, Uchiyama S, Sato K. Statistical observation of osteosarcoma of the maxillofacial region in Japan. Analysis of 114 Japanese cases reported between 1930 and 1989. *Oral Surg Oral Med Oral Pathol* 1991; 72: 444-8.
2. Vege DS, Borges AM, Aggrawal K, Balasubramaniam G, Parikh DM, Bhaser B. Osteosarcoma of the craniofacial bones. A clinico-pathological study. *J Craniomaxillofac Surg* 1991; 19: 90-3.
3. Delgado R, Maafs E, Alfeiran A, et al. Osteosarcoma of the jaw. *Head Neck* 1994; 16: 246-52.
4. Martin JW, Chambers MS, Lemon JC, Toth BB, Helfrick JF. Prosthodontic and surgical considerations for pediatric patients requiring maxillectomy. *Pediatr Dent* 1995; 17: 116-21.
5. Tanaka N, Murata A, Yamaguchi A, Kohama G. Clinical features and management of oral and maxillofacial tumors in children. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1999; 88: 11-5.
6. Linsen S, Niederhagen B, Braumann B, Koeck B. Functional and esthetic rehabilitation after mandibular resection in a child using a tooth/implant-supported distraction device: A clinical report. *Int J Oral Maxillofac Implants* 2004; 19: 603-8.
7. Lavertu P, Wanamaker JR, Bold EL, Yetman RJ. The AO system for primary mandibular reconstruction. *Am J Surg* 1994; 168: 503-7.
8. Troulis MJ, Williams WB, Kaban LB. Staged protocol for resection, skeletal reconstruction, and oral rehabilitation of children with jaw tumors. *J Oral Maxillofac Surg* 2004; 62: 335-43.
9. Lello GE. Intraoral reconstruction of mandibular defects after tumor resection. *J Oral Maxillofac Surg* 1986; 44: 864-70.
10. Fowler EB, Breault LG. Ridge augmentation with a folded acellular dermal matrix allograft: a case report. *J Contemp Dent Pract* 2001; 2: 31-40.

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