Complete Oral Rehabilitation of a Postresection Ameloblastoma Patient: A Clinical Case Report

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Conventional ameloblastomas are rare, benign, epithelial odontogenic tumors that tend to grow slowly in the mandible or maxilla, but are locally invasive and can be highly destructive of the surrounding dental anatomy. Aggressive resection is the most effective method of eliminating the tumors, but treatment can further contribute to patient deformity and malfunction. Ameloblastomas also have a high rate of recurrence, which significantly diminishes 8 years after resection, but still requires vigilant clinical monitoring. This case report describes the complete oral rehabilitation of a postresection ameloblastoma patient with a mandibular reconstruction plate and partial edentulism. An autogenous graft was taken from the patient’s iliac crest, shaped to fit the defect, and attached with bone screws. After graft incorporation, dental implants were successfully placed into the augmented ridge and restored with a fixed partial denture. There was no evidence of tumor recurrence during the 10 months of treatment or 8 years of subsequent clinical monitoring.

Key Words: ameloblastoma, resection, implants, grafting, odontogenic

Introduction

Ameloblastomas are rare, epithelial odontogenic tumors that grow slowly but are locally invasive and can be highly destructive of the surrounding dental anatomy. The neoplasms can clinically manifest in 3 forms: peripheral, unicystic, and multicystic (conventional). Peripheral odontogenic tumors have the histologic characteristics of intraosseous ameloblastomas but occur solely in the soft tissues covering the tooth-bearing parts of the jaws. Treatment consists of excision with a small amount of surrounding tissue. If compression around the alveolus is noted, then further excision including the peristem is conducted. Unicystic ameloblastomas clinically appear as cysts and have been variously termed as mural ameloblastomas, luminal ameloblastomas, and ameloblastomas that arise in dentigerous (follicular) cysts. These tumors can be conservatively treated with enucleation.

Conventional ameloblastomas grow almost exclusively in the mandibular and maxillary jaws and infrequently in the sinonasal cavities. They are the most common odontogenic tumor and represent approximately 10% of all odontogenic tumors in the jaw. The majority (80%) of conventional ameloblastomas occur in the mandible and can range from the ascending ramus or molar region (70%) to the
premolar (20%) and anterior (10%) regions of the jaw.\textsuperscript{2,4–6} The majority of remaining conventional ameloblastomas (20%) occur in the maxillary jaw and are most often located in the canine and antral regions.\textsuperscript{5} Approximately 10% to 15% of conventional ameloblastomas are associated with nonerupted teeth.\textsuperscript{5,10}

The clinical symptoms of a conventional ameloblastoma can range from localized painless swelling to facial deformity, malocclusion, loose teeth, ulcers, or periodontal disease as the mass continues to develop. Rarely, paresthesia and pain may occur if the swelling impinges on other vital structures, such as the mandibular posterior nerve bundles.\textsuperscript{2} Growing tumors can infiltrate through the medullary spaces and erode cortical bone.\textsuperscript{2} If left untreated, they can resorb the cortical plate and extend into adjacent tissue.\textsuperscript{2} Posterior maxillary tumors can obliterate the maxillary sinus and subsequently extend intracranially.\textsuperscript{1,2,11} Most lesions, however, are detected incidentally on radiographic studies in asymptomatic patients.\textsuperscript{2–7} Disease onset usually occurs after the age of 20 years (median age = 35 years), with no gender predilection, but geographic and racial differences have been reported.\textsuperscript{1,4} Reichart et al\textsuperscript{12} compiled a biological profile of ameloblastoma based on 3677 cases. The average age of patients with ameloblastoma was 36 years.\textsuperscript{12} Men and women were equally affected. Women, on average, were 4 years younger than men when ameloblastomas first occurred.\textsuperscript{12} Tumors appeared to be larger in women compared to men.\textsuperscript{12} The incidence of ameloblastomas was 5 times greater, and tumors appeared 12 years earlier in the mandible than in the maxilla.\textsuperscript{12}

Ameloblastomas may be tentatively diagnosed through radiographic examination, and frequently appear as sharply delineated, multilocular radiolucent lesions. Additionally, their slow growth rate allows time for the periosteum to develop a thin shell of bone ahead of the expanding lesion, which can have a tendency to expand the bony cortices. This thin shell of bone will easily crack when palpated, which can be an important diagnostic feature. Definitive diagnosis can only be made through histologic analysis. A tendency for the nucleus to move away from the basement membrane (reverse polarization) can be observed histopathologically.

The surgical treatment of conventional ameloblastomas has been controversial, however, and reported modalities have included enucleation, curettage, cryotherapy, or radical surgical treatment.\textsuperscript{13} Although ameloblastomas have virtually no tendency to metastasize, complete removal of the neoplasm is essential to prevent recurrence.\textsuperscript{1,2,11} Conservative treatment, therefore, harbors an unacceptably high risk of recurrence. Larger, more aggressive, and malignant lesions are rare and require a more radical surgical approach because abnormal cell growth easily infiltrates and destroys surrounding bony tissues, which results in large jaw defects.\textsuperscript{11}

Gardner and Pecak\textsuperscript{14} suggested that curettage alone should not be used because it can result in recurrence rates of 55% to 90%. Sehdev et al\textsuperscript{15} reviewed 72 cases and found a local recurrence rate of 90% after curettage of mandibular lesions. Muller and Slootweg\textsuperscript{16} noted that recurrences were diagnosed within the first 5 years after treatment in 95% of cases. Eleven of their 22 patients with recurrences were treated conservatively, and 73% developed another recurrence.\textsuperscript{16} However, of 12 patients who were treated radically, only 8% developed another recurrence during the 5-year follow-up period.\textsuperscript{16} Chappelle et al\textsuperscript{17} reported a significantly higher recurrence rate of 90% to 100% after curettage. Gerzenshtein et al\textsuperscript{3} found that treatment by wide excision was curative in 95% of ameloblastoma cases, while Chappelle et al\textsuperscript{17} reported a 13% to 15% recurrence rate after resection.
Reconstruction of significant resection defects and prosthetic rehabilitation of the patient can pose significant challenges, depending on the volume and dimensions of bone loss, and impingement or destruction of associated or adjacent dentition. In such cases, a 20% to 30% nonunion rate has been reported for bone grafting, and multiple surgical procedures may often be required to achieve satisfactory results. This clinical report presents the postoperative oral rehabilitation and long-term follow-up of an ameloblastoma patient.

**Clinical Report**

A 25-year-old woman presented with a history of mandibular ameloblastoma and a missing left third molar. At the time of resection 4 years earlier, 9 teeth (mandibular right first bicuspid to left second bicuspid) were removed, and a reconstruction plate was placed in the mandible (Figure 1). The patient exhibited a severely resorbed jaw in the region of the resection but experienced no paresthesia and had not been prosthetically restored (Figure 2).

After carefully reviewing the patient’s medical and dental histories, a thorough clinical evaluation was conducted to assess current dental health and to identify any existing pathologies that needed to be addressed. Radiologic examinations consisted of a panoramic radiograph and a computerized tomography (CT) scan to rule out recurrence of the tumor, assess the dimensions of the residual defect, and identify optimal locations where implants should be placed after defect resolution. The CT scan suggested that the 3 most posterior screws on the right side of the metal support plate encroached on the inferior alveolar canal. In area number 20, residual jaw dimensions were estimated to be 12 mm from the top of the mandibular canal to the crest of the alveolar ridge, and 2 mm in

![Figure 1. Postresection radiograph shows a mandibular reconstruction plate retained by bone screws.](image-url)
width at the crest. In area number 28, there was approximately 12 mm height and 3 mm width. In the anterior mandible there was almost a complete atrophy of the mandible across its anterior surface around the symphysis menti with only 1 mm width or less in some areas (Figure 3). The patient had excessive overjet of the upper maxilla and was referred to the orthodontist for maxillary treatment. The treatment plan and alternative options were discussed, and the patient was provided signed informed consent prior to all treatments.

After maxillary banding the upper first bicuspids were extracted with local anesthesia, and the patient underwent orthodontic treatment. During orthodontic treatment, a diagnostic work-up was performed to evaluate the volume and location of available bone and the esthetic and functional needs of the case relative to the expressed desires of the patient. A study cast was fabricated and mounted on a semi-adjustable articulator utilizing a face bow transfer and vertical registration to determine the jaw relationships, available occlusal dimension, proposed implant position(s), crown-root ratio, and potential complications. This allowed creation of a prosthetic wax-up and fabrication of a transitional mandibular removable partial denture for use by the patient (Figure 4). The wax-up was also used to fabricate a surgical template to guide placement of an autogenous iliac crest graft to increase the buccal and labial thickness of the jaw defect and to allow ideal placement of the implants relative to the planned prosthesis.

The patient was referred to the oral and maxillofacial surgeon for mandibular reconstruction. The patient was prepared for surgery and sedated under intubated general anesthesia by an anesthesiologist. The iliac crest was located, and a crestal periosteal incision was made 1 cm posterior to the anterior superior iliac spine to expose the medial aspect of the iliac crest. Care was taken to protect the soft tissues through completion of the surgery. An osteotomy was performed using a combination of drills, saws, and chisels to harvest the required graft from the iliac crest. Rough bony edges of the donor site were smoothed and thoroughly cleaned with sterile saline. Wound closure was achieved in layers using interrupted sutures and then a pressure dressing was applied to the surgical site.

An intraoral, mid-crestal incision was made beginning slightly anterior to the mandibular left first molar and extending to slightly anterior to the mandibular right second bicuspid. Vertical releasing incisions were made and full-thickness flaps were elevated to expose the mandibular defect site. The harvested bone was shaped to passively conform to the defect, and then

Figures 2 and 3. Figure 2. Clinical view of the patient’s severely resorbed mandible after tumor resection. Figure 3. Computerized tomography scan illustrates severely atrophic anterior mandible.
rigidly secured to the recipient site with 1.5-mm bone screws (Lorenz Center Drive Screws, Biomet Microfixation, Jacksonville, Fla). The reconstruction plate was not removed because it would not interfere with the implant surgery (Figure 5). The lingual soft tissue flap was undermined and expanded to obtain adequate tissue to achieve graft coverage, and passive, tension-free closure was achieved. Sutures were removed after soft tissue healing and maturation 14 days later.

The patient was reappointed for graft evaluation and dental implant placement 5 months after augmentation. Initial clinical evaluation with palpation and panoramic radiography revealed a stabilized graft with excellent ridge contours (Figure 6). The patient was anesthetized via bilateral inferior alveolar blocks in the mandible. A midcrestal incision extending from the area of the mandibular left first molar to the right second premolar and terminal buccal and lingual vertical releasing incisions were made, followed by elevation of mucoperiosteal flaps to expose the graft site. The graft appeared fully healed with no discernible resorption.

After identifying the locations of the mental nerves to avoid impingement, fixation screws in the areas of the planned implant sites were removed, and implant osteotomies were prepared by sequential cutting with internally irrigated drills for the placement of 6 dental implants (Tapered Screw-Vent MTX, Zimmer Dental Inc). Three implants 10 mm in length and 3.75 mm in width were placed in the areas of the left first and second premolars and right first premolar, and 3 implants 13 mm in length by
3.75 mm width were placed in the areas of the left cuspid and lateral incisor as well as the right cuspid and occluded with surgical cover screws (Figure 7). A surgical fixture level impression was taken prior to fixation mount/impression post removal with a vinyl silane impression material (Splash! VPS impression material, Discus Dental, Culver City, Calif) and an interocclusal record (Regisil vinyl polysiloxane impression material, Caulk Dentsply, Milford, Del) was made. Impression posts were removed from the implants, attached to implant analogs, and placed back into the impression.

Any remaining fixation screws from the healed graft were removed at this time, and the screw holes were augmented with 1 mL of solvent-dehydrated, mineralized bone allograft (Puros cancellous allograft, Zimmer Dental) and covered with a resorbable collagen membrane (BioMend, Zimmer Dental). Surgical cover screws were attached to the implants in the patient's mouth, the soft tissues were approximated over the implants, and primary closure without tension was achieved with 3-0 chromic gut sutures (Ethicon Inc, Piscataway, NJ) and the patient's provisional removable partial denture was relined with a soft reline material (Coe-Soft). Total blood loss during the procedure was less than 20 mL.

Immediately following surgery, the impression was poured in dental stone and mounted on a semi-adjustable articulator using the bite registration. Six custom-manufactured, patient-specific abutments were fabricated for the case. The patient was instructed to avoid chewing with her removable partial denture until suture removal 1 week later to allow for soft tissue maturation. At that time, the patient's removable partial denture was relieved over...
the locations of the implants to avoid tissue load.

The submerged implants were allowed to heal beneath the soft tissues for 5 months to allow for secondary graft healing and osseointegration of the implants. After the submerged healing period, the patient returned for surgical exposure of the implants. She was anesthetized by local injection, and a midcrestal incision was made to expose the tops of the implants. Osseointegration was clinically assessed manually via palpation and attempted gentle reverse torque, and radiographically by ascertaining that there was an absence of periimplant radiolucency. Surgical cover screws were removed from the implants and 6 custom abutments were attached to the implants and tightened with 20 Ncm of applied torque. An acrylic transitional fixed partial denture with pontics in the locations of the mandibular left and right central incisors and cemented implant abutments in the locations of the left first and second premolars, cuspid and lateral incisors, and the right cuspid and lateral incisor was provisionally cemented, and soft tissues were approximated and sutured around the abutments. Closure was made with 3-0 Vicryl sutures (Ethicon) sutures (Figures 9 and 10).

After 2 weeks of soft tissue healing, the patient returned for suture removal. The patient returned after 4 weeks of provisional loading, and a poly vinyl silane impression was taken (Splash! VPS impression material) and the precious metal casting were fitted. A definitive ceramometal fixed partial denture was delivered after several appointments, using a polycarboxylate adhesive (Duralon Cement, 3M ESPE, Norristown, Pa) (Figure 11). The patient was scheduled for a 4-month periodontal maintenance visit.

The patient has been monitored annually for the past 8 years and has exhibited an absence of pain during chewing, no implant mobility after removal of the appliance, and stable marginal bone as evaluated relative to the cemento-enamel junction on periapical radiographs. The patient did exhibit some tissue periimplantitis in the area on implant number 20 and number 21 during a recall visit at year 3 of maintenance. A small periodontal flap was elevated in this area under local anesthesia, and the abutment of implant number 20 was recontoured for less emergence profile. The area healed over the next several weeks with no recurrence of inflammation. No changes in graft contours have been noted clinically or radiographically during this time. The implants were considered clinically successful according to the criteria of Zarb and Albrektsson and appeared to be prosthetically loaded within their physiologic limits to prevent further resorption of the surrounding bone.

**Discussion**

In the present case, resection of the anterior mandible coupled with 4 years of extensive partial edentulism resulted in significant deformity and dysfunction. Immediate reinforcement of the resected mandible with a reconstruction plate and screws helped prevent mandibular fracture but could not address the esthetic and functional needs of the patient. Complete oral rehabilitation helped to restore the patient’s appearance and ability to chew and provided subjective improvements in self-confidence and social comfort according to the patient. Immediate follow-up is crucial in treating ameloblastomas because more than 50% of all recurrences happen within 5 years postoperatively. While there was no presence of additional tumors during the 13 months of treatment or subsequent 3 years of clinical monitoring, ameloblastomas have been reported to be capable of recurrence several decades after resection and reconstruction with autogenous bone grafts. Zachariades reported on a case of ameloblastoma recurrence in a patient treated by resection and autoge-
nous bone grafting 36 years earlier. Successful implant placement and prosthetic rehabilitation of a patient who was treated for ameloblastoma, within 1 year, by segmental resection of the mandible with obturator placement has been reported.25

While various outcomes have been reported for different augmentation techniques used to restore resected ameloblastomas, the fibular flap has been extensively used for oromandibular reconstructions and has been reported8 to be reliable in treating large ameloblastoma resections.

The double barrel fibular graft technique with subsequent implant placement has been advocated to provide an esthetic and functional reconstruction after ameloblastoma resection.26 Pediatric maxillofacial tumors have been successfully treated by resection, rigid fixation, and delayed reconstruction with minimal morbidity and a high success rate.27 The present case report demonstrated that the staged pediatric rehabilitation technique also produced an excellent outcome in an adult patient. In a study by Zemann et al,28 dental implants were placed in 7 patients with ameloblastoma. All patients were subsequently prosthetically rehabilitated and survived throughout the observation time.28 The efficacy of restoring grafted ameloblastoma patients with dental implants has also been reported in other studies with excellent outcomes.27,29 Either vascularized or nonvascularized bone grafts may be used, and subsequent vestibuloplasty procedures may be required before placement of implants. Chiapasco et al29 retrospectively evaluated the clinical outcome of vascularized (iliac crest) and nonvascularized (calvarial) bone grafts for the rehabilitation of mandibular defects following tumor resection in 29 patients. All grafts successfully healed and graft resorption was noted in only 1 patient.29 Of 60 implants placed into the grafts, only 2 implants failed.29 Nonvascularized bone grafts should be used with caution, however, if there are associated soft tissue defects. If the bony defect is larger than 4 cm, which is often the case with multicystic ameloblastomas, block allografts may be shaped to the recipient site, but they may also be more technique-sensitive than block autografts.30 It has been reported that the delayed placement of the implants into Fresh Frozen Bone has a better success rate when compared to simultaneous placement of implants at the time of allograft reconstruction.

In contrast, autogenous block grafts are hydrated and osteogenic and may thus be easier to use and less likely to fail than block allografts. The iliac crest is an appropriate location for an extraoral donor site because it provides a high amount of pluripotential cells, and its corticocancellous structure maintains greater volume than cancellous particulate grafts.31 However, autogenous iliac bone grafting requires additional surgical time to harvest the tissue, and there are associated risks of intraoperative and postoperative complications as well as subsequent patient morbidity. Some studies have reported that 25% of patients treated with autogenous bone grafts harvested from the iliac crest experienced significant postoperative pain at an average of 5 years after graft harvesting.31 Other researchers have surmised that 6% to 20% of patients experience pain, hypersensitivity, or numbness in the buttocks, while 3% to 9% sustain significant complications from iliac graft harvesting.28,31 Patients may also have an inadequate volume of available bone if they were previously subjected to iliac graft harvesting.28 After augmentation, iliac crest grafts can also resorb at a rate of 30% to 90% when a denture is placed over them.32,33 Implants can help to minimize resorption to a rate similar to the same quality of bone. The recommended time for placement of implants into healed grafts is 4 to 8 months postoperatively.18
Treatment of ameloblastoma patients is technique-sensitive and cannot guarantee future recurrence of the tumor, although outcomes generally improve after the first 5 years following resection. Thorough resection and rehabilitation with an iliac crest graft and dental implants resulted in a good outcome in the present case, but annual monitoring for tumor recurrence is essential to minimize additional skeletal damage. This case report shows an 8-year follow-up of implants placed into a patient with post-reconstructive tumor with a favorable result as evidenced by other studies.34

CONCLUSION

Conventional ameloblastomas are rare, benign, epithelial odontogenic tumors that tend to grow slowly in the mandible or maxilla and can be highly destructive of the surrounding dental anatomy. This case report describes the complete oral rehabilitation of a postresection ameloblastoma patient with a mandibular reconstruction plate and partial edentulism. An autogenous graft was taken from the patient’s iliac crest, shaped to fit the defect, and attached with bone screws. Four years later, dental implants were successfully placed into the augmented ridge and restored with a fixed partial denture. There was no evidence of tumor recurrence or implant failure after 8 years of subsequent clinical monitoring.

ABBREVIATIONS

CT: computerized tomography

REFERENCES


