



## Rehabilitation of Surgically Reconstructed Partially Edentulous Mandible with Iliac Crest Graft After Ameloblastoma Resection with an Implant-Supported “Toronto Prosthesis”

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### **Abstract**

Ameloblastomas are locally invasive and benign odontogenic tumors with a high long-term recurrence rate. These lesions can cause serious anomalies in the facial area and alveolar bones, leading deformity and deterioration of functions. Wide local excision and reconstruction are required for the surgical treatment of these tumors. Aggressive resection effectively eliminates tumors; however, this approach may cause various problems that need reconstruction to restore the oral functions. In the present case report, the rehabilitation of surgically reconstructed partially edentulous mandible with iliac crest graft after ameloblastoma resection with an implant-supported “Toronto Prosthesis” is presented. In the surgical procedure, mandible was partially resected and simultaneous iliac bone graft was applied. Then, four dental implants were inserted into the reconstructed bone and implant-supported Toronto prosthesis was fabricated. The patient was satisfied with the final result of the treatment and recurrence was not observed during the 2-year clinical follow-up.

## 1. Introduction

Ameloblastoma is classified as a benign tumor that forms from epithelial origin. Although it has benign characteristics, ameloblastoma is the most extensive odontogenic tumor with heavy clinical effects because of having locally aggressive growing pattern (Effiom et al., 2018). According to the grade of the tumor, two treatment techniques are used. Conservative treatments are chosen for the smaller lesions, while radical procedures are used for larger lesions because of the aggressiveness and recurrence risk (Zemann et al., 2007). Conservative approach includes enucleation and cauterization, curettage, cryotherapy, or marsupialization. This type of surgery prevents tissues, reduces facial disfigurement and enables sufficient quality of life post-surgery but it has higher recurrence risk (Effiom et al., 2018). Ameloblastomas are generally treated with radical surgeries. The treatment involves tumor resection with large bone borders followed by immediate or delayed bone reconstruction of the surgical defect (Effiom et al. 2018; Chiapasco et al., 2008; Goh et al., 2008). However, success of the treatment is also affected by the patient's physical and medical states and facial deformity (Effiom et al., 2018).

Esthetic and functional rehabilitation of the resected site is a challenging clinical situation for both surgeons and prosthodontists (Ozen et al., 2017). It is often difficult to satisfy anatomical and functional needs of the patients with conventional rehabilitation methods (Krishnan et al., 2021). Prosthetic options for the rehabilitation of these patients are removable prosthesis, implant retained overdentures, conventional implant-supported prosthesis, hybrid dentures, and implant-supported bar overdentures

(Krishnan et al., 2021). Implant-supported fixed prostheses are being beneficial for the treatment in terms of function and esthetics. However, due to the reduced height of the mandible, increased crown height can make the prosthesis of these patients very demanding (Krishnan et al., 2021). When the crown/implant ratio is higher than 1:1, higher forces are existed, and this can be detrimental for the implants (Krishnan et al., 2021). Implant-supported fixed prostheses can be screw-retained, cemented-retained, and the combination of these two methods (Montero et al., 2012). Toronto Prosthesis which combines two retention methods is a method that a substructure screwed on implant abutments and then, single or multiple crowns are cemented on this substructure (Montero et al., 2012; Nematollahi et al., 2018).

In this case report, rehabilitation of surgically reconstructed partially edentulous mandible after ameloblastoma resection and iliac crest reconstruction with an implant-supported "Toronto Prosthesis" was presented.

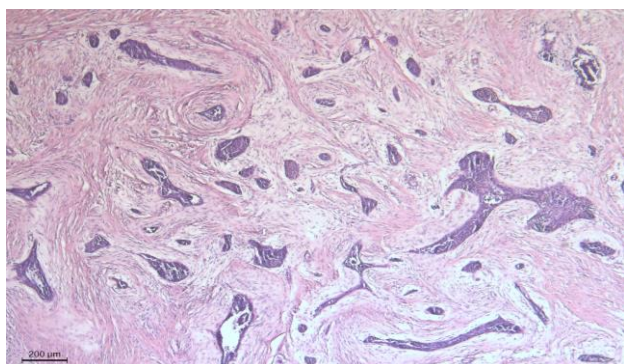
## 2. Case Presentation

A 35-year-old man with a radiolucent lesion on the left posterior side of the mandible was referred to Gazi University, Faculty of Dentistry, Department of Oral and Maxillofacial Surgery. In the anamnesis, it was observed that he did not have any systemic disease. Radiological examination showed a well-defined, multicystic radiolucent lesion with radiopaque borders, extending 3,6×3×2 cm (Fig. 1).



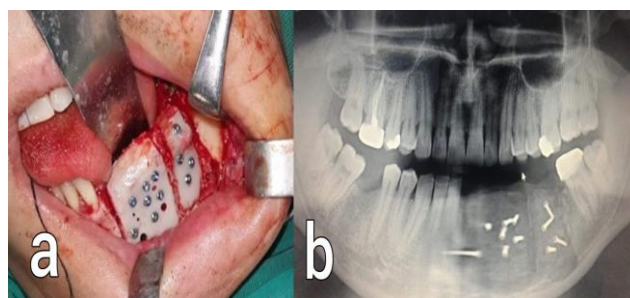
**Figure 1.** Panoramic radiograph of the patient before the operation.

Incisional biopsy was applied under local anesthesia and the biopsy material was sent for histopathological examination. Histopathological analysis revealed a benign epithelial odontogenic tumor containing infiltrative islands within desmoplastic collagenized connective tissue. The tumor islands consisted of a palisading of columnar cells at the periphery, and loosely arranged stellate reticulum-like cells at the center of the islands. Some tumor islands which become squamoid and/or elongated were seen in the desmoplastic stroma. The lesion was diagnosed as desmoplastic type ameloblastoma (Fig. 2).



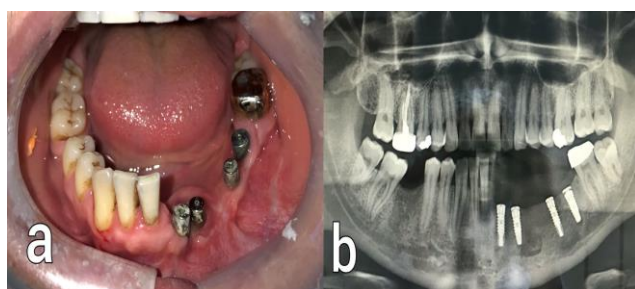
**Figure 2.** Histopathological view of the lesion. Squamoid and/or elongated ameloblastoma islands infiltrated into desmoplastic stroma (Hematoxylin&Eosin x40).

Thus, a multidisciplinary treatment was planned, including excision of the tumor with wide surgical excision, application of iliac crest bone graft, and rehabilitation with implant-supported fixed prosthesis. Information was given about the treatment procedures, and the patient signed informed consent forms. Under general anesthesia, regional and infiltrative anesthesia was applied to the surgical area. In the left mandibular region, the lesion was resected with intact bone tissue that was 1 cm around the lesion. Mandible was reconstructed by using left iliac crest graft (6x3 cm in dimensions). Iliac crest graft was fixed to mandible with mini screws (Fig. 3 a, b).



**Figure 3.** Iliac crest graft fixation a) clinical view b) panoramic view.

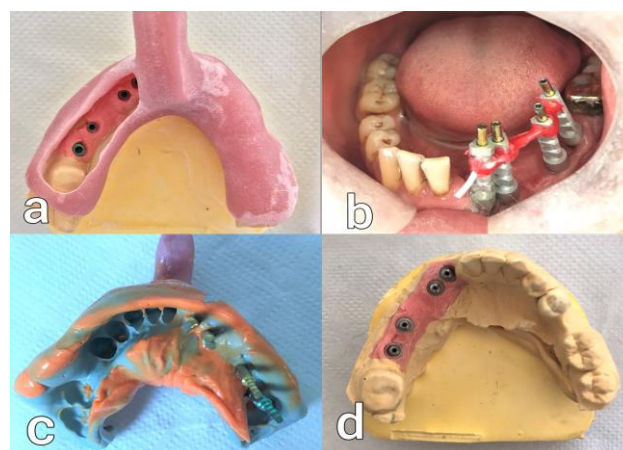
No complication like paresthesia was observed after the surgical procedures. After six months later the surgical reconstructions, the operated site was examined with panoramic radiography. Four dental implants (Thommen Medical Implants, Grenchen, Switzerland) were placed after complete healing of the reconstructed site. Three months were waited for the osseointegration and healing abutments were placed (Fig. 4 a, b).



**Figure 4.** a) Intra-oral view of the left mandible with four implants. b) Panoramic view of the implants inserted in the left mandible.

Then, the patient was referred to Gazi University Faculty of Dentistry, Department of Prosthodontics for prosthetic rehabilitation. Mandibular restoration is supposed to restore both hard and soft tissues with implant-supported fixed partial prosthesis. Due to the increased inter-occlusal space (crown height), it was decided to fabricate a Toronto Prosthesis, which is a combination of fixed partial prosthesis cemented on intermediate substructures. Impression was taken from the mandible with an irreversible hydrocolloid impression material (Alginoplast; Heraeus Kulzer, Hanau, Germany) and an individual tray was prepared for the patient (Fig. 5 a). Multi-unit abutments were attached to the implants and screwed with a torque value of 15 Ncm according to the manufacturer's recommendations. Then, multi-unit impression copings for open tray were placed. Impression copings were splinted using autopolymerized acrylic resin (Pattern Resin™ LS, GC America INC, USA). Then, impression was taken using the open tray method with condensed silicone (C-silicone; Zetaplus Zhermack S.p.A., Badia Polesine, Italy) (Fig. 5b). In addition, impression was taken from the upper jaw with an irreversible hydrocolloid impression material (Alginoplast; Heraeus Kulzer, Hanau, Germany). After attaching

the implant analogs to the impression copings (Fig. 5c), a silicone material (Zhermack Gingifast Rigid, Zhermack S.p.A., Badia Polesine, Italy) was injected around the coping analogues. Then, type IV dental gypsum material (Denston Synthetic Plaster (Type-4), Ankara, Turkey) was used to obtain casts (Fig. 5d).



**Figure 5.** a) Individual tray prepared for the patient. b) Splinting of impression copings using autopolymerized acrylic resin of multi-unit open impression posts placed on multi-unit abutments. c) Impression after attachment to impression copings of implant analogues. d) Obtained gypsum model with multi-unit abutments.

A metal substructure was made with laser sintering (Sisma SpA 3Shape 2020/ 3Shape D1000, Piovene Rocchette (VI), Italy) system and after a clinically acceptable passive fit was confirmed, it was covered with pink porcelain to imitate soft tissues. Then metal-ceramic crowns were made. The adaptation of the metal substructure with the gingiva and the compatibility of the metal-ceramic crowns with the metal substructure were evaluated intraorally (Fig. 6).





**Figure 6.** Intra-oral view of the metal substructure produced by laser sintering system.

The occlusion was checked and premature contacts in centric occlusion and lateral movement were eliminated. After the metal substructure was screwed with a torque value of 30 Ncm, teflon tape was inserted into the screw holes, the holes were closed with temporary impression material (PSP Dental Nucavfil, Belvedere, Kent, UK). Finally, the crowns were cemented on the metal substructure with zinc polycarboxylate cement (Adhesor Carbofine, SpofaDental a.s., Europa, EN) (Fig. 7 a,b).



**Figure 7.**a) Compatibility of metal-ceramic crowns, b) Crowns cemented on metal substructure.

The “Toronto prosthesis” made of metal-porcelain crowns on a metal substructure was delivered and the patient was informed about the oral hygiene procedures. The patient was satisfied with the prosthesis in terms of esthetical appearance and function. Tumor recurrence was not observed during the 2-year clinical follow-up.

### 3. Discussion

The ameloblastomas which are defined as benign odontogenic tumors arise from remnants of malassezous epithelial cells and aggressively infiltrate trabecular bone resulting in local tissue deformities (Mareque Bueno et al., 2007). 80% of lesions in the literature are located in the mandible and most of them occur in the molar region or ramus (Zemann et al., 2007). Resective procedures are the most definitive treatment options to minimize recurrence, but may lead to loss of orofacial function and esthetics. There are studies presenting successful rehabilitation of maxillofacial defects reconstructed using non-vascularized/vascularized free grafts and implants (Goh et al., 2008; Cuesta-Gil et al., 2009; Askin et al., 2015). And also, dental implant-supported prostheses are often the ideal prosthetic rehabilitation by ensuring superior stability and function for the treatment of functional, esthetic, and phonetic problems associated with resected sites. Chiapasco et al. (2008) retrospectively investigated the clinical results of iliac crest and calvarial bone grafts after tumor resection. All grafts healed successfully and graft resorption was noted only in 1 patient. 60 implants were placed in the graft sites in 29 patients, only 2 of them were failed.

In the present case report, the defect was reconstructed after resection of the ameloblastoma together with the healthy bone around it, and then iliac crest graft was applied by giving the appropriate shape to the defect area. The iliac crest is a suitable site for an extra oral donor site, because it provides a high amount of pluripotent cells and its corticocancellous nature preserves a larger volume than cancellous particle grafts (Leonetti et al., 2003).

However, getting the autogenous iliac bone graft is needed supplementary surgical time and has related risks of intraoperative and postoperative complications. It was reported that cases treated with iliac crest grafts experience prominent postoperative pain in approximately 5 years after graft removal (Zemann et al., 2007; Leonetti et al., 2003). In the present case report, the patient did not experience any sensitivity, pain, and numbness after the surgical operation was completed. He did not have any complaints during the 2 years following the surgical procedures. The implants were applied 6 months after graft placement simultaneously with resection. Thus, it was noticed that delayed insertion of implants into the autogenous bone grafts had a better success rate than simultaneous emplacement of implants during allograft reconstruction (Kim and Ghali, 2011; Viscioni et al., 2010).

Prosthetic rehabilitation of the partially resected and reconstructed jaws has complexity because it is often difficult to restore the deformities in terms of function and esthetics. Combination of screw-retained and cement-retained implant-supported prostheses is beneficial for the patients especially when crown height increased or abutment angulation is needed. Combination of two retention system has been presented in the case reports with different prosthodontic procedures and manufacturing techniques (Krishnan et al., 2021; Montero et al., 2012; Baig et al., 2009). In the present case report, the patient was rehabilitated with implant-supported Toronto Prosthesis comprised of six teeth, supported by four implants. Toronto prostheses are not frequently used; however, this prosthetic design should be beneficial for some patients by combining the advantages of both cement-retained and screw-

retained implant-supported prostheses (Baig et al., 2009). A metal substructure was prepared and screwed on the multi-unit abutments. Pink colored porcelain was used to mimic the soft tissues in gingival areas (Montero et al., 2012; Nematollahi et al., 2018). The main advantage of this metal substructure is implant position/angulation and implant emergencies could be corrected (Nematollahi et al., 2018). In this prosthesis design, crowns are cemented on the metal substructure. And this provides that each crown can be prepared in the correct position regardless of location of screw holes (Nematollahi et al., 2018). The crowns are provisionally cemented on the substructure for enabling easy retrievability, repair, and maintenance (Baig et al., 2009). However, the crowns were permanently cemented in the present case report due to the risk of dislodgement of the crowns in function. Because the patient was living in another city and decementation would be undesirable for him. This technique has also some disadvantages. The technique is time consuming because it has complex laboratory procedures. And also, it has higher laboratory costs (Baig et al., 2009).

#### 4. Conclusion

Extensive ameloblastomas are successfully treated with multidisciplinary treatments that contain radical resection, mandibular segment reconstruction with iliac crest graft transfer, and dental implants. With these procedures, important progress can be achieved in the life quality of patients, both esthetically and functionally. Frequent maintenance periods including clinical and radiographic evaluations are suggested to determine inflammatory changes. The treatment of ameloblastoma is sensitive. Complications generally

exist after the first 5 years of the resection and it cannot guarantee future recurrence of the tumor. In the existing case, extensive resection and rehabilitation with iliac crest graft and dental implants resulted in a good outcome after two years; however, yearly examination of tumor recurrence is necessary. Also, for the long-term achievement and care of dental implants placed in reconstructed areas, the prosthesis should be designed to allow the patient easily clean it. Patient should be informed about the oral hygiene procedures and daily maintenance should be performed.

### Conflicts of interest

The authors declare that they have no conflicts of interest.

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