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Mandibular Reconstruction in Ameloblastoma Using Allogeneic Cord Stem Cells and Alloplastic Graft Material- Case Report

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Abstract

Ameloblastoma is a histologically benign odontogenic tumour and has a tendency of locally aggressive behaviour. This is second most prevalent odontogenic tumour and most common in the molar-ramus-angle region and surgical resection is only treatment option. In this article, we propose an innovative approach to deal with these cases by using alloplastic graft with cord stem cells. Over 2.5 years follow-up, we could demonstrate bone regeneration using this technique with no recurrence. To the best of our knowledge, this is the first report of successful regeneration of part of ramus and body of mandible using allogeneic cord stem cells in cases of Ameloblastoma.

***Keywords*:** Ameloblastoma, Mandibular reconstruction, Allogeneic cord stem cells, Allogeneic graft material

Introduction

Ameloblastoma being the most common clinically significant odontogenic tumor, it accounts for 11% of all odontongenic tumours. Histologically, the most common histological subtypes of Ameloblastomas are follicular, plexiform, acanthomatous, granularcell, basal cell and desmoplastic. Large tumours often show a combination of these microscopic patterns [1]. The lesion has a high recurrence rate and if not treated, it can increase significantly in size, resulting in severe facial dysmorphology and functional disability. Established literature supports two therapeutic options: radical resection or conservative treatment such as enucleation [2]. To the best of our knowledge this is the first case that demonstrated successful mandibular

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regeneration by filling the defect created during curettage with the use of allogeneic cord stem cells and allogeneicgraft material.

Case Report

A 29 year old female reported to the department of oral and maxillofacial surgery with the chief complaint of swelling on the right side of the lower jaw since 3 months. Intra oral examination revealed missing 46, 48, 16, 18, and 36with buccal cortical plate expansion in relation toright mandibular posterior region. Aspiration was negative, Panoramic radiography (OPG) revealed impacted right lower wisdom tooth (48) with multilocular radiolucent lesion involving part of the body and ramus of the mandible (Figure 1).

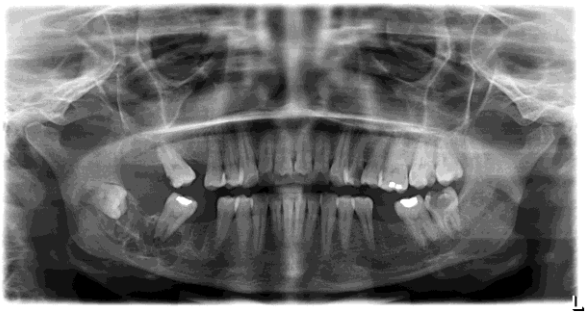

Figure 1. Panoramic radiograph showing a multilocular radiolucent lesion around impacted 48 involving part of the body and ramus of mandible.

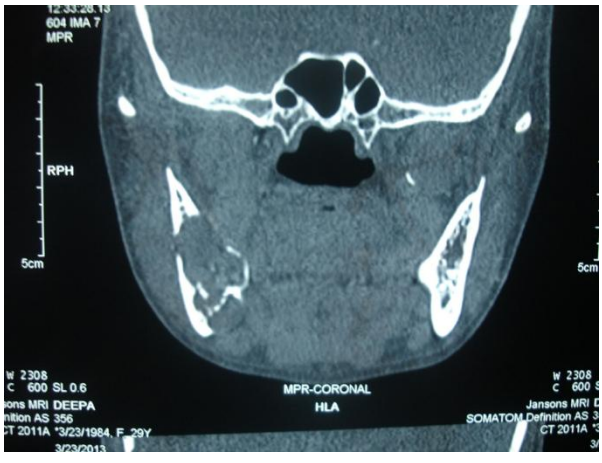

Figure 2. Preoperative CT showing cortical bone expansion, bone perforation in the buccal, lingual and lower border of right mandibular ramus and body.

Preoperative computed tomography (CT) revealed cortical bone expansion and bone perforation in the buccal, lingual and lower border of right mandibular,ramus and body (Figure 2).

Histopathology report confirmed the lesion as Ameloblastoma. Mandibular reconstruction was planned with stem cell incorporation in collaboration with Mother cell regenerative centre Pvt Ltd Tirchy, Tamilnadu, India. This study was approved by the local ethics committee of the KSR College of dental science and research, Tiruchengode, Tamil nadu, India.

Operating Procedure

Patient consent was obtained for the procedure described below.

The patient's right mandibular lesion was exposed via intraoral approach, right lower 2nd molar (47) was removed and the lesion was curetted. Thin cortical plates present buccally, lingually and at intralesion sites were removed and impacted right lower wisdom tooth also removed. Multiple small perforations were cauterized with diode laser under proper protective measures.

During operative procedure15 ml of blood was collected from the patient and platelet rich plasma (PRP) was prepared. Prepared PRP by first spin was at 1500 rpm for 10 minutes and second spin was at 3000 rpm for 10 minutes. After obtaining the PRP, cord stemcells were segregated through nutrient media by centrifuge. Cord stemcells which were obtained from Mothercell regenerative centre Pvt Ltd had proper certification. Both stem cells and PRP were mixed and kept ready in a test tube to be placed inside the defect. PRP acts as nutrient for stem cell until it gets nutrient from surrounding tissues. Viability of these cells was tested by methylene blue dye exclusion test before placing in the defect.

After complete removal of the lesion, the defect was irrigated with saline, washed with platelet poor plasma, followed by placement of 3 allogeneic graft material- sterile synthetic beta-tricalcium phosphate – plugs (25 mm x 12 mm) at the bottom of the defect, which act as scaffold for stem cells. Forty million cord stem cells mixed with PRP were placed over the graft material and two more graft materials were placed over primary graft material. 15 ml solution contains 40

million stem cell and PRP. The surgical wound was closed without tension, OPG was taken one week post operatively (Figure 3).

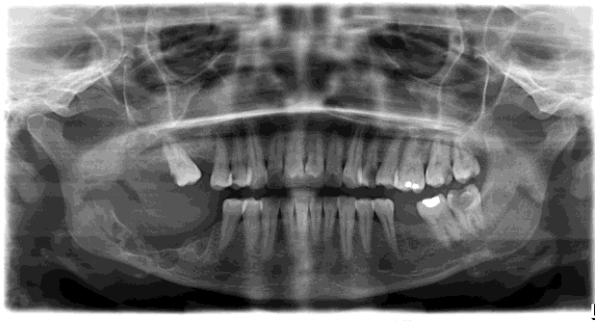

Figure 3. Postoperative Panoramic radiograph taken after One weeks showing resorbed body of mandible, part of ramus, and thin border of mandible on right side.

Post-operative biopsy was follicular ameloblastoma. Patient was examined on a monthly basis, with OPG at every third month visit during first year of follow-up, followed by once in six months during second year. Over the course of 2.5 year follow-up, patient showed an uneventful healing process with no signs of rejection, reaction or recurrence till the last follow-up. At latest follow-up visit, biopsy was performedat 46 region to asses the bone quality. Histological report demonstrated dense cortical bone formation arranged in lamellar pattern without any pathology (Figure 4).

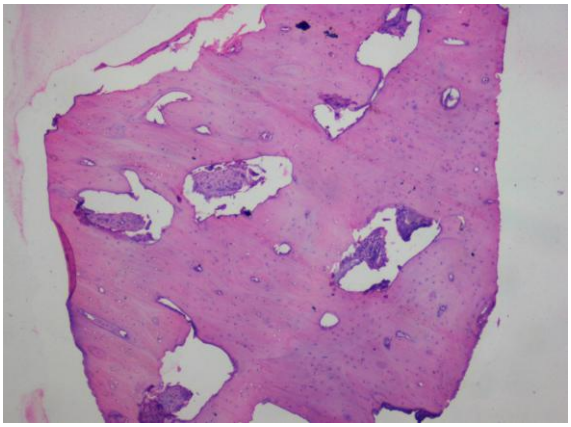

Figure 4. Histopathological report demonstrate dense cortical bone formation with lamellar pattern without any pathology.

After biopsy OPG was taken it reveals normal bone formation with no recurrence of lesion (Figure 5).

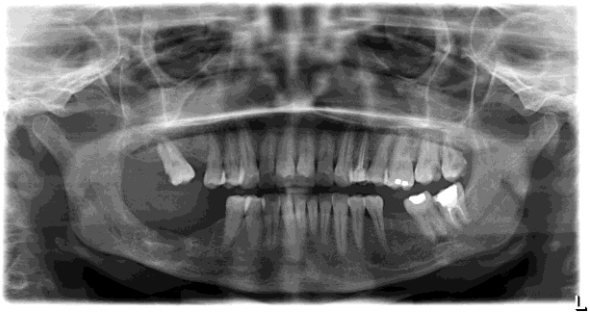

Figure 5. Follow up Panoramic radiograph over the course of 2.5 years reveals normal bone formation with no recurrence of lesion.

Discussion

Ameloblastoma is a benign aggressive odontogenic tumourof epithelial origin that may arise from the enamel organ, remnants of dental lamina, the lining of odontogenic cyst(dentigerous cyst) or possibly from the basal epithelial cells of the oral mucosa. The clinicopathological features are benign with a slow growing pattern, but locally invasive and the high recurrence is a problem for clinicians. Unlike carcinomas, ameloblastoma as are circumferentially derived by a continuous basement membrane, and they tend to spread into tissue spaces by expanding their compartment volumes. According to Tingehunetal, a tumour that lies adjeacent to or is contained within the mandibular canal may destroy and grow into the canal [3]. Nakamuraetal detected neither invasion into the nerve sheath nor invasion into the nerve itself by ameloblastomas [4]. Hong et al. have shown that the follicular, granular cell of acanthomatous types have a relatively high likelihood of recurrence whereas desmoplastic, plexiform and unicystic type show a relatively low potential form recurrence [1]. Treatment of ameloblastoma is primarily surgical. The conservative modalities include curettage, enucleation and crycosurgery whereas the radical modalities are marginal segmental and composite resection. According to many authors radical treatment is associated with serious cosmetic functional and aesthetic problems.Several authors have recommended enucleation rather than partial or complete jaw resection to treat unicystic ameloblastoma. Recurrence rate was 30.5%, 18% in enucleation and

marsupialization methods respectively. Enucleation with carnoy's solution and resection demonstrated 16% and 3.6% respectively [5]. However our case has not shown any signs of recurrence over a period of 2.5 yr follow up.

There has been an interest in recent past regarding use of Adipose stem cell tissue (ASCs) -engineered construct to treat large anterior mandibular defect. Sandoor et al. concluded that ASCs in combination with β-TCP and BMP-2 offer a promising construct for the treatment of large, challenging mandibular defects without the need for ectopic bone formation [6]. Wolf et al. have concluded that constructs with ASCs, β-TCP scaffolds, and rhBMP-2 can be used to reconstruct a variety of large mandibular defects in their experience with 3 cases [7]. Mesimäki et al. have demonstrated ectopic bone formation using autologous ASCs in microvascular reconstruction surgery [8]. We have used cord stem cells and could demonstrate dense cortical bone formation arranged in lamellar pattern.

Sandra F et al. has been reported that human mesenchymal stem cells suppressed noticeably osteoclast differentiation and activation. Also Oshita et al. demonstrated that human MSCs have potential to improve bone erosive diseases [9].

Manimaran K et al. they successfully treated two cases of osteoradionecrosis (ORN) without resecting jaw, where conventional methods have failed. One case treated with Autologous bone marrow concentrate (MSC) and another case treated with dental pulp stem cell (DPSC) were mixed with tricalcium phosphate. It avoids the deformity and functional loss [10].

With this concepts we decided to treat ameloblastoma with MSC stemcells which acts both by antitumour mechanisms and also by preventing osteoclastogenesis. Being a single case report study has limitation and need to prove the concept in many more patients. There is poor consensus in treatment modalities of ameloblastoma, hence we are in process of recruiting more number of patients to validate the results achieved in this case.

References

[1] Hong, J; Yun, PY; Chung, IH; Myoung, H; Suh, JD; Seo, BM; Lee, JH; Choung, PH. Long term follow up on recurrence of 305ameloblastoma cases. *Int J Oral Maxillofacial Surg*, 2007, 36, 283–8.

[2] Zemann, W; Feichtinger, M; Kowatsch, E; Kärcher, H. Extensive ameloblastoma of the jaws: surgical management and immediate reconstruction using microvascular flaps. *Oral Surg Oral Med Oral Pathol Oral RadiolEndod*, 2007, 103, 190-6.

[3] Wu, TC; Chen, Z; Tian, FC; Tian, QZ; You, CT. Ameloblastoma of the mandible treated by resection , preservation of the inferior alveolar nerve , and bone graft. *J Oral Maxillofac Surg*, 1984, 42, 93-6.

[4] Nakamur N; Mitsuyasu, T; Higuchiy; Sandra, F; Ohishi, M. Growth. Characteristics of ameloblastoma involving the inferior alveolar nerve - a clinical & histopathological study - Oral surgery, Oral medicine, Oral pathology, Oral radiology. *Endodontics*, 2001, 91, 557 – 62.

[5] Lau, SL; Samman, N. Recurrence related to treatment modalities of unicystic ameloblastoma: a systematic review. *Int J Oral MaxillofacSurg*, 2006, 35, 681-90.

[6] Sándor,GK; Tuovinen,VJ; Wolff,J; Patrikoski, M; Jokinen, J; Nieminen, E; Mannerström, B; Lappalainen, OP; Seppänen, R; Miettinen, S. Adipose Stem Cell for Bone Regeneration. *J Oral MaxillofacSurg*, 2013, 71, 938-50.

[7] Wolff, J; Sándor, GK; Miettinen, A; Tuovinen, VJ; Mannerström, B; Patrikoski, M; Miettinen, S. GMP-level adipose stem cells combined with computer-aided manufacturing to reconstruct mandibular ameloblastoma resection defects: Experience with three cases. *Ann MaxillofacSurg*, 2013, 3, 114-25.

[8] Mesimäki, K; Lindroos, B; Törnwall, J; Mauno, J; Lindqvist, C; Kontio, R; Miettinen, S; Suuronen, R. Novel maxillary reconstruction with ectopic bone formation by GMP adipose stem cells. *Int J Oral MaxillofacSurg*, 2009, 38, 201-9.

[9] Sandra F, Hendarmin Let al – Ameloblastoma induces osteoclastogenesis: a possible role of ameloblastoma in expanding in the bone. *Oral Oncology* 2005 41, 637-644.

[10] K. Manimaran, S. Sankaranarayanan, V. R. Ravi, S. Elangovan, M. Chandramohan, S. Mahendra Perumal : Treatment of osteoradionecrosis of mandible with bone marrow concentrate and with dental pulp stem cells : *Annals of Maxillofacial Surgery* | July - December 2014 | Volume 4 | Issue 2 / 189 -192.