

Analysis of Titanium Reconstruction Plates in Patient's with Mandibular Benign Tumor

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Abstract

Purpose: The purpose of this retrospective clinical study was to evaluate the efficacy and the utility of titanium reconstruction plates in the management of the mandibular benign lesion. The complications associated with plate use were also assessed.

Patients and methods: The clinical and radiological data of 16 patients (5 males, 11 females) with Mandibular benign lesions were evaluated. During operation, reconstruction plates were used to restore mandibular contour or to allow for bone reconstruction after segmental or disarticulation resection. The mean follow-up time was 9.72 months.

Results: Among 16 patients 4 patients were having postoperative complications observed during 36 months follow up. Reconstruction plate was removed from three patients because of fracture and screw loosening. A plate

was exposed Extra-orally and Intra-orally in 2 patients who had undergone a disarticulation resection and segmental resection along with screw loosening.. 3 customized pre-bended plates used with contouring on 3D model, they all had excellent results after 9 months follow up.

Conclusion: Reconstruction plates can be safely used to manage mandibular benign lesions. Plate bending is difficult and it requires time for adaptation during operation. All complications can be managed with careful follow-up.

Keywords: Reconstruction plate, Micro-vascular, Ameloblastoma, Disarticulation resection.

Introduction

Odontogenic benign tumors are unique to the jaw, more so common in mandible many of which behave more

aggressively and possess a high rate of recurrence when treated by methods, other than the resection. The resulting mandibular continuity defects require reconstruction due to the complex function of the mandible. It is important for providing a good functional as well as cosmetic result. Early return of mandibular function and support of oral soft tissue helps to minimize oral incompetence and collapse of oral airway with improved speech. Free vascularized bone transfer met most of the reconstructive criteria, however, special skills, increased operating time, donor site morbidities and graft recontouring difficulties has limited its practical use. [1]

Titanium reconstruction plate is an alloplast for bridging of mandibular defects. Its ability to be shaped, its structural rigidity and ease of application make the plate ideal for variety of procedures. Recently, complications associated with the use of reconstruction plates in patients who have undergone malignant tumor resections have

been reported. However, utility of the reconstruction plates for management of benign mandibular lesions is not much discussed.[2] Therefore, in this study we evaluated the clinical outcomes of reconstructions plates to manage benign lesions. Few complications associated with it is also discussed.

Materials and methods

16 patients who were treated for mandibular benign tumor with immediate reconstruction using Titanium reconstruction plates at the Department of Oral and Maxillofacial Surgery, Government College of Dentistry Indore (M.P.), from July 2017 to July 2020 was retrospectively reviewed. Defect reconstructed included 7 disarticulation resection, 8 segmental resection and 1 curettage (without continuity defect). The distributions of tumor types, extent of defect, side of defect and type of plate (Standard/customized) along with demographic details are listed in table I.

Ca se.	Age/s ex	Diagnosis	Treatment	Lesion site	Complication	Plate type	Follow up	Complicati on occurs
1	39/F	Ameloblastoma	Disarticulation Resection	Left	Nil	Standard	36 month	-
2	48/F	Ameloblastoma	Segmental resection	Left	Nil	Standard	36 month	-
3	32/F	Ameloblastoma	Disarticulation resection	Right	Plate exposed (Intra-oral) & Screw loosening	Standard	36 Month	After 12 month
4	20/F	Odontogenic myxoma	segmental resection	Right	Plate fracture	Standard	35 month	After 13 month
5	45/F	Ameloblastoma	Disarticulation resection	Left	Nil	Customized	33 month	-
6	15/m	CGCG	Disarticulation resection	Left	Nil	Standard	33 month	-

7	55/M	Recurrence of Ameloblastoma	Segmental resection	Right	Nil	Customized	24 Month	-
8	60/F	CGCG	Segmental resection	Anterior	Nil	Standard	23 Month	-
9	30/M	Ameloblastoma	Disarticulation resection	Left	Plate exposed (Extra-oral) & Screw loosening	Standard	21 month	After 5 month
10	40/F	Ameloblastoma	Disarticulation resection	Left	Nil	Standard	16 month	-
11	35/F	Ameloblastoma	Segmental resection	Left	Nil	Standard	16 Month	-
12	32/M	Ossifying Fibroma	Segmental resection	Left	Nil	Standard	11 month	-
13	53/F	Ameloblastoma	Disarticulation resection	Left	Nil	Standard	10 Month	-
14	22/F	CEOT	Curettage	Right	plate exposed (Intra-oral)	Standard	8 month	After 1 month
15	70/F	Recurrence of Ameloblastoma	Segmental resection	Left	Nil	Customized	6 Month	-
16	30/M	Ameloblastoma	Segmental resection	Left	Nil	Standard	6 month	-

Indication for segmental resection, or disarticulation resection were based on clinical involvement of both lingual and buccal cortex, extent of lesion which was confirmed with radiological evidence (CT mandible and OPG).

Figure 1: OPG showing large multilocular lesion involving Ramus, Angle, body on left side



Figure 2: 3D CT Mandible showing destruction of buccal and lingual cortex



Patients were evaluated for intra-operative and post-operative complications. Follow-up period varied from 8 months to 36 months.

In three patients customized Titanium reconstruction plate was fabricated on 3D model and in remaining prefabricated standard titanium reconstruction plate was used. Post-operative Intermaxillary fixation for 1-3 weeks were also done. Patients were reviewed throughout the follow up period. None of these patients was lost during follow up period.

Results

The clinical records of 16 patients, 5 males and 11 females aged 15–70 years were reviewed. The mean patient age was 39.25 years, and the mean follow-up period was 9.27 months. No recurrence was noted in any patient during follow-up. 9 patients had ameloblastoma, 2 patients had a recurrence of ameloblastoma, 2 patients had central giant cell granuloma, 3 patients had odontogenic myxoma, pindborg tumor (CEOT), and ossifying fibroma respectively. 7 patients (43%) had undergone disarticulation resection, 8 patients (50%) undergone segmental resection and in 1 patient (6%) curettage had

been done. The mean follow-up in disarticulation resection was 26.42 months, segmental resection was 19.62 months and curettage is 8 months. All disarticulation resection defects were fixed with standard Titanium reconstruction 2.7mm plate with 3 screws, 5 segmental defects reconstructed with standard Titanium 2.7mm reconstruction plate and 3 screws on either side, 3 segmental defects were reconstructed with customized Titanium 2.7mm reconstruction plate with 3 screws on either side and in 1 patient with curettage Titanium 2.7mm reconstruction plate used for stability and support with 3 screws on either side. In 13 patients the titanium plate bended intra-operatively and in 3 patients we used prebended customized plate on the 3D model. The total intra-operative time when standard Ti reconstruction plate used was 2hrs and 30 minutes and with customized Ti plate was 1 hr and 40 minutes.

All patients were satisfied with their facial appearance and were able to chew semi-solid food after 1 week of surgery. Patients were able to eat hard food from normal opposite side after 4 weeks but 4 patients (3 disarticulation resection and 1 segmental defect reconstruction) complained of difficulty in chewing even after 3 months. We observed that the left side (56%) of the mandible were more commonly involved. 4 patients (25%) had postoperative complications, with a mean follow up 7.75 months. 2 patients who had undergone disarticulation resection had one extra-oral and one intra-oral plate exposure with screw loosening in 5month (extra-oral) and 12 months (intra-oral) respectively. One patient who had segmental resection after 13 months plate fracture occurred and in 1 patient with curettage had intraoral plate exposure.

Discussion

Odontogenic benign tumors commonly involve mandible and are locally destructive. Many patients remain

asymptomatic till significant involvement and destruction of jaw bone which leads to resection of the jaw for complete cure. Reconstruction of the defect is challenging, requires surgical expertise, advanced care centers and higher costs. Reconstruction of defects upto 6 cm can be done with nonvascular bone graft.[3] Larger defects require micro-vascular free autogenous graft, transport distraction osteogenesis which require advance centres and multiple procedures for definitive reconstruction.[4] In India these are limited owing to higher number of patients, co-morbidities and non-availability at many places especially in rural areas. However, primary reconstruction with Titanium reconstruction plate with limited surgical expertise in smaller set-up can provide technically and economically temporary or sometimes even permanent reconstruction until more definitive care can be available.[2]

In this study, 16 patients who were treated for benign mandibular tumor with resection and reconstruction with Titanium reconstruction plate, were retrospectively reviewed for the efficacy and complications. All 16 patients have regular follow up. Of the 16 cases operated, there were no significant intraoperative complications, except for plate adaptation, it was difficult in all cases of reconstruction with standard Titanium plates. 1 case had suture opened intraorally in first week post-operatively which was managed with resuturing under local anaesthesia. From the available information, there is no recurrence of the primary lesion in any of the cases during the entire period of follow-up.

Radiotherapy and the use of plate crossing the midline of the mandible have been a significant risk factor for plate exposure.[2] In our study, no patient was treated with radiotherapy but in 2 patients who had ameloblastoma crossing the midline had plate exposure. Yao et al. found that a greater surgical defect size may also trigger plate-

related complications like plate exposure. [5] one patient who had undergone curettage had plate exposure. In Figure3. Intra-oral plate exposure

curettage most likely because of shrinkage of oral mucosa and oral tissue during healing.[2]

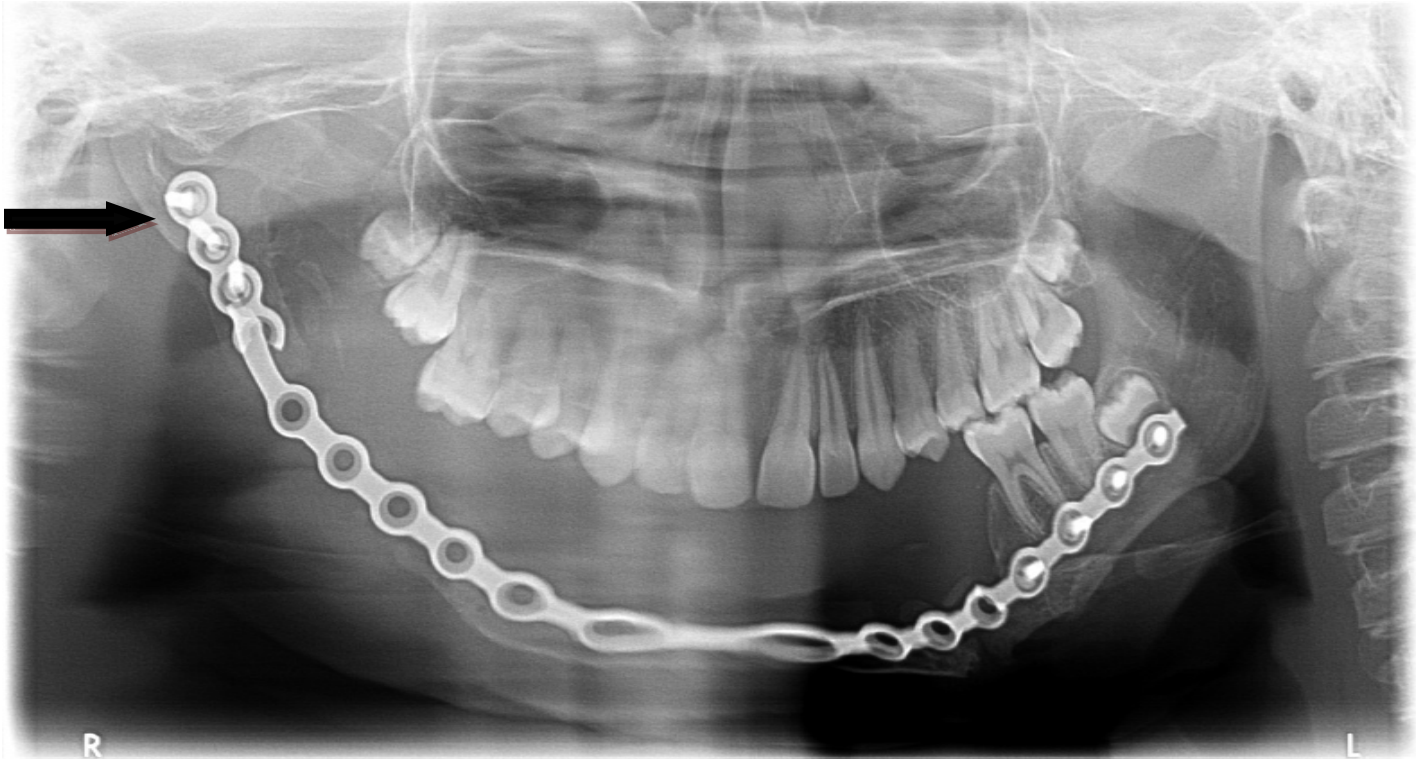


In two patients with recurrent ameloblastoma treated with disarticulation resection and standard Ti reconstruction plate, had screw loosening and plate exposure. Apart from these two patients all patients were treated with locking reconstruction plates. The plate was subsequently removed and definitive reconstruction was done using free fibula graft in one patient and in second patient a standard Ti reconstruction plate was used. Arias- Gallo et al. reported that screw loosening was provoked principally by

failure of condylar stump fixation, mechanical failure over period of time. [6] Within the limitations of our present study it may be recommended to use locking plates which reduces or eliminates screw loosening. Frequent torsion and the presence of opposing teeth seemed to be risk factors for plate fracture.

In 1 patient with odontogenic myxoma and segmental resection there was plate fracture after 13 months.

Figure 5: Reconstruction Plate fracture as evidenced on OPG



The patient was dentulous on the opposite side, consistent with literature reports. Plate was subsequently removed and other standard Ti reconstruction plate was placed as patient denied for other modes of reconstruction. The bite force affects mechanical stress imposed on the plate. The plate fracture may also be caused by extensive Intra-operative bending of the reconstruction plate. [2,7] This may be another advantage of using customized prebended Ti reconstruction plate on models. After such plate fracture, management options are limited. The plate can be removed but the patient may require permanent reconstruction including graft of vascularized autogenous bone. *Peacock et al.* in his study treated three patients with fractured reconstruction plates by placing customized prosthesis engaging the plates and that was stable at 9th month follow up. [8]

Placement of a titanium reconstruction plate during surgery requires time and surgical skills. Even when an extra-oral approach is chosen to allow direct access to the reconstruction site,[9] Intra-operative plate bending is more challenging because of the difficulty accessing the surgical site, especially at the posterior mandible. [2]

We had used customized pre-bended plate in 3 patients which was contoured on 3D model obtained from CT scan but the disadvantages of this are higher costs. It is not possible for all patients to afford cost of 3D model. The advantages of the model before surgery reduces the intra-operative time and ensure the appropriate adaptation of the plate to the mandible. [2]

Figure 6: Customized pre-bended Titanium Reconstruction plate with adaptation on model and on mandible intra-operatively.



From 36 months follow up, it is evident that the titanium reconstruction plate is a viable option for patients who cannot undergo advanced major surgeries or because of lack of microvascular surgical expertise. We evaluated outcomes of the success of titanium plate in terms of exposure and fracture. Out of 16 patients, we noticed there

Conclusion

Standard Ti Reconstruction plates can be safely used to manage mandibular benign lesions although with 3D models, its accuracy and outcomes may improve but also increases the cost of treatment. Some complications can be seen after the use of titanium reconstruction plate, but the success rate is high and complications can be

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are complications only in 4 patients and in only 3 there was need to replace the plate which implies that the titanium reconstruction plate has excellent dimensional stability, and strength, resisting breakage from masticatory stress. [10]

managed. Long term follow up with larger sample size may further help in evaluating other complications relating to this method of reconstruction. Patients should be informed about possible complications, and surgeons must schedule close follow-up visits to manage any complications that arise.

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