



## Mandibular Reconstruction using AO/ASIF Stainless Steel Reconstruction Plate: A Retrospective Study of 36 Cases

G Harsha, S Ganesh Kumar Reddy, Sunil Talasila, S Abdus Salaam, M Srinivasulu, V Sridhar Reddy

### ABSTRACT

**Aim:** The study was aimed at esthetic and functional results as well as patient tolerance after reconstruction with reconstruction plate. The follow-up ranged from 1 to 4 years.

**Materials and methods:** A retrospective study of 36 patients who had mandibular reconstruction with AO/ASIF stainless steel reconstruction plates after oncologic resection was evaluated. The indications and postoperative outcomes were studied.

**Results:** At the end of study, 24 of 36 patients (67%) still had the plate in place. Around three (8%) plates were fractured. Nine (25%) plates got exposed leading to surgical intervention. Surgical results were satisfying, particularly when looking at delayed healing or long-term tolerance. Esthetic (79% rated results as good or acceptable) and functional results of this reconstruction were satisfying.

**Conclusion:** We conclude by saying that reconstruction plate provides a solution for safe and rapid mandibular reconstruction for patients with poor prognosis or poor condition. This method also preserves the possibility of secondary reconstruction.

**Clinical significance:** The reconstruction plate may be a good clinical choice for safe and rapid mandibular reconstruction.

**Keywords:** Reconstruction plates, Mandibular reconstruction.

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### INTRODUCTION

The goals of mandibular reconstruction after oncologic resection are achievement of primary wound closure, functional improvement of phonation, deglutition and esthetic preservation. The final aim of the reconstruction is to allow prosthetic rehabilitation. The benefits of mandibular

reconstruction are controversial on all of these points, particularly for prosthetic rehabilitation.<sup>1</sup>

The only need for mandibular reconstruction that is generally accepted is the need for symphyseal reconstruction.<sup>2</sup>

In oncologic surgery, the need for mandibular reconstruction frequently arises. It is rendered more complex than other clinical situations because of the associated mucosal, muscular and neurologic defects. Additionally, local conditions are difficult: Irradiated surgical site, precarious general patient condition and the need for tumor ablation. These elements make mandibular reconstruction challenging. There are many surgical techniques for such a reconstruction.<sup>3</sup> The development of microvascular surgery has placed the vascularized osteocutaneous flaps as the preferred surgical technique for many patients. However we believe that there is still a role to be played by mandibular reconstruction plates, especially in patients with poor general prognosis who do not tolerate a long microvascular procedure.

The purpose of this study was to evaluate patient tolerance, esthetic and functional results of mandibular reconstruction with reconstruction plate after oncologic resection.

### MATERIALS AND METHODS

#### Patients

This retrospective study was conducted among patients who reported to the Department of Surgical Oncology, MNJ Regional Cancer Centre, Hyderabad between March 2004 and April 2008. A total number of 36 patients were included in the study. Out of 36 patients, 32 (89%) patients had squamous cell carcinoma, two (6%) had central giant cell granuloma, one (3%) patient had adenocarcinoma. The age

group ranged from 38 to 72 years with mean age of 56 years. Most of the patients had advanced tumors, classified as T<sub>3</sub> in 12 (34 %) patients, T<sub>4</sub> in 20 (56%) patients and T<sub>2</sub> in four (11%) patients. Primary surgery along with postoperative radiotherapy was given in all 36 patients.

### Plate

The AO/ASIF mandibular reconstruction plate used in this study was shown in Figure 1.

The bridging plate is made of commercially pure stainless steel with advantages that include good adaptability, stability, rigidity, minimal artefacts with orthopantomogram. Plates are L-shaped with 20 screw holes and self-tapping screws (8-12 mm length). Plate ends can be bent and torqued.

### SURGICAL TECHNIQUE

After neck dissection, the mandible is approached via a cervical approach, if necessary with the help of lip split incision. After exposure of the mandible, the lines of osteotomies are drawn. The plate is positioned on the basal edge of the mandible. Two holes were drilled on the proximal and distal segments to mark the position. The plate is then removed and the tumor is resected.

A myocutaneous flap was used to reconstruct oral cavity as well as cervical or facial skin as necessary. The previously adapted plate was then positioned, remaining holes were drilled and the plate was secured by three self-threading screws on each side as shown in Figure 2.

The plate is then wrapped by muscle. The cervical incision is closed in two layers as shown in Figure 3.

When the tumor involves vestibular mucosa, it is impossible to expose lateral surface of the mandible to readapt the plate before resection. The plate is instead adapted after resection, if possible with the help of

maxillomandibular fixation, to avoid postoperative occlusal disorders.

### CLASSIFICATION OF MANDIBULAR DEFECTS

Defects were classified according to HCL classification described by Boyand et al,<sup>4</sup> which reflects complexity of reconstructive problem rather than the size of the defect. C defect involves the symphyseal region including both canines. L defects are lateral, without condylar involvement. H defects are lateral defects including condyle. LCL defects are angle to angle defects. The soft tissue components associated with the gift were also taken into consideration. The letters s (skin involvement), m (mucosa), sm (skin and mucosa), o (neither skin or mucosa) involvement.

### Mandibular Defects (MD)

In our study, 27 patients (75%) (MD: L) had lateral defect with conservation of condyle. Rest nine patients (25%) (MD:C) had symphyseal region defect. Every mandibular



Fig. 2: Reconstruction of mandible using AO/ASIF reconstruction plate



Fig. 1: AO/ASIF reconstruction plate



Fig. 3: Intraoral defect covered with pectoralis major myocutaneous flap and extraoral defect covered with deltopectoral flap

defect had cutaneous or mucosa associated defects. Thirty (83%) patients had pectoralis major myocutaneous flap and the rest six (17%) patients had combination of pectoralis major myocutaneous flap (PMMC) and deltopectoral (DP) flap as shown in Graph 1.

**RESULTS**

The mean follow-up time was 19 months (minimum 12 months, maximum 48 months). At the end of study, 24 (67%) out of 36 patients still had the reconstruction plate in place. Around three (8%) reconstruction plates were fractured. Nine (25%) plates got exposed leading to surgical intervention as shown in Graph 2.

The patients were later assessed on the basis of following criteria:

- Early complications (less than 30 days after surgery)
- Late complications (greater than 30 days after surgery)
- Esthetic and functional results.

The mean follow-up period was 3 years.

**Early Complications**

Out of 36 patients, eight (22.22%) had early complications like local infection without exposure of plate controlled with

antibiotics and local irrigation. None of the patients had any exposure of plate within 30 days.

**Late Complications**

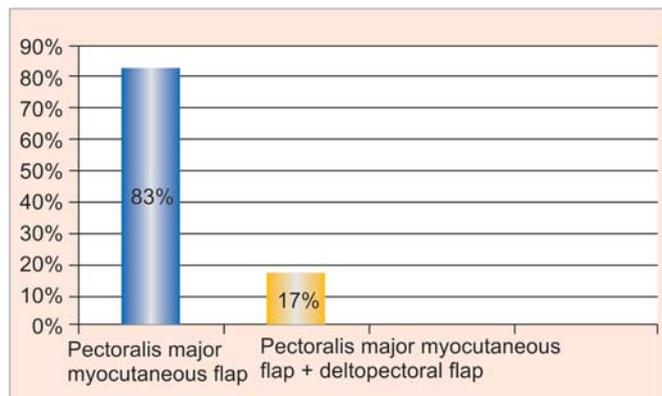
Out of 36 patients, nine (25%) had cutaneous exposure of reconstruction plate within 3 months of surgery because of local infection. All these five patients were later treated with vascularized osteocutaneous flap. Only three (8%) reconstruction plates were fractured at 6 months postoperatively.

**Esthetic and Functional Results**

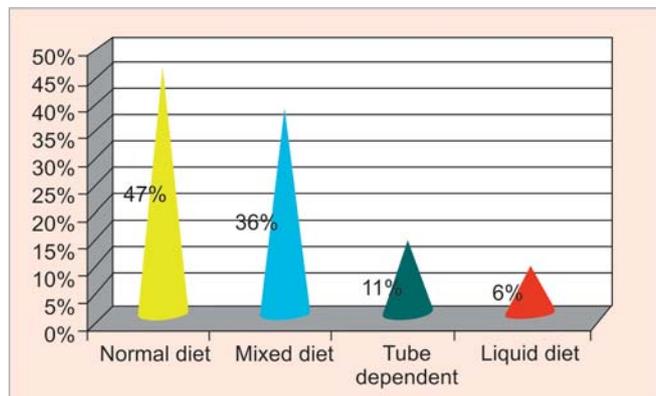
In regard to maximal diet achieved, 17 (47%) patients had normal nutrition. Thirteen (36%) patients had mixed diet, four (11%) patients were tube dependent, two (6%) had liquid diet as shown in Graph 3.

In regard to speech 16 (44%) patients had normal speech, 18 (50%) had near normal speech, two (6%) patients were difficult to understand their speech as shown in Graph 4.

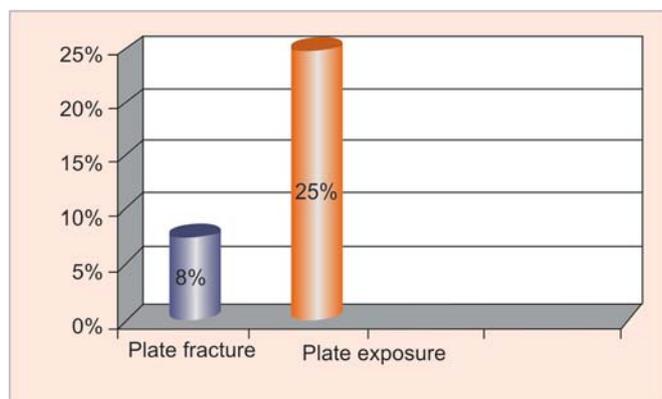
In regard to esthetics, 19 (53%) had acceptable esthetic result, 10 (28%) patients had good physical appearance, seven (19%) had poor esthetic result as shown in Graph 5.



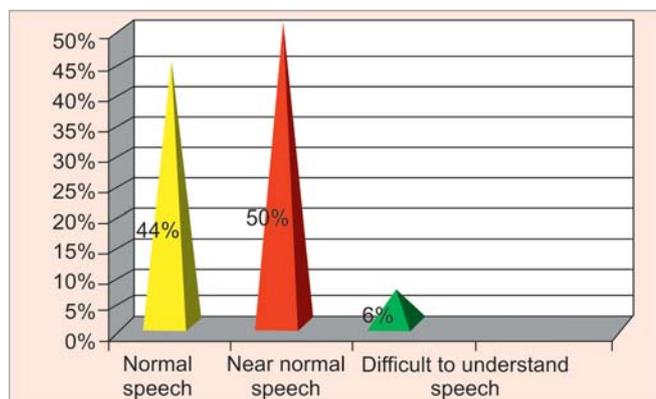
**Graph 1:** Type of flaps used to cover the associated defects



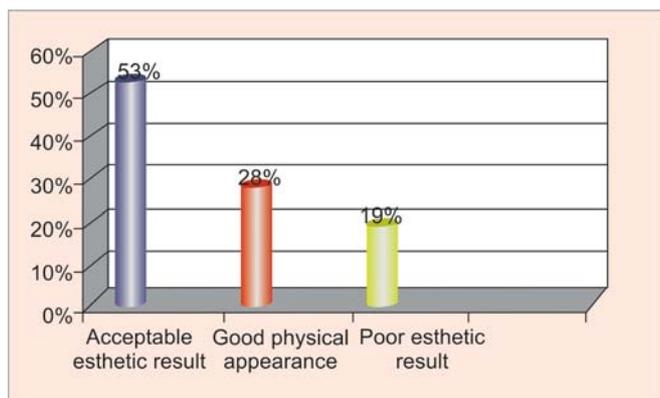
**Graph 3:** Type of diet achieved after reconstruction with reconstruction plate



**Graph 2:** Reconstruction plate associated complications



**Graph 4:** Type of speech achieved after reconstruction with reconstruction plate



**Graph 5:** Esthetic result achieved after reconstruction with reconstruction plate

## DISCUSSION

Reestablishing bone continuity after oncologic resection is important not only from a functional point of view but also for esthetic reasons.<sup>5</sup> Because mandible is involved in speech, food intake, physical appearance, even minor disability causes major stress and extensive morbidity.<sup>6,7</sup> Therefore, main goals of mandibular reconstruction are to restore function and esthetics, including dental rehabilitation. Since the advent of reliable microsurgical procedures, vascularized osteocutaneous flaps are the preference of many authors like Barnard N,<sup>8</sup> Bozec A,<sup>9</sup> Gbara A,<sup>10</sup> Garret A.<sup>11</sup> However, microsurgical procedures cannot be performed on all patients, especially those in whom a long and complex procedure could be of high risk. In patients with poor general condition, a reconstruction with a metallic plate with or without soft tissue flap remains an appealing solution.

Between Feb 2004 and 2008, we had used mandibular reconstruction plates in 36 oral cancer patients, the plates can be easily adapted as well as allows for rapid replacement. In our study, only three (8%) plates were fractured, one reason for the cause of fracture is the lack of flexibility at the distal part of the plate. However fracture of the central bar seems unlikely.<sup>10</sup> Yi zhang et al<sup>12</sup> in their retrospective study had concluded that main complications associated with reconstruction plates were skin or mucosal perforation, plate fracture, loss of screw retention. Cordeiro P et al<sup>13</sup> in their retrospective study on soft tissue coverage of mandibular reconstruction plates had concluded that free flap group have high success rate, shorter hospital stay and require few additional procedures than pectoralis flap group. Kim M et al<sup>14</sup> in their critical analysis of mandibular reconstruction using AO reconstruction plate had concluded that plate removal incidence was higher in irradiated patients (33.3%) than in nonirradiated patients (5.7%). Our success rate with AO/ASIF reconstruction plate was 67% which was comparable to that of THORP plate system with

a success rate of 74% (straumann, waldenburg, Germany) as reported by Coustal et al.<sup>15</sup> Klotch et al<sup>16</sup> reported a success rate of 86.7% using stainless steel AO/ASIF reconstruction plate.

In our study plate exposure rate was 25% which was comparable to that of Nicholson et al<sup>18</sup> who reported 27% plate exposure rate in a series of 92 patients using 5 different types of plates. Klotch et al<sup>16</sup> observed 39% plate exposures in 31 patients treated with THORP system and 13% in 60 patients treated with AO/ASIF system. Maurer P et al<sup>21</sup> also reported plate exposure rate of around 26%. DP Coleti et al<sup>22</sup> in their study on mandibular reconstruction had reported 36% complication rate. Other authors describe plate exposure rates between 4 and 29%.<sup>2,17,18</sup>

Arden RL et al<sup>19</sup> in their study on volume-length impact of lateral jaw resections had concluded that extirpative losses involving more than 5 cm of bone or tissue volume loss greater than 240 cm<sup>3</sup> are associated with high risk of plate exposure. Blackwell KE et al<sup>20</sup> in their retrospective study on bridging lateral mandibular reconstruction plate had concluded that plate exposure can be reduced using low profile rounded contour mandibular reconstruction plate.

Mupoz Guera MF et al,<sup>23</sup> in their statistical analysis of 106 cases on marginal and segmental mandibulectomy cases had suggested in edentulous cases with significant vertical resorption and also in those which have been previously irradiated, a load sharing reconstruction plate may be advisable, spanning the weakened segment and affording additional strength in function. Murakami K et al<sup>24</sup> in their biomechanical analysis of strength of mandible after marginal resection had suggested that residual height and bite forces are critical factors for prevention of pathologic fracture of mandible after marginal resection, currently a residual height of more than 10 mm and reduction of bite force are recommended to reduce the risk of fracture.

## CONCLUSION

Mandibular reconstruction has always been challenging and demanding operation in plastic surgery. Distortion in self image and inability to communicate requires immediate reconstruction to overcome the problem of facial disfigurement and psychological effect. With reconstruction plates mandibular function can be established by restoring form, and load bearing capacity of the mandible. It may be concluded that for lateral resections, especially if conservation of condyle is possible, the reconstruction plate gives excellent functional and esthetic results. The morphologic restoration is satisfying but phonation and feeding possibilities depend on the amount of soft tissue resection. For resection involving symphysis, the esthetic result is poor, chin and inferior lip tend to retract with time.

The reconstruction plate is ideal for patients with too precarious physical state to undergo reconstruction by free flap and for symphyseal reconstruction. Functional and esthetic results, despite the difficulty of objective evaluation seem to be comparable to results of other systems.

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## ABOUT THE AUTHORS

### G Harsha (Corresponding Author)

Professor, Department of Oral and Maxillofacial Surgery, MNR Dental College, Sangareddy, Hyderabad, Andhra Pradesh, India  
e-mail: dentiharsha@yahoo.com

### S Ganesh Kumar Reddy

Professor, Department of Oral and Maxillofacial Surgery Priyadarshini Dental College, Chennai, Tamil Nadu, India

### Sunil Talasila

Reader, Department of Oral and Maxillofacial Surgery, Gitam Dental College, Vishakhapatnam, Andhra Pradesh, India

### S Abdus Salaam

Reader, Department of Oral and Maxillofacial Surgery, Mithila Minority Dental College, Darbhanga, Bihar, India

### M Srinivasulu

Professor and Head, Department of Surgical Oncology, MNJ Regional Cancer Centre, Hyderabad, Andhra Pradesh, India

### V Sridhar Reddy

Professor, Department of Oral Pathology, Sri Aurobindo College of Dentistry, Indore, Madhya Pradesh, India