

A Comparative Assessment of the Management of Mandibular Fracture using 3D Plates and 2D Miniplates

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Abstract

Aims: The aim of this study was to compare 2D plates with 3D miniplate system in the management of mandibular fractures. **Materials and Methods:** The study was conducted on 40 patients with mandibular fracture, who were equally divided into two groups of 20. Patients in Group I were treated with 3D plating and in Group II with 2D plating. In all cases, 2.0 mm titanium miniplates were used. Etiology pain, swelling, paresthesia, mobility between fracture fragments, and occlusion are the criteria after the 1, 3, and 6 weeks and 3 months. **Results:** Patients were randomly divided into two equal groups of 20 patients each. Group A patients underwent osteosynthesis using 2.0 mm 3D miniplates while Group B patients underwent osteosynthesis using 2.0 mm 2D miniplates. Road traffic accident was the most common cause of injury (55%). Fall from height, assault, and other etiologies comprised 15% of the study subjects each. The age of patients ranged from 16 to 55 years. Majority of patients were within 16–30 years of age (65%). There were only 6 (15%) patients aged above 40 years. Mean age of the patients was 29.45 ± 11.11 years. Majority 32 (80%) of patients were male, only 8 (20%) were female. **Conclusion:** The authors found that the 3D miniplate system is more useful in the management of cases of mandibular fracture as compared to 2D miniplates.

Keywords: Mandibular fracture, Miniplates, Mouth opening.

INTRODUCTION

In the era of increasing automobilization, industrialization, and technology, the treatment of maxillofacial injuries has attained a prominent position. Road traffic accidents, which are becoming more and more frequent, particularly have brought about an increase in maxillofacial injuries. The head being the exposed part of the body is involved in highest percentage of injuries of all body regions. The other causes of maxillofacial injuries are interpersonal violence, falls, sporting injury, and industrial trauma.^[1]

Techniques for the treatment of mandibular fracture have evolved significantly in the past decades. These techniques have ranged from closed reduction with maxillomandibular fixation (MMF), to open reduction with wire osteosynthesis, to open reduction with either rigid internal fixation or adaptive miniplate fixation.^[2]

Open reduction and internal fixation (ORIF) of the mandible with bone plates was first described by Schede in 1888, who used steel plates and screws. Rigid fixation using compression

plates has decreased the period of MMF and provided early return of mandibular function.^[3]

Through the decades, various plate and screw osteosyntheses have been introduced like AO bicortical plating system; two-dimensional (2D) miniplating system, resorbable plates and screws, three-dimensional (3D) miniplating system, and locking miniplate system.^[4,5] Research continues to focus on the size, shape, number, and biomechanics of plate/screw/ systems to improve surgical outcome.

In this study, we are using 2 mm 2D titanium miniplates system and 2 mm 3D titanium miniplate system, comparing them in mandibular fracture for evaluating post-operative pain, paresthesia, radiolucency, occlusal, and segmental mobility implant failure during entire course of study.

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MATERIALS AND METHODS

The study was a randomized prospective study conducted on patients reporting to the Department of Oral and Maxillofacial Surgery, D. J. Dental College and Research Centre, Modinagar, Ghaziabad, with definitive diagnosis of mandibular fractures. All patients were well informed regarding the study, and the written consent was obtained. Ethical clearance was obtained from review board of our institution. Patient data, such as name, age, and gender, were recorded. Inclusion criteria were patients aged 20–70 years of both genders and with American Society of Anesthesiologists physical status classification system I (ASA I) and exclusion criteria were patients with pre-existing musculoskeletal disease or neurologic disease and patients with midface fractures. Depending on the plating system, patients were equally divided into two groups of 20–20. Patients in Group I were treated with 3D plating and in Group II with 2D plating. In all cases, 2.0 mm titanium miniplates were used. General physical examination was done to assess injury of thorax, abdomen, genitourinary tract, or long bones. Panoramic radiographs were taken to see the type of fracture. Fracture site at mandibular was approached extraorally and intraorally as necessary. ORIF was performed with 3D miniplates in Group I patients and 2D miniplates in Group II patients. A single maxillofacial surgeon performed all the procedures under aseptic surgical procedures. Post-operative panoramic radiographs were taken to assess fracture reduction and correct insertion of plates. Patients were prescribed antibiotics amoxicillin 500 mg 3 times/day (TDS) and analgesics diclofenac sodium 400 mg TDS for 5 days. The etiology of fracture, amount of mouth opening, and pain and sensory deficits were recorded. Clinical and radiographic assessment was done at 1, 3, and 6 months.

RESULTS

Figure 1 shows that pain after 1, 3, and 6 weeks and 3 months at 1 week interval, the mean pain score in Group I was 1.40 ± 1.58 and in Group II, it was 0.90 ± 1.52 whereas on the 3rd week, the mean pain score in Group I was 0.20 ± 0.03 as compared to 0.30 ± 0.95 in Group II.^[6] From 6 weeks onward, none of the patients in Group I had any pain whereas at 6 weeks, the mean pain score in Group II was 0.1 ± 0.32 . At 3 months, none of the Group I patients had pain, however, two patients of Group II had mild pain (score 3). At none of the time intervals, a statistically significant difference was observed between two groups ($P > 0.05$). Sensory deficit was present in both the groups after 1, 3, and 6 weeks but absent after 3. At 1 week interval, 6 (30%) patients in each Group I and Group II, respectively, were having swelling. However, from 3 weeks onward, none of the patients in either group had a swelling till 3 months^[7] given in Figure 2. At 3 months interval, swelling was observed in one case of Group II. Statistically, there was no significant difference between two groups at any time interval ($P > 0.05$).

Thus, there was better patient response with 3D (Figure 3) plating as compared to 2D (Figure 4) plating in mandibular fracture.^[8]

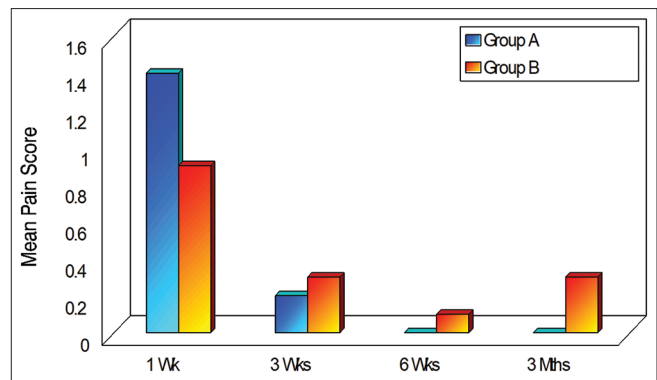


Figure 1: Comparison of paresthesia in Group A and Group B

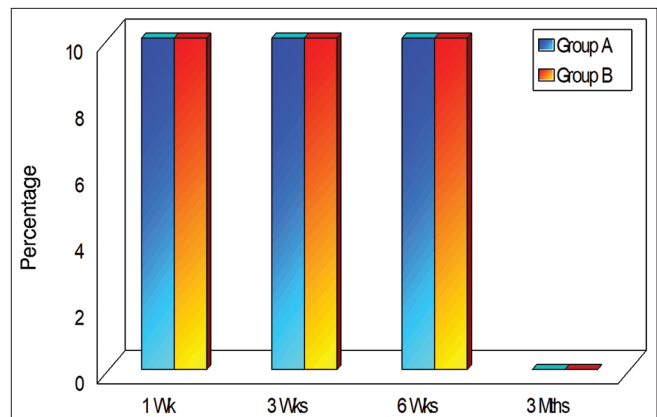


Figure 2: Comparison of swelling in Group A and Group B



Figure 3: OPG showing post operative 3-D mini plating in bilateral mandibular parasymphysis fracture.

Statistical analysis

Results were expressed as mean $\pm$ SD. Chi-square test was used for the study using SPSS version 21.0. $P < 0.05$ was considered statistically significant.

DISCUSSION

Mandibular fractures are commonly seen among facial bone fractures. The advancement in techniques and methods in the

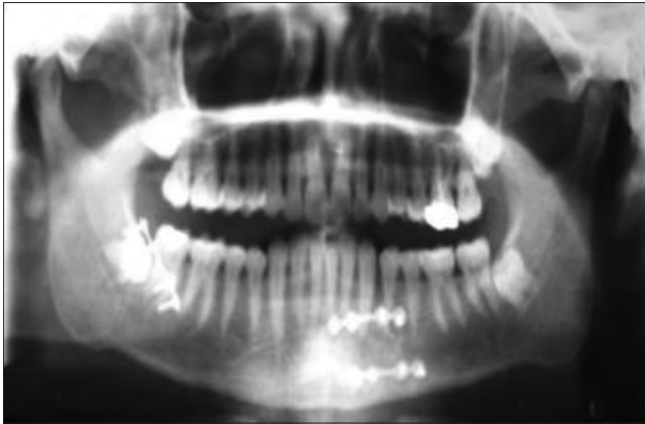


Figure 4: 3D Plates VS 2D Mini Plates In Mandibular Fracture Management

management of mandibular fractures has led better patient outcome and favorable results. There are different methods of direct fixation with an open approach. AO bicortical plating system such as 2D miniplating system and screws and 3D miniplating system is recent methods for mandibular fractures. This study aimed at comparing 2D plates with 3D miniplate system in the management of mandibular fractures.^[9] In this study, we enroll 40 patients who visited to the department for the treatment of mandibular fracture which was confirmed by taking panoramic radiographs. Based on the plating system used, there were 20 patients each in Group I (3D) and Group II (2D). Write Raymond *et al.*^[10] conducted a study in which 30 patients with non-comminuted mandibular parasymphysis fractures were divided into 2 mm 3D and 2 mm 2D miniplate systems, respectively.^[10] All patients were systematically monitored at the 1st, 3rd, and 6th week and 3 months postoperatively. The results showed that one patient in each group had post-operative pain, infection, occlusion derangement, and mobility. In Group I, one patient had paresthesia while in Group II, two patients had paresthesia.^[11] There was no implant failure in any group. There was no statistically significant difference between 3D and 2D miniplate systems in all the recorded parameters at all the follow-ups. We observed that the etiology of mandibular fracture is mostly RSA seen. In maximum cases, parasymphysis fracture was involved in 32 patients in both groups and 25 in Group II followed by the right angle fracture in 28 in Group I and 30 in Group II patients. The left angle and right parasymphysis fracture in 14 cases, and the right angle and left parasymphysis fracture was seen in five patients. Singh *et al.*^[12] found that out of 70 patients, 77.14% corresponded to the age group of 15–30 years and 82.85% were male. Road traffic accident (80%) was the leading cause of fracture. The time required to adapt and fix the 2D miniplates was slightly more than 3D plates and the results were statistically significant. Skeletal and occlusal stability was maintained in both groups. We found that mean pain assessed on VAS in both groups preoperatively, at 1 week, 3 week, and 6 week and 3 months was significant ($P < 0.05$). Group I had lower score than Group II. We also

observed that cases of sensory deficit were more in Group II as compared to Group I. It is found that a thin cross-sectional area relative to the body, symphysis, and parasymphysis anteriorly, and the presence of the third molars is among various causes leading to mandibular fracture.^[10] Barde *et al.* conducted a study in 40 patients with anterior mandibular fractures.^[13] Group I consisting of 20 patients in whom 3D plates and Group II consisting of other 20 patients in whom four holes straight plates were used. It was found that the mean operation time for Group II was more compared to Group I. There was significantly greater pain on day of surgery and at the 2nd week for Group II patients but there was no significant difference between the two groups at the 4th week. The post-operative infection, occlusal disturbance, wound dehiscence, post-operative mobility at the fracture site, and neurological deficit were statistically insignificant. The limitations of the study are the small sample size and the limited follow-up period.

CONCLUSION

The authors found that 3D miniplate system is more useful in the management of cases of mandibular angle fracture as compared to 2D miniplates.

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