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Research Article

TO COMPARE TREATMENT OUTCOMES OF MANDIBULAR FRACTURES IN 3D VS CONVENTIONAL MINIPLATES IN PATIENTS PRESENTING IN TERTIARY CARE HOSPITAL

Fatima tuz-Zahra¹, Gulraiz Zulfiqar², M. Asim Naqash³, Ayesha Bint e
Aslam⁴, Sidra Batool⁴, Shehzada Faiz Ahmad Khan⁴

¹Registrar Department of Oral & Maxillofacial Surgery Allama Iqbal Medical College

²Assistant Professor Oral & Maxillofacial Surgery, Allama Iqbal Medical College

³Senior Registrar Oral & Maxillofacial Surgery, Children Hospital, Faisalabad

⁴Jinnah Hospital, Lahore

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Abstract:

The ability to treat fracture with open reduction and internal fixation (OR/IF) has dramatically revolutionized the approach to mandible fracture. With OR/IF, the postoperative role of rigid maxilla mandibular fixation (MMF) has declined, but it is used to maintain proper occlusion until internal fixation of the fracture is achieved. Objectives: The main objective of the study is to compare treatment outcomes of mandibular fractures in 3D vs conventional miniplates in patients presenting in tertiary care hospital. Methodology of the study: This is randomized controlled trial conducted in the Department of Oral and Maxillofacial Surgery, University Dental Hospital, The University of Lahore. This study was carried out over a period of six months from 23-11-2017 to 22-05-2018. A total of 66 cases (33 in each group) were included in the study. In Group-A, patients were treated with 3-Dimensional miniplates of 2mm thickness while in Group-B, patients were treated with conventional miniplates (2D) of 2mm thickness. Results: Mean age of the patients was 33.7±11.1 and 33.8±10.8 years in group-A and B, respectively. In group-A 30 patients (90.9%) and in group-B 29 patients (87.9%) were male while 3 patients (9.1%) of group-A and 4 patients (12.1%) of group-B were female. Mean duration of procedure in group-A was 53.9±3.8 and in group-B 62.2±3.1 minutes. Anatomical reduction in group-A was statistically significant as compared to group-B (p=0.020). Optimal occlusion was better in group-A when compared with group-B. Distribution of patients by diagnosis in group-A and B, as follows: Symphysis 4 (12.3%) vs 6 (18.2%), parasymphysis 23 (69.7%) vs 19 (57.6%), body 1 (3%) vs 2 (6%) and angle 5 (15%) vs 6 (18.2%). Stratification with regard to age, gender and duration of procedure was also carried out. Conclusion: In conclusion, 3D titanium miniplates are effective in the treatment of mandibular fractures as compared to conventional miniplates in terms of anatomical reduction and optimal occlusion. Thus, 3D plate can be used as an alternative to conventional miniplates. The system is reliable and effective treatment modality for mandibular fractures

Key Words: 3D miniplates, Conventional miniplates Mandibular fractures, Internal fixation, Open reduction

Corresponding author:**Fatima tuz-Zahra¹,***Registrar Department of Oral & Maxillofacial Surgery,
Allama Iqbal Medical College.*

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INTRODUCTION:

Maxillofacial trauma is a matter of prime concern due to the increasing motor vehicle accidents; inter personal violence and sports injuries. The mandible is frequently fractured bone because of its prominent and vulnerable position in the face [1]. If put on time line, the treatment of mandibular fractures has evolved significantly over past few years. Previously, mandibular fractures were treated with closed reduction and a course of prolonged maxillomandibular fixation. The next phase of mandibular fracture management involved open reduction and wire osteosynthesis. Wire osteosynthesis was replaced by open reduction and internal fixation with titanium hardware including miniplates and screws [2].

Concept of internal rigid fixation of mandibular fracture was initially introduced by Michelet et al, which was later on revolutionized by Champys [3]. It consisted of application of conventional (2D) miniplates, which took only two dimensions of the forces into account, bending and torsional, because of their linear geometry. 3D manipulating system was first introduced by Mustafa Farmland in 1992 [4]. A 3-dimensional miniplate is based on the principal of a quadrangle, as a geometrically stable configuration for support. Inter-connections of the plate reduce the vertical displacement and shearing of the bone to minimal. Studies show, at a given point in fracture site that there are three forces acting on the mandible namely; bending, torsional, and shear. These are best counteracted

by 3D miniplates by offering good resistance against torque forces due to parallelism of vertical arms with fracture line. Because the screws are arranged in the configuration of box on either side of the fracture, a broadband platform is created, increasing the resistance to twisting and bending of long axis of plate. Therefore there is simultaneous stabilization of the tension & compression over that of conventional miniplates, thereby avoiding the need of intermaxillary fixation, ensuring early reinstatement of function and decreased rate of postoperative complications. Other advantages of 3D miniplates over conventional miniplates are, ease of application, reduced operating time and malleability [5].

Objective of the study:

The main objective of the study is to compare treatment outcomes of mandibular fractures in 3D vs. conventional miniplates in patients presenting in tertiary care hospital.

MATERIAL AND METHODS:

This randomized controlled trial was conducted in Department of Oral and Maxillofacial Surgery, University Dental Hospital, The University of Lahore. This study was carried out over a period of six months from 23-11-2017 to 22-05-2018.66 cases (33 in each group) was taken with 80% power of study and 5% level significance taking expected percentage of anatomical reduction as 80% and 47% in 3-D vs 2-D miniplates, respectively. The sampling technique was Non-probability consecutive sampling for this study.

Inclusion Criteria

- Age: 18-60 years
- Fracture mandible (as per operational definitions)
 - Symphysis
 - Parasymphysis
 - Body
 - Angle

Exclusion Criteria

- Retreatment cases
- Gunshot injuries
- Blast victims
- Comminuted fractures
- Malunited fractures
- Condylar fractures
- Diabetic/immuno compromised patients (on medical record).

Data collection:

66 patients of ages between 18-60 years of both genders fulfilling selection criteria were included in study after taking informed consent from patients and approval from Institutional Ethical Review Committee. Patients were randomly allocated into group-A and group-B by lottery method for their treatment:

Group A: Patients were treated with 3-Dimensional miniplates of 2mm thickness.

Group B: Patients were treated with Conventional miniplates (2D) of 2mm thickness.

In both the groups all the patients were operated under GA, with intraoral approach. After adequate exposure of fractured segments, debridement & curettage was done. The fractured segments were reduced to their anatomical form & temporary Intermaxillary fixation (IMF) was done for optimal occlusion. 3D or conventional miniplates were applied as per case selection by lottery method. After completion of procedure IMF was removed for 3D miniplates cases while kept there for conventional miniplates. Hemostasis was checked & primary closure was done. All patients were given postoperative antibiotics & analgesics for 5-7 days. Oral hygiene was maintained by 0.2% chlorhexidine mouthwash. All the surgical procedures were done by same Consultant, assessed by postoperative Orthopantomogram (OPG) radiographically.

Follow up was done by a blind observer of the same specialty, starting from 3rd post-operative day till 3 months. Outcome variables were assessed postoperatively. Another variable i.e. optimal occlusion was also noted.

Data analysis:

The collected information was transferred to SPSS (statistical Package for Social Sciences) version 22. Quantitative variables such as age and duration of procedure was presented as mean±SD. Qualitative variables such as gender, anatomic reduction were presented as frequency and percentage. Both groups were compared by applying Chi square test. Data were stratified for age, gender and duration of procedure to address effect modifiers. Post-stratification Chi square test was applied with p value ≤ 0.05 considered as statistically significant.

RESULTS:

A total of 66 cases (33 in each group) were included in this study during the study period of six months from 23-11-2017 to 22-05-2018.

Group A: 3-Dimensional miniplates of 2mm thickness.

Group B: Conventional miniplates (2D) of 2mm thickness.

Mean age of the patients was 33.7 ± 11.1 and 33.8 ± 10.8 years in group-A and B, respectively. In group-A 30 patients (90.9%) and in group-B 29 patients (87.9%) were male while 3 patients (9.1%) of group-A and 4 patients (12.1%) of group-B were female. Mean duration of procedure in group-A was 53.9 ± 3.8 and in group-B 62.2 ± 3.1 minutes. Anatomical reduction in group-A was statistically significant as compared to group-B ($p=0.020$). Optimal occlusion was better in group-A when compared with group-B. Distribution of patients by diagnosis in group-A and B, as follows: Symphysis 4 (12.3%) vs 6 (18.2%), parasymphysis 23 (69.7%) vs 19 (57.6%), body 1 (3%) vs 2 (6%) and angle 5 (15%) vs 6 (18.2%). Stratification with regard to age, gender and duration of procedure was also carried out.

Table-1: Distribution of patients by age

Age (Year)	Group-A (3D miniplates)		Group-B (2D miniplates)	
	No.	%	No.	%
18-40	24	72.7	25	75.7
41-60	09	27.3	08	24.3
Total	33	100.0	33	100.0
Mean±SD	33.7±11.1		33.8±10.8	

Table-2: Distribution of patients by gender

Gender	Group-A (3D miniplates)		Group-B (2D miniplates)	
	No.	%	No.	%
Male	30	90.9	29	87.9
Female	03	09.1	04	12.1
Total	33	100.0	33	100.0

Table-3: Distribution of patients by duration of procedure

Duration of procedure (min)	Group-A (3D miniplates)		Group-B (2D miniplates)	
	No.	%	No.	%
45-50	6	18.2	0	0
51-59	26	78.8	8	24.3
≥ 60	1	03.0	25	75.7
Total	33	100.0	33	100.0
Mean±SD	53.9±3.8		62.2±3.1	

Table-4: Distribution of patients by anatomical reduction

Anatomical reduction	Group-A (3D miniplates)		Group-B (2D miniplates)	
	No.	%	No.	%
Yes	26	78.8	17	51.5
No	07	21.2	16	48.5
Total	33	100.0	33	100.0

Chi Square=5.405

P value=0.020

DISCUSSION:

Techniques for open reduction of mandibular fractures have changed and diversified enormously in recent decades and 4 achieved new heights. Transorally placed miniplates have gained wide acceptance for the treatment of mandibular fractures as described by Champy et al [6,7]. Non-comminuted symphyseal and parasymphyseal fractures, as well as condylar fractures, can be treated with two 2.0-mm miniplates [8].

Newer plating system like 3-D titanium has come into existence to meet the requirements of semi rigid fixation with lesser complications. The basic concept of 3D fixation lies in their shape which is based on principle of quadrangle as a geometrical stable configuration for support. The 3D miniplate system provides good stability in most cases and operative time is shorter because of simultaneous stabilization at both superior and inferior borders [9].

The 3D plating system provides definite advantages over conventional miniplates as

former uses fewer plates and screws as compared to conventional miniplates to stabilize the bone fragments. In case of conventional miniplates, 2 plates are recommended in symphysis and parasymphysis region, while only one 3D plate is necessary. Thus it uses lesser foreign material, reduces the operation time and overall cost of the treatment [10,11]. The current understanding of the biomechanics and fracture healing of the mandible has influenced the modern approach to the open reduction and internal fixation of this fractures [12]. The objectives in the treatment of mandibular fracture are to reestablish normal occlusion and masticatory function with minimal disability and complications. Conservative treatment to achieve this is performed by immobilizing the mandible for the healing period by IMF which is achieved by dental wiring, arch bars, cap splints, and gunning splints. Operative treatment of mandibular fractures involves intra or extraoral opening of the fracture site and direct osteosynthesis with transosseous wires, lag screws [13]; or bone plates [14]. A number of fixation methods have been advocated for the treatment of mandibular fractures [15].

Recently open reduction with internal fixation is the norm and tiny titanium plates are used to immobilize fragments of the jaw. Morbidity of the procedure is low with the advantage that the patient returns to normal function within days of treatment [16]. The intraoral approach is preferred unless indicated otherwise as it is time saving and less traumatic. Miniplate osteosynthesis first introduced by Michelet et al in 1973 and further developed by Champy and Lodde in 1975 [17]. The plates are applied close to tension zone of mandible. The screws are monocortical to prevent injury to dentition and alveolar nerve [18].

CONCLUSION:

In conclusion, 3D titanium miniplates are effective in the treatment of mandibular fractures as compared to conventional miniplates in terms of anatomical reduction and optimal occlusion. Thus, 3D plate can be used as an alternative to conventional miniplates. The system is reliable and effective treatment modality for mandibular fractures. The small sample size and limited follow-up could be considered as the limitations of this study.

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Functional efficacy of 3-d mini plates versus conventional miniplates for open reduction and internal fixation of fracture mandible

PROFORMA

Patient's Name _____ Age _____ Sex _____

Address _____

Contact No. _____ Hospital No. _____

Diagnosis _____

Group:

Group A: 3-Dimensional miniplates of 2mm thickness.

Group B: Conventional miniplates (2D) of 2mm thickness.

Duration of procedure _____

	Yes	No
Anatomical reduction		
Other variable: Optimal occlusion		

Informed consent _____ Doctor's signature _____