

ORIGINAL ARTICLE

Comparison of Outcome of Conventional Miniplates Versus 3-D Miniplates for Reduction of Mandibular FracturesTAZEEM UL HASSNAIN¹, UMER HUSSAIN², WAJIHA ABBAS³, MUHAMMAD ATHAR KHAN⁴, MUHAMMAD AZEEM KHAN⁵, MUHAMMAD JUNAID HASHMI⁶¹Post graduate resident FCPS Department of Oral and Maxillofacial Surgery KEMU/Mayo Hospital, Lahore²Consultant Department of Oral and Maxillofacial Surgery, Trauma Centre and Emergency Department/Sandeman Provincial Hospital Quetta³Resident Department of Oral and Maxillofacial Surgery Trauma Centre and Emergency Department/Sandeman Provincial Hospital Quetta⁴BDS, FCPS (oral Maxillofacial surgery) Assistant professor, Bakhtawar Amin Medical and Dental College, Multan⁵BDS, FCPS (Oral and Maxillofacial surgery) Assistant professor and head of department (Oral medicine) Bakhtawar Amin Medical and Dental College, Multan⁶B. SC, BDS, M-Phil community dentistry, CHPE, Senior Lecturer, Department of Community Dentistry Bakhtawar Amin Medical and Dental College, MultanCorrespondence to: Tazeem Ul Hassnain, Email: tazeem87@yahoo.com**ABSTRACT****Background:** Mandibular fracture, also known as fracture of the jaw, is a sudden discontinuity through the mandibular bone. In the treatment of un-favorable mandibular angle fractures, 3D plating system was analogous to double miniplates Osteosynthesis. Over the last century, the indicators for closed vs. open reduction have shifted considerably.**Objective:** To compare the outcome of conventional miniplates versus 3-D miniplates for reduction of mandibular fractures**Material & Methods****Study Design:** It was randomized control trial**Setting:** Department of Oral & Maxillofacial Surgery, Mayo Hospital, Lahore**Duration:** 6 months i.e. from 24-04-2017 to 24-10-2017**Data collection:** 70 mandibular fracture patients were enrolled. The patients were split into two groups. Group A is treated with 3D plates technique and group B treated with conventional mini plate technique. After surgery patients were evaluated for plate failure or and at 1 month for occlusal discrepancy. All the data was entered and put in SPSS version 21.**Results:** In this study the mean age of the group A patients was 29.29±1.802 years whereas the mean value of age in group B patients was 35.69±11.65 years, male/female ratio of the patients was 1.05:1. Plate was successfully inserted in 100% patients by 3D mini-plate technique. The occlusal discrepancy was noted in 8(11.43%) patients (p-value=0.005).**Conclusion:** 3-D mini-plates for reduction of mandibular fractures is significantly more efficacious than to conventional mini-plates method**Keywords:** 3-D mini-plates, Conventional, Mandibular Fractures,**INTRODUCTION**

A mandibular fracture comprises of 80% of all maxillo facial injuries and in 20 to 30% patients the most common site is angle of the mandible. Certain functional and structural characteristics makes mandible unique and require treatment, it includes thinner compact plate, form variations throughout life, frequent embedded or bilateral muscle cover, partially erupted teeth, and extraosseous and endosseous and circulation of blood. For mandibular angle fracture treatment, several therapy approaches have been recommended [1]. Several biomechanical approaches and plate types, such as adaptation miniplates, mini-dynamic double plates compression plates and resorbable plates were tested in various clinical trials. Various methodologies have been used to explore the biomechanical and physical behaviour of mandibles [2].

In the repair of unfavorable mandibular angle fractures, 3d plate's osteosynthesis was comparable to standard double mini plates osteosynthesis. Both methods provided enough stability to allow for proper fracture healing, correct functional blocking, and return to normal function as soon as possible [3]. In the case of badly displaced and crumble fractures, exact adaption and each miniplate becomes time consuming and more difficult at the time of placement, whereas a 3-D locking plate placement is easier and faster, economical having better bio mechanical behavior [4].

According to one randomised trial, the average length of plate adaptation and fixation (minutes) for conventional miniplates was 19.42.75 and 10.81.93 for 3D miniplates (P0.001). The average duration of operation for conventional miniplate was 1.88 0.38 and 1.61 0.27 for 3D miniplate. It was discovered that there was statistically significant difference (p value =0.001) [5]. With 3D miniplate, there is no plate failure observed while with conventional miniplate, 6.6% cases had plate failure (p<0.05) as well as occlusal discrepancy was also absent with 3D miniplate while 13.3% patients had occlusal discrepancy with conventional miniplate (P<0.05) [6].

The basis of our research is in contrast with the outcome of conventional miniplate versus 3-D miniplate of mandibular fractures for reduction. In literature, it has been reported that 3D

miniplate is more convenient as compared to conventional miniplate (2D). But there is no local evidence available regarding effectivity of 3D miniplate for reduction of mandibular fractures and conventional plating is done in routine. So through this study we want to get local magnitudes and implement the use of 3D miniplate instead of conventional miniplate for patient management presenting with mandibular fractures.

METHODOLOGY

This randomized controlled trial was conducted at Department of Oral and Maxillofacial Surgery, Mayo Hospital, Lahore from 24-04-2017 to 24-10-2017. Sample size of 70 cases; 35 cases in each group was calculated with 95% confidence level, 80% power of test and taking expected mean operative time i.e. 1.88±0.38 hours with conventional plate and 1.61±0.27hours for 3D plate for reduction of mandibular fractures [5]. Non- probability, consecutive sampling method was used. Patients of 15 to 60 years of age of either gender with mandibular fracture (ASA I & II) were included in this study. Mandibular fracture was defined as fracture in a breach in connectivity of bone lower jaw assessed through clinical examination and 2 x-ray i.e. posteroanterior view and orthopantomogram. Patients with systemic disease affecting healing i.e diabetes mellitus, patients with comminuted, complex, malunion of fractures, and infections at site of injury as well as coronoid and condyle of mandible (on OPG) were excluded from the study.

By using random number table, patients were divided, randomly, into two groups. Group A had reduction of mandible with 3D miniplate while Group B had reduction of mandible with conventional 2D miniplate. Then patients undergo surgery under general anesthesia by same senior consultant surgeon, with assistance of researcher. During surgery, operative time and duration required to fix the plate was noted by another resident using a clock. Then after surgery, patients were shifted in the ward and later discharged from there after 48 hours when patient was able to drink liquid. Patients were asked to come back for follow up after 7 days and 1 month of surgery in OPD. After 7 days, patients

were evaluated for plate failure or and at 1 month for occlusal discrepancy by researcher himself. All of this data was documented through proforma (attached).

All collected information was examined by using SPSS version 22. Assessable characteristics like age, operative time and time span required for plate fixation was describe as mean and SD. Qualitative variables like gender, plate failure and occlusal discrepancy was described as percentage and frequency. T-test was used to compare mean operative time and duration required for plate fixation in both groups. P≤0.05 will be as significant. Chi-square test was used to compare plate failure and occlusal discrepancy taking p-values≤0.05 as significant.

RESULTS

In this research the average age of the group A patients was 29.29±1.802 years whereas the mean value of age in group B patients was 35.69±11.65 years. There were 36(51.43%) male patients whereas 34(48.57%) female patients. Male to female patients' ratio was 1.05:1 as shown in Table 1. The average value of operative time of the group A patients was 1.67±0.401 hours whereas the mean value of operative of group B patients was 1.69±0.385 hours. The mean duration of plate fixation of group A patients was 9.37±1.63 minutes whereas the mean value of duration of plate fixation of group B patients was 14.31±3.01 minutes as shown in Table 2. Both results showed that in group A plate was found successfully inserted in all the patients whereas the plate failure in group B noted in 5(100%) patients. In our research in group A occlusal discrepancy not found in even a single patient whereas the occlusal discrepancy in group B patients was found in 8(100%) patients as shown in Table 3.

Table 1: Descriptive statistics of age and gender of study patients

Parameter	Details of Variable	Values
Age	Group A	29.29±10.802
	Group B	35.69±11.65
Gender	Male	36(51.43%)
	Female	34(48.57%)

Table 2: Comparison of operative time and duration of plate fixation in both groups

Parameter		Study Groups		p-value
		Group A	Group B	
Operative time (hours)	n	35	35	0.880
	Mean	1.67	1.69	
	SD	0.401	0.385	
Duration of plate Fixation (min)	Mean	9.37	14.31	<0.001
	SD	1.63	3.01	

Table 3: Comparison of plate failure and occlusal discrepancy in both groups

Parameter		Study Groups		Total	p-value
		Group A	Group B		
Plate failure	Yes	0	5	5	0.054
		0.0%	100.0%	100.0%	
	No	35	30	65	
		53.8%	46.2%	100.0%	
Occlusal Discrepancy	Yes	0	8	8	0.005
		0.0%	100.0%	100.0%	
	No	35	27	62	
		56.5%	43.5%	100.0%	

DISCUSSION

Mandibular angle fractures are quite technically difficult, and in the literature, a wide array of procedures has been suggested for treatment of these fractures [7, 8]. In our research the mean value of operative time of the 3D mini-plate group patients was 1.67±0.401 hours whereas the mean value of operative of conventional mini-plate group patients was 1.69±0.385 hours (p-value=0.88). Bipin S. Sadhwani and Sonal Anchlia⁶ documented that out of fourteen patients treated with standard 2-mm miniplates, two experienced occlusal disparity, two had postoperative movement at the fracture site, and one developed plate failure and

infection, which was managed with plate removal under antibiotic treatment. Tooth damage occurred in one patient who was treated with 3-dimensional plates. They claimed that using three-dimensional plates for treatment of mandibular fractures offers three-dimensional stability and were associated with decreased morbidity and infection rates [6]. According to one randomized trial, the average operation time for conventional miniplate was 1.88 0.38 and 1.61 0.27 for 3D miniplate [7]. G. K. Vivek et al confirm that single-plate fixation of mandibular anterior fractures with 3-D titanium miniplates is a good alternative to Champy's 2 miniplates system because it provides good stability, requires less intraoperative time, and has lower infection rates than regular miniplate systems [9].

The incidence of plate failure in 3D patients was found in our study, which is consistent with Guimond et al. findings on the fixation of mandibular angle fractures with 3-D plates [10]. Norhan A. El Nakeeb et al. found that three-dimensional plates are as successful as conventional miniplates to cure the anterior mandibular fractures [11]. Its advantages over conventional miniplates include easiness of use and reduced operating period. However, no statistically significant difference was found in bite force, discomfort, and bone density between the two groups or maximal mouth opening. Hughes^[12] and Feledy^[7] discovered greater bending stability in 3D plates in their clinical investigations, and said that the 3D plates were easy to apply so that the average operating time was reduced [12, 7]. Zix et al in alteration with conventional miniplates, 3D plates are a time-saving, according to the author, because they are simultaneously stabilised at both superior and inferior boundaries [13]. Over the previous three decades, researches have shown that rates of complication for miniplate osteosynthesis for mandibular fracture therapy have extended from 3.8 percent to twenty eight percent [10, 13-16]. Until now, the complication rates reported ranges from 0 % to 10 % for 3D plate fixation in mandibular fractures [17-21].

Zix et al^[13], Guimond et al.^[10] and Feledy et al.^[7] which presented that in 3D plate, the incidence of occlusal changes range from 0% to 20 %. This is utmost possible because to the 3-D plate design's increased fracture segment stability and, as a result, stable occlusion. Another study by Agrawal et al. stated that in both conventional and 3Dminiplates groups no malocclusion was noted [22]. Also Melek et al. showed that all patients of both groups had satisfactory occlusion at the 1 month postoperative [23].

CONCLUSION

This research concluded that 3-D mini-plates for reduction of mandibular fractures is significantly more efficacious than to conventional mini-plates method.

REFERENCES

- 1 Singh R, Pal U, Agrawal A, Singh G. Single miniplate osteosynthesis in angle fracture. National J Maxillofac Surg 2011;2(1):47-50.
- 2 Dayi E, Omezli MM. Review of biomechanical experimental studies on different plating techniques of mandibular condyle fractures. Ann Maxillofac Surg 2011;1(1):48.
- 3 Al-Tairi N, Shoushan M, Khedr MS, Abd-alal S. Comparison of three-dimensional plate versus double miniplate osteosynthesis for treatment of unfavorable mandibular angle fractures. Tanta Dental J 2015;12(2):89-98.
- 4 Goyal M, Marya K, Chawla S, Pandey R. Mandibular osteosynthesis: a comparative evaluation of two different fixation systems using 2.0 mm titanium miniplates and 3-D locking plates. J Maxillofac Oral Surg 2011;10(1):32-7.
- 5 Khalifa ME, El-Hawary HE, Hussein MM. Titanium three dimensional miniplate versus conventional titanium miniplate in fixation of anterior mandibular fractures. Life Sci J 2012;9(2):1006-10.
- 6 Sadhwani BS, Anchlia S. Conventional 2.0 mm miniplates versus 3-D plates in mandibular fractures. Ann Maxillofac Surg 2013;3(2):154.
- 7 Feledy J, Caterson EJ, Steger S, Stal S, Hollier L. Treatment of mandibular angle fractures with a matrix miniplate: a preliminary report. Plast Reconstruct Surg 2004;114(7):1711-6.
- 8 Amanat N. Ananalysis of maxillofacial fractures in Aga Khan University Hospital. . Pak J Surg 1993;9:128-32.

- 9 Vivek G, Shetty A, Vaibhav N, Imran M. A comparative study of single 3-D titanium plate versus conventional Champy's 2 miniplate fixation in the management of mandibular anterior fracture: A Prospect Clin Study 2016;3(6):194-9.
- 10 Guimond C, Johnson JV, Marchena JM. Fixation of mandibular angle fractures with a 2.0-mm 3-dimensional curved angle strut plate. J Oral Maxillofac Surg 2005;63(2):209-14.
- 11 El Nakeeb NA, El Dibany MM, Shokry MM. A comparative study between 3-d plates and conventional miniplates for internal fixation of anterior mandibular fractures. Alexand Dental J 2016;41(3):253-60.
- 12 Hughes P. 3D plate versus the lag screw technique for treatment of fractures of the anterior mandible. J Oral Maxillofac Surg (Oral Abstract session 1) 2000;58:23.
- 13 Zix J, Lieger O, Iizuka T. Use of straight and curved 3-dimensional titanium miniplates for fracture fixation at the mandibular angle. J Maxillofac Surg 2007;65(9):1758-63.
- 14 Champy M, Lodde J, Schmitt R, Jaeger J, Muster D. Mandibular osteosynthesis by miniature screwed plates via a buccal approach. J Maxillofac Surg 2001;6:14-21.
- 15 Farmand M. The 3-D plating system in maxillofacial surgery. J Oral Maxillofac Surg 2006;51(3):166-7.
- 16 Wittenberg JM, Mukherjee DP, Smith BR, Kruse RN. Biomechanical evaluation of new fixation devices for mandibular angle fractures. Int J Oral Maxillofac Surg 2001;26(1):68-73.
- 17 Smith W. Delayed miniplate osteosynthesis for mandibular fractures. Brit J Oral Maxillofac Surg 2004;29(2):73-6.
- 18 Regalo SCH, Santos CM, Vitti M, Regalo CA, de Vasconcelos PB, Mestriner Jr W, et al. Evaluation of molar and incisor bite force in indigenous compared with white population in Brazil. Arch Oral Biol 2008;53(3):282-6.
- 19 Van Spronsen P, Weijs W, Valk J, Prah-Andersen Bv, Van Ginkel F. Comparison of jaw-muscle bite-force cross-sections obtained by means of magnetic resonance imaging and high-resolution CT scanning. J Dent Res 2006;68(12):1765-70.
- 20 Shinogaya T, Bakke M, Thomsen C, Vilmann A, Sodeyama A, Matsumoto M. Effects of ethnicity, gender and age on clenching force and load distribution. Clin Oral Invest 2001;5(1):63-8.
- 21 Ikebe K, Nokubi T, Morii K, Kashiwagi J, Furuya M. Association of bite force with ageing and occlusal support in older adults. J Dent 2005;33(2):131-7.
- 22 Agarwal M, Meena B, Gupta D, Tiwari AD, Jakhar SK. A prospective randomized clinical trial comparing 3D and standard miniplates in treatment of mandibular symphysis and parasymphysis fractures. J Maxillofac Oral Surg 2014;13(2):79-83.
- 23 Melek LN, El Mahallawy A, Sharara A. Evaluation of the 3-dimensional threadlock plate in the management of mandibular angle fractures: A clinical and radiographic study. Tant Dent J 2015;12(2):140-8.