https://doi.org/10.29309/TPMJ/2024.31.04.7939

The Professional Medical Journal
www.theprofesional.com
2024, Volume, 31 Issue, 04

ORIGINAL ARTICLE

Comparison between mini-plate and reconstruction plate osteosynthesis in the treatment of the comminuted mandibular fracture.

Bisma Iftikhar[1], Gulraiz Zulfiqar[2], Asad Mehmood[3]

Article Citation: Iftikhar B, Zulfiqar G, Mehmood A. Comparison between mini-plate and reconstruction plate osteosynthesis in the treatment of the comminuted mandibular fracture. Professional Med J 2024; 31(04):637-645. https://doi.org/10.29309/TPMJ/2024.31.04.7939

ABSTRACT… Objective: To compare the treatment outcome for reconstruction plates and mini plates in treating comminuted mandibular fracture. **Study Design:** Randomized Controlled Trial. **Setting:** Department of Oral and Maxillofacial Surgery, Allama Iqbal Medical College/Jinnah Hospital, Lahore. **Period:** October 2021 to April 2023. **Methods:** All subjects presented for treatment of comminuted fractures of the mandible fulfilling the inclusion criteria at Jinnah Hospital Lahore Maxillofacial surgery department were included in the study, and were randomly allocated into group A and group B. The mini-plate osteosynthesis technique was used on Group A and Group B was treated by fixation with reconstruction plate. **Results:** A total of (n=30) patients were included in this study. Fifteen of these patients received mini-plate fixation (group A) and the remaining fifteen were treated with reconstruction plates (group B). The mean age was 29.4± 10.5 years. 80% of study subjects were male n=24. All patients of (group A) were treated via an intraoral approach. However, n=10 (66.6%) patients were treated by intraoral approach in (group B). Whereas the rest of the subjects (n=4) were treated with extra oral approach and (n=1) through combined intraoral and extra oral approach.100% stability at the fracture site was observed in both groups. Comparative occlusion status showed a nonsignificant p-value (p=1.000). Pearson chi-square value=0.0000a for plate exposure between both groups also shows a non-significant difference. The contour of the mandible was improved in 38.89% of (group A) population and 61.11% of group B patients. **Conclusion:** Mini-plate and reconstruction plate osteosynthesis are equally effective for the fixation of comminuted fractures of the mandible, considering postoperative occlusion status, stability of the fracture segment, and the possibility of plate exposure.

Key words: Comminution, Load Bearing, Mandibular Fracture, Reconstruction Plate, Rigid Fixation.

INTRODUCTION

Mandibular fractures are commonly encountered injuries following facial trauma, inflicting functional and cosmetic damage to the patients.[1] In order to implement an effective treatment approach, mandibular fractures have been divided into simple and comminuted fractures. Existence of multiple fracture lines and bone fragments in the same area of the mandible is referred to as comminution of the mandible.[2] 5-7% of mandibular trauma consists of comminuted mandibular fractures, which are frequently linked to high intensity trauma and impact.[3]

Comminuted fractures can range in complexity from simple to extensive, depending on the degree of comminution. Comminuted fracture is referred to as simple comminuted fracture if fracture lines are confined to the single region of mandible. In contrast, in extensive fractures comminution exceeds more than one region of mandible.[4]

Considering their poor outcomes and major consequences including infection, non-union, and other issues, comminuted mandibular fractures are challenging to treat.[5] They should be treated with meticulous preoperative planning, appropriate fracture reduction and fixation.[6] (Bouloux et al, 2014). Properly executed rigid internal fixation brings reliable outcomes. The duration of therapy is also greatly reduced, resulting in a faster return to normal function.[6]

1. BDS, Post graduate Resident Oral and Maxillofacial Surgery, Allama Iqbal Medical College, Jinnah Hospital, Lahore.
2. BDS, FCPS, Head Oral and Maxillofacial Surgery, Allama Iqbal Medical College, Jinnah Hospital, Lahore.
3. BDS, PGR Oral and Maxillofacial Surgery, Allama Iqbal Medical College, Jinnah Hospital, Lahore.

Correspondence Address:
Dr. Bisma Iftikhar
Department of Oral and Maxillofacial Surgery
Allama Iqbal Medical College, Jinnah Hospital, Lahore.
bismamuhammad3@gmail.com

Article received on: 19/10/2023
Accepted for publication: 16/12/2023

There are presently two treatment options for rigid fixation of mandibular fractures. One is load bearing osteosynthesis, also known as reconstruction plate osteosynthesis. The alternative method uses miniplates for load sharing osteosynthesis. Miniplates can be characterised as fixation plates with a diameter of 2.0 mm or less, and reconstruction plates as fixation plates with a diameter of 2.0 mm or more.

Restoring functional occlusion with both mini-plates and reconstruction plate systems used for internal fixation of mandible fracture is usually effective.[7] However, the Rigid plating technique was more effective in preventing the postoperative usage of elastics. Mini-plates enables the application of elastic traction to rectify minor occlusal discrepancies after surgery. Reconstruction plate fixation lacks this treatment's flexibility.[8] In terms of maximising function and morphological recovery and reducing the possibility of iatrogenic patient harm, reconstruction plate systems may not always be the best option and are inappropriate for addressing all types of comminuted mandibular fractures.[5]

The objective of this study is to compare the treatment outcome for reconstruction plates and mini plates in treating comminuted mandibular fracture.

METHODS

This Randomized controlled trial study was carried out at Department of Oral and Maxillofacial Surgery Allama Iqbal Medical College/Jinnah Hospital Lahore. One year and six month from October 2021 to April 2023. Non probability consecutive sampling technique was used. All 30 patients who presented for treatment of comminuted fractures of mandible at Jinnah hospital Lahore maxillofacial surgery department within the duration of study period were included in study.

Inclusion Criteria

All patient with comminuted fractures of mandible diagnosed on 3D computed tomography reconstructive images, between 10 -65 yrs of age, presented within one month after injury and maintained follow-up visit until clinical and radiological evidence of sound bone healing after operation.

Exclusion Criteria

(i)Pathological fracture (ii)Old fracture (duration >1 month) (iii)history of radiation treatment of the head and neck area (iv) using absorbent plate as osteosynthesis material (v)patients who did not complete follow-up until postoperative bone healing (3 months).

Data Collection Procedure

During the research period, all subjects who satisfied the inclusion requirements were recruited. This investigation was conducted in compliance with the World Medical Association Declaration of Helsinki. Following approval from ethical committee (282/21/07/2022/S1 ERB), a detailed history and careful clinical examination along with radiological assessment i.e OPG, CT scan was done. Every patient depicted in the images permitted their photographs and radiological data to be published Each participant received details regarding the research and completed a written informed consent form. Subjects who gave consent were randomly divided into two treatment groups through lottery method.

Group A was treated by miniplate osteosynthesis technique and Group B was treated by fixation with reconstruction plate. A prospective randomized controlled study was performed with equal chance of any population to be included in any of the two groups. Fracture stability was clinically evaluated by exerting pressure across the fracture segments. If intersegmental movement existed, the fracture was declared unstable; otherwise, it was marked stable. The occlusal relationship examination was conducted using the Edward Ellis criteria of occlusion. Participants or their parents were requested for interviews, while ensuring anonymity of data. Patient was assessed post operatively at 3rd post operative day after which they were assessed once weekly and then biweekly for next 2 months for occlusion status, stability of fractured segment, post operative plate exposure and final contour of mandible. Clinical

and radiographic assessments with the help of an OPG were conducted at the end of 3rd month to rule out malunion or non-union. Complications were recorded during follow-up visit, including bone nonunion and hardware exposure. Data was collected using proformas.

Procedure

To prevent inter-operator bias, the same surgeon carried out the surgeries. All cases were done under general anesthesia. To perform miniplate osteosynthesis, fracture sites were approached through intraoral incision. Erich arch bars fixed to the both upper and lower dental arches with 26-gauge stainless steel wire allow for rigid fixation of the teeth and alveolar segments, and maxillomandibular fixation is done before final fixation of bony pieces. The extraction of all unhealthy teeth along the fracture line was done before handed. Fractured segments were reduced and fixed using miniplates after simplification and in accordance with the Champy method.

Fixation with reconstruction plate is often applied successfully using an extraoral technique. However, intraoral method of fixation can also be employed. The fractures are accessed through 1st neck crease incision. If properly raised, the superior flap preserves and protects the marginal mandibular nerve. Before applying the load-bearing, locking reconstruction plate, the fracture should first be “simplified.” It is recommended to address the bigger fragments first. Then, with three or four screws on either side of the fractures, a locking reconstruction plate is fixed to entirely span the fracture. Layered closure of the tissues is mandatory.

Preoperatively, parenteral antibiotics were administered to all patients since it had been assumed that all trauma wounds were dirty. Following surgery, the antibiotics were continued for three days.

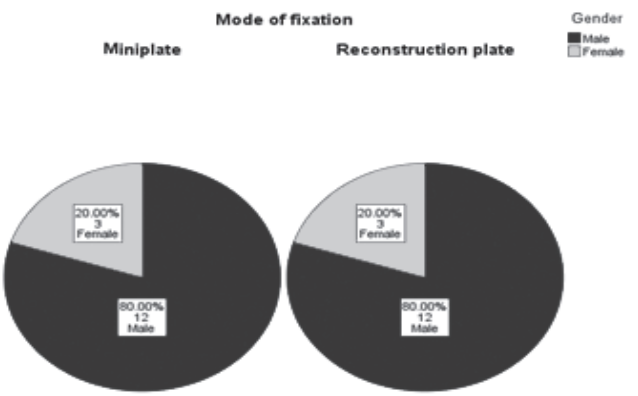
Data Analysis

After thoroughly analyzing the study’s variable, a proforma was generated in which all the information was entered. This information was subsequently imported into a statistical software called “IBM SPSS Statistics 20” and a descriptive analysis was carried out. Age, gender, the site of the fracture, the surgical technique, the degree of healing, and complications including malocclusion, osteosynthesis plate exposure were among the variables that were analyzed. Location of the fracture was classified as symphyseal (between the central incisor), parasymphyseal (area distal to central incisors and mesial to canines) body (canine, premolar, and molar region), and angle. Frequency and percentages for age and gender were calculated. Chi square and Pearson T tests were applied. P value 0.05 considered significant. Mean ± standard deviation (SD) calculated for all quantitative variables with normal distribution including age, gender, surgical approach. To determine the significance of differences between those patients who developed postsurgical complications related to exposure of hardware and those who did not, Pearson cross-table analyses were performed. Those patients who had complications and those who did not were crossed with the mode of treatment received. For the analysis of treatment, the cases were divided into miniplate and reconstruction plate osteosynthesis. To determine the significance of differences between those patients who developed malocclusion and those who did not, Pearsoncross-table analyses were performed. The final occlusal relationship (normal vs malocclusion) was crossed with the treatment received as just described. The relationship between final contour of mandible and mode of fixation was also examined using Pearson cross-table analysis. The data was analysed using the ChiSquare test. All hypothesis-generating tests were two-sided at a significance level of 0.05

RESULTS

A total of (n=30) patients were included in this study. Fifteen of these patients received mini-plate fixation (group A) and the remaining fifteen were treated with reconstruction plates (group B). The mean age was 28.73± 7.44 years. 80% of study subjects were male n=24 and n=6 (20%) were females. All patients of (group A) were treated via an intraoral approach. However, n=10 (66.6%) patients were treated by intraoral approach in (group B). Whereas the rest of the subjects

(n=4) were treated with extra oral approach and (n=1) through combined intraoral and extra oral approach. Frequency and percentage of different sites of communution are described in table no 3. 100% stability at the fracture site was observed in both groups. Comparative occlusion status showed a nonsignificant p-value (p=1.000). Pearson chi-square value=0.0000a for plate exposure between both groups also shows a non-significant difference. The contour of the mandible was improved in 38.89% of (group A) population and 61.11% of group B patients.



Frequency of age distribution with respect to mode of fixation					
AGE:					
Mode of Fixation	**N**	**Mean**	**Std. Deviation**	**Minimum**	**Maximum**
Miniplate	15	28.60	7.278	17	40
Reconstruction plate	15	28.87	7.855	17	42
Total	30	28.73	7.441	17	42

Age * Mode of Fixation Crosstabulation					
			Mode of Fixation		**Total**
			Miniplate	**Reconstruction Plate**	
Age	< 30 years	Count	9	9	18
		% within Age	50.0%	50.0%	100.0%
	> 30 years	Count	6	6	12
		% within Age	50.0%	50.0%	100.0%
Total		Count	15	15	30
		% within Age	50.0%	50.0%	100.0%

Frequency of Gender Distribution					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Male	25	83.3	83.3	83.3
	Female	5	16.7	16.7	100.0
	Total	30	100.0	100.0	

Diagnosis * Mode of fixation

Crosstab					
			Mode of Fixation		**Total**
			Miniplate	**Reconstruction Plate**	
Diagnosis	Symphysis	Count	1	1	2
		% within Diagnosis	50.0%	50.0%	100.0%
	Symphysis+ Parasymphysis	Count	3	4	7
		% within Diagnosis	42.9%	57.1%	100.0%
	Parasymphysis	Count	3	2	5
		% within Diagnosis	60.0%	40.0%	100.0%
	Parasymphysis + Body	Count	2	3	5
		% within Diagnosis	40.0%	60.0%	100.0%
	Body	Count	3	2	5
		% within Diagnosis	60.0%	40.0%	100.0%
	Angle	Count	2	1	3
		% within Diagnosis	66.7%	33.3%	100.0%
	Symphysis+Parasymphysis+Body	Count	1	2	3
		% within Diagnosis	33.3%	66.7%	100.0%
Total		Count	15	15	30
		% within Diagnosis	50.0%	50.0%	100.0%

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.410[a]	6	.965

Surgical approach * Mode of fixation

Crosstab					
			Mode of Fixation		Total
			Miniplate	Reconstruction Plate	
Surgical approach	Intra Oral	Count	15	10	25
		% within Surgical approach	60.0%	40.0%	100.0%
	Extra Oral	Count	0	4	4
		% within Surgical approach	0.0%	100.0%	100.0%
	Intra Oral + Extra Oral	Count	0	1	1
		% within Surgical approach	0.0%	100.0%	100.0%
Total		Count	15	15	30
		% within Surgical approach	50.0%	50.0%	100.0%

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.000[a]	2	.050

Stability within 3 months * Mode of fixation

Crosstab					
			Mode of Fixation		Total
			Miniplate	Reconstruction Plate	
Stability within 3 months	Yes	Count	15	15	30
		% within Stability within 3 months	50.0%	50.0%	100.0%
Total		Count	15	15	30
		% within Stability within 3 months	50.0%	50.0%	100.0%

Occlusion within 3 * Mode of fixation

Crosstab					
			Mode of Fixation		Total
			Miniplate	Reconstruction Plate	
Occlusion within3	Intact	Count	13	13	26
		% within Occlusion within 3	50.0%	50.0%	100.0%
	Minor discrepancies	Count	2	2	4
		% within Occlusion within 3	50.0%	50.0%	100.0%
Total		Count	15	15	30
		% within Occlusion within 3	50.0%	50.0%	100.0%

Chi-Square Tests					
	Value	df	Asymp. Sig. (2-Sided)	Exact Sig. (2-Sided)	Exact Sig. (1-Sided)
Pearson Chi-Square	.000[a]	1	1.000		

Hardware exposure * Mode of fixation

Crosstab					
			Mode of Fixation		Total
			Miniplate	Reconstruction Plate	
Hardware exposure	Yes	Count	2	2	4
		% within Hardware exposure	50.0%	50.0%	100.0%
	No	Count	13	13	26
		% within Hardware exposure	50.0%	50.0%	100.0%
Total		Count	15	15	30
		% within Hardware exposure	50.0%	50.0%	100.0%

Chi-Square Tests					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.000[a]	1	1.000		

Contour of mandible * Mode of fixation

Crosstab					
			Mode of Fixation		Total
			Miniplate	Reconstruction Plate	
Contour of mandible	Improved	Count	7	11	18
		% within Contour of mandible	38.89%	61.11%	100.0%
	Not improved	Count	5	2	7
		% within Contour of mandible	71.4%	28.6%	100.0%
	Not applicable	Count	3	2	5
		% within Contour of mandible	60.0%	40.0%	100.0%
Total		Count	15	15	30
		% within Contour of mandible	50%	40%	100.0%

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.375[a]	2	.305
Likelihood Ratio	2.426	2	.297
N of Valid Cases	30		
a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is 2.50.			

DISCUSSION

Comminuted mandibular fractures are high impact injuries that offer crucial concerns to surgeons due to their substantial consequences and unpredictable squalae.[8] The mode of injury should be evaluated since impacts, such as gunshot wounds, can cause soft tissue loss.

Comminution has several definitions, one of which describes it as multiple fractures in a single mandibular area. Finn previously described comminution as the occurrence of several fracture lines resulting in several little fragments of bone in the same region of the mandible.[15] According to the degree of comminution, comminuted fractures have been further divided into simple and extensive. Simple comminuted fractures are limited to one region of the jaw, whereas extensive fractures affect many areas of the mandible.

Xiaofeng Xu (2022) categorised CMF patients into five groups.:
Type 1: Relatively good occlusion, undisplaced fracture and no continuity defect
Type 2: Low degree of comminution but achievable occlusal disharmony and no bony defect
Type 3: Deteriorated morphology, more fragmentation, no discontinuity of mandible.
Type 4: greater degree of comminution, discontinuity of mandible and poor occlusal relationship
Type 5: segmental mandibular loss[8]

A detailed history and a comprehensive clinical examination should be carried out to assess malocclusion, fracture site as well as dental, soft tissue and osseous defects. A preliminary digital orthopantomogram should be followed by CTscan face with 3D reconstruction.[6] The main objective of treating mandibular fractures is to restore the patient's anatomy, function, and appearance. This will lead to a faster social recovery and a return to normal daily activities.[3] According to Kazanjian, proper stabilization of bone fragments is absolutely essential in achieving osseous union, as inadequate immobilization can result in non-united fractures and the risk of subsequent infection. Historically, comminuted fractures gave been treated by various methods based on different concepts of reduction and fixation.

This study compares the success rate of mini plates and reconstruction plates in treating mandibular fractures and aims to clarify the selection criteria for osteosynthesis plates. There's a lack of consensus in treatment protocols for comminuted mandibular fractures globally, making this study necessary. While both miniplate and reconstruction plate osteosynthesis are effective, their efficiency has not been compared in any published research.[11]

In the past, comminuted mandibular fractures were treated using closed methods to prevent the periosteum from being stripped off and the bone pieces from being devitalized. This is achieved through the use of extraoral skeletal pins, splints, and MMF.[6] Bromiage treated comminuted fractures by threaded Kirschner wire via an extraoral approach.[3] Coniglio and Norante later explained modification of this technique.[4] Cohen and coworkers introduced concept of free graft in treatment of comminuted mandibular fracture.[5] Recently, open reduction and internal fixation with plates and screws have been recommended for comminuted fractures.[7] Compared to MMF (17.1%), ORIF has a lower complication rate of 10.3%. and better infection prevention.[2]

Currently, there are two procedures for fixing comminuted mandibular fractures. The first involves reconstruction plates for load-bearing osteosynthesis, while the second uses titanium miniplates for load-sharing osteosynthesis. (Bouloux et al., 2014) (Shaw et al. 14). A retrospective research supports the use of mini plates or reconstruction plates using ORIF for the treatment of comminuted mandibular fractures.[2] There is, however, a purposeful dispute concerning the relative effectiveness of the two methods. Recent research validates the use of load-bearing reconstruction plates for treating comminuted fractures. A few investigations, nevertheless, have not found a statistically significant disparity between the clinical outcomes of the two groups. To assess the clinical results and complications of the two procedures, we conducted a randomized controlled trial as part of our study.

It is imperative to note that reconstruction plates necessitate a broad surgical area in the majority of cases. (Bouloux et al., 2014). Executing the surgery may be challenging and time-consuming. The expense of therapy is also high. Miniplates and monocortical screws with shattered bone fragments can be a simpler and quicker alternative to huge plates and bicortical screws. However, caution is required when choosing an osteosynthesis plate for mandibular fracture repair. Following AO/ASIF principles, the ultimate objective of open reduction and internal fixation (ORIF) for mandibular fractures, is to promote uninterrupted healing and reinstate both form and function while avoiding maxillomandibular fixation (MMF).[12]

Neal D. Furtan suggests that load-bearing osteosynthesis of comminuted mandible fractures can speed up healing, lower the risk of nonunion and malunion, and reduce therapy length.[6] Studies show that reconstruction plates have lower rates of screw and plate fracture compared to 2.0-mm titanium mini plates.[9] In our research, one patient with a miniplate experienced screw and plate exposure, which necessitated its removal.

According to Brian Alpert, miniplate osteosynthesis is not recommended for stabilizing small bone fragments because they cannot be compressed or share loads.[2] With minimal comminution, mini-plate can be applied to restore a damaged mandibular morphology.[8] There were no statistically significant variations in complication rates between mini plates (27% vs. 30%). No significant difference was found in plate removal or infection rate.[2]

The clinicians express significant concerns about the extraoral surgical method for the reconstructive plate. The surgical approaches for miniplate and reconstruction plates differ significantly. Mini-plates may often be implanted through an intraoral incision. Intraoral approach circumvents major issues such as scarring and facial nerve weakness. Based on multiple studies, the incidence of facial nerve injury ranges from 7.9% to 12%[15] With enhanced trans-buccal equipment and expertise, a higher proportion of these plates can now be implanted intraorally.[11] Our research reinforces this assertion. Out of the 15 patients, 4 (or 27%) received intraoral treatment, while only 1 patient was treated with combined intraoral and extraoral approach. However, out of 10 patients treated with an intraoral technique, 2 individuals (20%) had plate exposure. Therefore, we only recommend an intraoral method for fixation with a reconstruction plate if there's sufficient soft tissue to cover the hardware.

Malocclusion can be observed if the intermaxillary fixation was insufficient. Minor occlusal interferences may eventually be corrected by grinding the occlusal surfaces of the teeth, but serious malocclusions need reosteosynthesis.[6] 2 patients with miniplate exhibited mild occlusal disharmony which was addressed by guiding elastics. For an equal proportion of patients in the reconstruction group with minor occlusal disharmony, an occlusal reduction was employed.

The influence of various osteosynthesis procedures on the shape of the mandible is seldom ever discussed. The rotation of the mandibular segments during closed fixation or micro-plate fixation might result in facial widening or other abnormalities. Insufficient bone support often leads to compression of the soft tissues at the fracture site, even with the use of reconstructive bone plates. Titanium mesh can shape mandibular morphology, yielding satisfactory results for all patients.[12] However, a reconstruction plate contributes more to enhance the mandibular shape when compared to a miniplate. As in our study, 38.89% of patients in group A and 61.11% of patients in group B had better mandibular shape.

Xiaofeng Xu (2022) recommends selecting the appropriate fixation method based on the type of fracture and developing a personalized treatment plan for each patient. The AO/ASIF suggests the use of load-bearing reconstruction plates with ORIF, which is considered the optimal method for treating CMFs worldwide. Reconstruction plate systems may not always be the best option for optimal function and minimal harm. Other alternatives should be considered in CMFs. However, it is beneficial to categorize each fracture and conduct a thorough evaluation to avoid postoperative complications due to incorrect treatment.[8]

CONCLUSION

Our main finding was that there are no significant differences in complication rates between 2-mm miniplate and rigid reconstruction plates. However, maxillomandibular fixation and guide elastics are required for longer time in miniplate. Whereas, reconstruction plate osteosynthesis requires minimal need of maxillomandibular fixation and guide elastics.

LIMITATIONS/RECOMMENDATIONS

A randomized controlled trial with large sample size should be done.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

SOURCE OF FUNDING

There are no sponsors for the research being carried out, it's a self-sponsored research.

REFERENCES

1. Sukegawa S, Kanno T, Masui M, Sukegawa-Takahashi Y, Kishimoto T, Sato A, Furuki Y. **A retrospective comparative study of mandibular fracture treatment with internal fixation using reconstruction plate versus miniplates.** Journal of Cranio-Maxillofacial Surgery. 2019 Aug 1; 47(8):1175-80.

2. Brian Alpert, DDS*, Paul S.Tiwana, DDS, MD, MS, George M. **Kushner, DMD, MD, Management of Comminuted Fractures of the Mandible.** Oral Maxillofacial Surg Clin N Am. 2009; (21):185-92.

3. Kanno T, Sukegawa S, Nariai Y, Tatsumi H, Ishibashi H, Furuki Y, et al. **Surgical treatment of comminuted mandibular fractures using a low-profi le locking mandibular reconstruction plate system.** Ann Maxillofac Surg. 2014; 4:144-9.

4. Dai J, Shen G, Yuan H, Zhang W, Shen S, Shi J. **Titanium mesh shaping and fixation for the treatment of comminuted mandibular fractures.** J Oral Maxillofac Surg. 2016 Feb; 74(2):337.e1-37.e11.

5. Edward Ellis III, DDS, MS,* Oscar Muniz, DDS, MD,† and Kapil Anand, DDS, MD‡, **Treatment considerations for comminuted mandibular fractures.** J Oral Maxillofac Surg. 2003; 61:861-70.

6. Futran ND. **Management of comminuted mandible fractures.** Operative Techniques in Otolaryngology-Head and Neck Surgery. 2008 Jun 1; 19(2):113-6.

7. Siddiqui S-u-d et al., **Efficacy of open reduction and internal fixation in achieving bony union of comminuted mandibular fractures caused by civilian gunshot injuries.** The Surgeon. https://doi.org/10.1016/j.surge.2019.10.004

8. Xu, X.; Zhu, F.; Yang, C.; Xu, B.; Yuan, Z.; Zhang, W.; Shi, J. **OCCS classification and treatment algorithm for comminuted mandibular fractures based on 109 patients and 11 years experiences: A retrospective study.** J. Clin. Med. 2022; 11:6301.

9. Richard J. Shaw, FRCS,1 A. N. Kanatas, MFDS,2 Derek Lowe, C Stat, MSc,1 James S. Brown, FRCS, MD,1 Simon N. Rogers, FRCS, MD,1 E. David Vaughan, FRCS1. **Comparison of miniplates and reconstruction plates in mandibular reconstruction.** Head Neck. 2004; 26:456-63.

10. Kwonwoo Lee, Kyuho Yoon, Kwan-Soo Park, Jeongkwon Cheong, Jaemyung Shin, Jungho Bae, Inchan Ko, Hyungkoo Park. **Treatment of extensive comminuted mandibular fracture between both mandibular angles with bilateral condylar fractures using a reconstruction plate: A case report.** J Korean Assoc Oral Maxillofac Surg. 2014; 40:135-39.

11. M. A. Kuriakose, M. Fardy, M. Sirikumara, D. W. Patton, A. W. Suga. **A comparative review of 266 mandibular fractures with internal fixation using rigid (AO/ASIF) plates or mini-plates.** British Journal of Oral and Maxillofacial Surgery. 1996; 34:315-21.

12. Paolo Scolozzi, MD, DMD,* and Michel Richter, MD, DMD†. **Treatment of severe mandibular fractures using AO reconstruction plates.** J Oral Maxillofac Surg. 2003; 61:458-61.

13. Dibya Falgoon Sarkar a, Niranjan Mishra a, Dipti Samal a, Debashish Pati a,*, Indu Bhusan Kar a, Debjyoti Mohapatra b, Abhipsa Mishra a, **Locking versus non-locking plating system in the treatment of mandibular fractures: A randomized comparative study.** Journal of Cranio-Maxillo-Facial Surgery. 2021; 49:184-190.

14. Ashley B. Robey, M.D. Michael L. Spann, M.D. Timothy M. McAuliff, B.S. Jane L. Meza, Ph.D. Ronald R. Hollins, M.D. Perry J. Johnson, M.D. Omaha, Neb. **Comparison of miniplates and reconstruction plates in fibular flap reconstruction of the mandible.** Plast. Reconstr. Surg. 2008; 122:1733.

15. Zhi Li, Zu-Bing Li*, **Clinical characteristics and treatment of multiple site comminuted mandible fractures.** Journal of Cranio-Maxillo-Facial Surgery. 2011; 39:296-299.

16. Tae Joon Choi, MD,* Young Hun Chung, MD,† Jae Young Cho, MD, PhD,‡ and Jin Sik Burm, MD, PhD†. **The use of microplates for internal fixation of comminuted mandibular fractures.** Annals of Plastic Surgery. 1, January. 2019; 82:.

AUTHORSHIP AND CONTRIBUTION DECLARATION

No.	Author(s) Full Name	Contribution to the paper	Author(s) Signature
1	Bisma Iftikhar	Conception and design of work, Acquisition, Analysis or interpretation of data for work.	
2	Gulraiz Zulfiqar	Drafting of work, Revising it critically for intellectual content.	
3	Asad Mehmood	Final approval of the version to be published.	