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Comparison of Post-Operative Results of Early Versus Delayed Open Reduction and Internal Fixation of Isolated Mandibular Fractures

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ABSTRACT

Objective: To evaluate the impact of treatment time of open reduction internal fixation of mandibular fractures in post-operative complications.

Study Design: Quasi-experimental study.

Place and Duration of Study: Oral and Maxillofacial Surgery, Armed Forces Institute of Dentistry, Combined Military Hospital, Rawalpindi Pakistan, from Jan to Jun 2019.

Methodology: A hundred and four patients with isolated mandibular fractures diagnosed clinically and radiologically were included in the study. Group-I was the early Group consisting of cases reported under 72 hours, and Group-II was the delayed Group consisting of patients after 72 hours and within fourteen days. Treatment outcomes were assessed and compared for all patients based on clinical parameters in the post-operative period during follow-up.

Results: One hundred and four patients with mandibular fractures were treated with open reduction internal fixation. On a periodic follow-up of 6 months, all patients were evaluated for malocclusion, surgical site infection, hardware exposure, and non-union complications. Group-I showed six patients (11.70%) with malocclusion, whereas three patients (6.10%) in Group-II had malocclusion (*p*-value=0.295). Surgical site infection was present in 2(3.84%) patients in Group-I and 3(5.76%) patients in Group-II (*p*-value=0.647). There was no case of non-union and three patients (5.76%) of hardware exposure in Group-I and two patients (3.84%) in Group-II (*p*-value=0.647). No statistically significant increase in post-operative complications in malocclusion, surgical site infection, hardware exposure, and non-union was found in Group-II with comparison Group-I.

Conclusion: Delay in the surgical intervention of mandible fractures does not lead to increased post-operative complications.

Keywords: Early fixation, Mandibular fractures, Post-operative complications, Timing of surgery.

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INTRODUCTION

Mandibular fractures are one of the most commonly encountered facial bone fractures due to their unique shape and mobility, thus making them prone to fracture. The aetiology of fracture includes road traffic accidents, falls from heights, assaults, and contact sports.[1]

Various treatment options to manage mandibular fractures range from closed reduction, i.e., maxillo-mandibular fixation (MMF) alone, MMF with non-rigid osteosynthesis, and open reduction and internal fixation (ORIF) with non-compressive or compressive plates. However, the choice of treatment modality differs from case to case, surgeon's preference, and logistics availability of materials. There is no golden rule for optimal treatment time for ORIF of mandibular fractures. Early or delayed ORIF has its advantages and disadvantages.[2] At the same time, early fixation suggests less operating time with minimal manipulation of the fracture segments. However, it may be associated with marked facial oedema. In con-trast, delayed fixation has lesser swelling, but callus and scar tissue formation add to technical difficulties leading to increased surgical time.[3]

The most common complications after surgical intervention of mandibular fractures are surgical site infection, malocclusion, temporomandibular joint dysfunction syndrome (TMDs), sensory nerve damage, hardware exposure, and malunion. Some clinicians propose that delaying treatment can increase complication rate and, therefore, can benefit from immediate care.[4] This study evaluated the impact of timing of open reduction and internal fixation of mandibular fractures in view of post-operative outcomes.

METHODOLOGY

This study was carried out at the Oral and Maxillofacial Surgery (OMFS) Department of Armed Forces Institute of Dentistry (AFID), Rawalpindi Pakistan, from January to June 2019 after approval from the

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Ethical Committee (905/Trg-ABPIK2). All the patients of both genders having mandibular trauma were treated as indoor cases. A definitive diagnosis was made with history, clinical examination, and radiographs. The total sample size was calculated to be 104, with each Group containing 52 patients. When the two-sided significance level was kept at 95%, the power of the test was kept to 80%. The sample size ratio, unexposed/exposed, was 1, while the percent of malocclusion in two groups was; percent of unexposed with the outcome: 9%, and percent of exposed with the outcome: 33%.[5]

Inclusion Criteria: Patients were categorized into two Groups based on their presentation time after the injury, i.e., Group-I (Early-Group) included all those patients who reported within the first 72 hours of injury and Group-II (Delayed-Group), all patients who presented after 72 hours up to 14 days of trauma.

Exclusion Criteria: Patients with obvious bone pathology, underlying systemic disease, edentulous maxilla or mandible, comminuted, and pan facial fractures were not included in the study.

Informed written consent was taken, and study proforma was filled by each patient after explaining the risks and benefits of the procedure to include them in the study. The procedure was carried out under general anaesthesia by one surgical team for all groups of patients, and no post-operative maxillomandibular fixation was done. All patients received three post-operative doses of Dexamethasone 8mg I/V, injection 1.2g Augmentin I/V, and injection Flagyl 500mg I/V. Follow-up was done weekly for the first four weeks, then fortnightly for another eight weeks. Post-operative radiographs were taken for each patient. At each visit, complications such as malocclusion, surgical site infection, hardware exposure, and non-union were evaluated. Malocclusion was checked clinically on the third post-op day and is referred to as the inability of the posterior teeth to interdigitate. Surgical site infection was clinically designated as the presence of extra/intraoral swelling, pus discharge, or the formation of an abscess. Hardware exposure implies that any exposed part of the miniplate system used through mucosa and non-union was characterized by mobility of fractured segments of the bone even after ORIF.

Statistical Package for Social Sciences (SPSS) version 22.0 was used for the data analysis. Mean and standard deviation was calculated for age. Frequencies and percentages were presented for all qualitative variables. The chi-square test was used to compare complications between two groups. The *p*-value of ≤ 0.05 was considered significant.

RESULT

In our study, a total of one hundred and four patients were included, with a mean age of 29.2±5.0 years (20-40) years. The mean hospital stay was 3.1±1.0 days. The frequency of fracture sites was described in Figure.

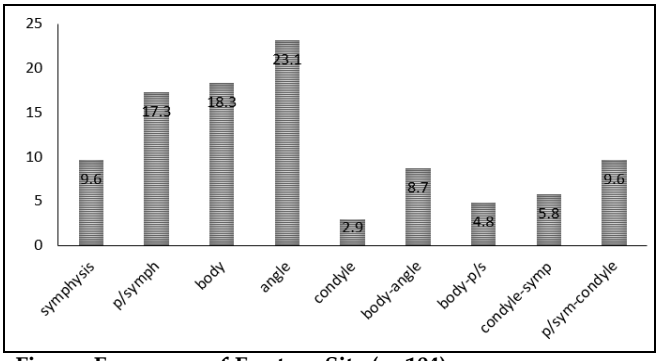

Figure: Frequency of Fracture Site (n=104)

One hundred and four patients with mandibular fractures were treated with open reduction internal fixation. On a periodic follow-up of 6 months, all patients were evaluated for malocclusion, surgical site infection, hardware exposure, and non-union complications. Each Group consisted of fifty-two patients of both genders. Group-I consisted of 33 males (63.46%) and 19 females (36.54%). In Group-II there were 27 males (51.92%) males and 25 females (48.08%), respectively (Table-I).

Table-I: Gender Distribution of Patients in Each Group (n=104)

	Group-I, (n=52)	Group-II, (n=52)
Male	33 (63.46%)	27 (51.92%)
Female	19 (36.54%)	25 (48.08%)

Group-I showed six patients (11.70%) with malocclusion, whereas three patients (5.80%) in Group-II had malocclusion (*p*-value=0.295). Surgical site infec-tion was present in 2(3.84%) patients in Group-I and 3(5.80%) patients in Group-II (*p*-value=0.647). There was no case of non-union and three patients (5.80%) of hardware exposure in Group-I and two patients (3.84%) in Group-II (*p*-value=0.647). No statistically significant increase in post-operative complications in malocclusion, surgical site infection, hardware exposure, and nonunion was found in Group-II with comparison Group-I. Details of both groups were shown in Table-II.

Table-II: Complications in the Postoperative Period (n=104)

Post Operated Complications	Group I (52)		Group II (52)		*p*-value
	Present	Absent	Present	Absent	
Malocclusion	6 (11.70%)	46 (88.30%)	3 (5.80%)	49 (94.20%)	0.295
Surgical site infection	2 (3.84%)	50 (96.16%)	3 (5.96%)	49 (94.04%)	0.647
Hardware exposure	3 (5.76%)	49 (94.24%)	2 (3.80%)	50 (96.20%)	0.647
Nonunion	0	52(100.00%)	0	52 (100%)	-

DISCUSSION

Among facial skeletons, the mandibular bone has relatively distinctive anatomy and structure. It is the only mobile unit among facial bones and has the mechanical strength to bear the occlusal forces due to its horseshoe-shaped bone. Fracture mandible is more common in males than females. It results in pain, malocclusion, limited mouth opening, and poor esthetics.[6] Like other long bones of the human body, fractures of the mandible occur in the areas of tensile strain. When a mandible is impacted, an event of injury forces is transmitted to different zones as compressive and tensile forces. When forces like a blow to the face or accidental injury occur, forces are transmitted to different zones as compressive and tensile forces. Hence, mandibles frequently fracture at two places, usually at the opposing side, like a boxing shot can fracture ipsilateral parasymphysis and a contralateral condyle. It was estimated that approximately 0.68-0.98N force is required to fracture the mandible.[7]

The time of fixation, to date, is still a matter of debate, and several conflicting ideas exist regarding the time to operate mandibular fracture.[2,3] Initially, it was believed that fractures should be treated within the first 6 hours of injury to lessen the rate of complications which was later extended to 48-72 hours.[2,3,8] Multiple systematic reviews were conducted to determine the effect of delay in treatment of mandible fractures, and conflicting results were obtained. The systemic review did not find a positive association between treatment timing and post-operative complications.[3] Systematic research by James *et al.* concluded that delay in surgical intervention for mandible fractures does not correspond to complications in the follow-up period.[9]

Complications after surgical intervention are due to many reasons, but the fracture and soft tissue loss pattern also complicate the process.[10] Other risk factors contributing include comorbid, pre-injury oral hygiene, and substance use.[3] Our study was conducted to see early versus delayed open reduction and internal fixation effects in patients with mandibular fractures. The most common complication is surgical site infection, followed by post-surgical malocclusion.[11]

Symphysis and para-symphysis regions are more likely to fracture at 24%. Para symphysis and condyle in bilateral fractures yield the highest fracture incidence at 10%, which is consistent with our study. Lee *et al*. in their study, reported that the commonest site was angle fracture, that is 36.4%.[1] while Abotalab *et al*. study showed fractures of para-symphysis/symphysis 27.2% and body 26.8% to be the commonest sites due to road traffic accidents as the leading cause, similar to our study.[7] The most documented cause of fracture in our country is road traffic accidents, followed by physical assault, interpersonal violence, and contact sports injury. In developing countries like ours, RTA is the common cause due to failure to implement traffic laws. In developed countries, interpersonal violence, physical assault, and driving under the influence are the top reasons for mandible fractures.[1] Another reason might be the shift to industrial from agricultural dependency, more traffic and more facial injuries.[12]

Our study was designed to investigate the effects of early versus delayed treatment of mandibular fractures in terms of post-operative complications, which included surgical site infection, malocclusion hardware exposure, and malunion up to a follow-up period of three months. At the end of the study, it was deduced that the most common post-operative complication seen was malocclusion (9%), followed by surgical site infection, which was seen in 5% of the patients. In our study, no case of non-union was reported. Generally, the complication rate in mandibular fractures ranges from 7-29% and depends upon the injury site, number of fractures, and severity of fracture.[12] Complications are due to multiple reasons, one being that the mandible is the only mobile bone to which muscles are attached in the craniofacial region, which can lead to fracture instability and movement after reduction and fixation of the fracture.[13,14]

Depending upon the age, normal bony union occurs at 4-8 weeks. Factors causing malunion are infection, instability, metabolic changes, or inadequate blood supply. Only one case of malunion was observed in our study. Malocclusion may result either due to the non-compliance of the patient with post-operative instructions given or technical errors such as inadequate reduction or loose hardware.[15,16] Different studies show variable results regarding the

development of post-op malocclusion ranging between 2.5% to 18.2% after ORIF.[17,18] In our study, 9% of the cases showed malocclusion in the post-operative period, comprising 22.2% in the Parasymphysis region. Maxillomandibular fixation was done for 03 weeks in patients showing posterior open bites in three patients, and selective occlusal grinding was done for four patients. A study by Ravikumar *et al.* showed similar results for malocclusion of 7.5% and infection occurring at a rate of 5.7%.[14]

Other risk factors such as alcohol consumption, smoking, and substance use contribute to complications in the post-operative period, along with patients' comorbidities, anaesthesia, and hospitalization. Variations in the complication rate after surgery exist and are found to be between 0.0% to 20.0%, as collected from the previous studies.[19]

Abdefadil *et al.*[20] stated that poor oral hygiene, such as periodontitis, gingivitis, and mobile tooth, affects post-operative wound healing. Open reduction internal fixation of fractures requires great care by oral hygiene practice and daily saline irrigation. A study showed that 7.9% of overall complications in which most of them were related to intraoral operating site.[7] However, the research analysis did not conclude any specific risk factors for these complications.[15] There is data showing readmission and reoperation after the development of post-operative complications. Christensen *et al.*[21] reported a 9.5% reoperation rate due to complications of ORIF mandibular fractures. The exact aetiology is unclear, but risk factors are reported.

Our study favours that delay in treating mandibular fractures is not associated with increased complications if an aseptic technique with proper reduction and fixation and regular follow-up is ensured. A prospective study by Hurrell *et al.*[19] also agrees, with our study, concluding that the time delay of surgical intervention is not directly related to an increase in complications. However, it also states that fractures result from assaults, surgery of long duration, advancing patient's age, and more clinical difficulties in the follow-up period. For future improvement in surgical outcomes, it is necessary to identify other risk factors so that the modern health care system provides a treatment that benefits the patient.

CONCLUSION

Mandibular fractures are the most common trauma that usually results from road traffic accidents. Contemporary management includes open reduction and internal fixation. The timing of ORIF does not govern the post-operative complication rate. However, adequate reduction, rigid fixation, and optimum soft tissue coverage are the most reliable indicators of successful operation.

Conflict of Interest: None.

Author's Contribution:

Following authors have made substantial contributions to the manuscript as under:

AH & YS: Critical review, drafting the manuscript, approval of the final version to be published.

AB: Study design, data analysis, critical review, drafting the manuscript, critical review, approval of the final version to be published.

SM & AM: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

MA: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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