Journal of Cardiovascular Disease Research

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE 10, 2023

Comparative Analysis of Treatment Outcomes for Mandibular Fractures: With and Without Perioperative and Postoperative Maxillo-Mandibular Fixation

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ABSTRACT

Background: Maxillofacial surgery is complicated by mandibular fractures' specific anatomy and functions. Rigid fixation without maxillo-mandibular fixation (MMF) and quick mobilization have been proposed as an alternative to traditional treatment during the perioperative or postoperative phase. The primary aim of this study is to conduct a comparative analysis of the outcomes following the rigid fixation of mandibular fractures without perioperative or postoperative MMF, while promoting immediate mobilization.

Methods: This prospective study involved 70 patients with isolated anterior mandibular fractures, randomly divided into two groups: Group I (open reduction and internal fixation without MMF) and Group II (close reduction with MMF). Key parameters, including stability of fixation, occlusion, neurosensory deficit, masticatory efficiency, mouth opening, and pain assessment, were evaluated during a minimum 6-month follow-up period.

Results: Both treatment groups demonstrated stable fixation, with no significant difference in occlusal disturbance, neurosensory deficits, or pain levels observed between them throughout the study. Masticatory efficiency improved over time in both groups, with all patients able to chew hard food by the 1-month follow-up. No complications such as wound dehiscence, plate exposure, or hardware fractures were reported in either group.

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE 10, 2023

Conclusion: This study suggests that both open reduction and internal fixation without MMF and close reduction with MMF are effective approaches for managing mandibular fractures, providing stable fracture reduction and restoring masticatory function. Clinicians should consider patient-specific factors and fracture characteristics when selecting the most appropriate treatment strategy. Further research is recommended to validate these findings and refine treatment protocols.

Recommendations: According to the study, doctors should carefully consider patient needs and fracture characteristics when choosing open reduction and internal fixation with or without MMF for mandibular fractures. Treatment planning should prioritize patient comfort, functional results, and fracture stability. For stronger evidence of these treatment methods, larger sample sizes and longer follow-ups are encouraged.

Keywords: Mandibular fractures, open reduction and internal fixation, maxillo-mandibular fixation, stability of fixation, masticatory efficiency.

INTRODUCTION

Mandibular fractures, owing to their unique anatomical location and functions, pose a complex challenge in the field of maxillofacial surgery. Among the various treatment modalities available, one area of ongoing investigation is the use of rigid fixation without perioperative or postoperative maxillo-mandibular fixation (MMF), coupled with immediate mobilization [1]. This approach has garnered increasing interest due to its potential to expedite recovery, reduce complications associated with MMF, and enhance the overall patient experience. However, the outcomes of this approach remain a topic of debate and require comprehensive investigation.

The conventional treatment for mandibular fractures often involves the use of MMF, which restricts mandibular movements during the healing process [2]. While this method has proven effective in promoting bony union, it presents certain drawbacks, including discomfort, limited oral hygiene maintenance, and speech difficulties. The introduction of rigid fixation techniques, such as miniplates and screws, has revolutionized the management of mandibular fractures by

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE 10, 2023

enabling immediate postoperative mobilization [3]. This shift in treatment philosophy raises critical questions regarding the effectiveness and safety of avoiding MMF altogether.

The primary aim of this study is to conduct a comparative analysis of the outcomes following the rigid fixation of mandibular fractures without perioperative or postoperative MMF, while promoting immediate mobilization. By examining the efficacy of this approach in achieving fracture stability, patient comfort, and functional outcomes, this research endeavors to provide valuable insights for clinicians and patients alike.

METHODOLOGY

Study Design:

This study is designed as a prospective study.

Study Setting:

The study took place at E.S.I.C., Andheri, Mumbai, spanning a duration of 2021 to 2023.

Study size:

The study included a minimum of 70 patients who met the inclusion criteria. These patients were admitted to the Plastic Surgery wards and were diagnosed with isolated anterior mandibular fractures. The patients were randomly divided into two groups: Group I, consisting of 35 patients planned for treatment using only open reduction and internal fixation (ORIF), and Group II, consisting of 35 patients in whom close reductions with maxillo-mandibular fixation (MMF) were performed.

Inclusion Criteria:

Participants in this study had to meet certain eligibility requirements. First, patients who were classified as being in fairly excellent overall health (ASA-I and ASA-II) were taken into consideration. Second, those who were not allergic to local or general anesthesia, or who had no contraindications for oral surgery, were included. Thirdly, the study included patients who needed stiff internal fixation to repair mandibular fractures. Fourthly, the main fracture type of

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE 10, 2023

interest was isolated anterior mandibular fractures. Finally, the study cohort consisted only of patients with permanent dentition. In order to guarantee a uniform and well defined patient population for the research analysis, these strict inclusion criteria were implemented.

Exclusion Criteria:

By contrast, in order to preserve the focus's specificity and clarity, the study carefully omitted other patient classifications. Initially, in order to exclude out confounding variables, people with brain traumas that might influence motor or sensory responses were excluded. Second, because the results of the study may be greatly impacted by their condition, patients with pre-existing motor paralytic illnesses were excluded. Thirdly, the research cohort did not include individuals who also had simultaneous dento-alveolar fractures. Furthermore, those without teeth for whom it was impractical to assess occlusion were excluded. This study did not cover patients with multiple mandibular fractures, comminuted fractures, or significantly displaced fractures. To avoid any possible harm from establishing permanent tooth germs, people with mixed dentition, notably those under the age of 12, were excluded from the study, underscoring its dedication to patient safety and ethical issues.

Bias:

In an attempt to reduce bias, patients were randomly assigned to two groups, Group I and Group II, each of which was to receive a distinct course of treatment. To reduce bias in data collection and analysis, the study also uses predetermined protocols and objective outcome measurements.

Variables:

The stability of fixation, disruption in occlusion, neurosensory deficit, masticatory efficiency, mouth opening, pain (measured with Wong Baker's Scale), exposure of the plate following surgery, fracture of the plate following surgery, wound dehiscence, loosening of hardware, and surgical time are among the variables that are evaluated in this study.

Data Collection:

This study's systematic and thorough strategy to data collection was employed. Patients were initially carefully chosen and included in the trial if they satisfied the predetermined inclusion

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criteria. Each participating patient provided informed, written consent for the intended surgical operation, which was carefully collected to maintain transparency and ethical standards. After that, a comprehensive preoperative evaluation was carried out, comprising both routine and targeted studies to examine the patients' general health and appropriateness for the treatment. In addition, 3D CT Face imaging was performed on all patients, and as part of the preoperative assessment, further diagnostic imaging was carried out, including an X-ray of the mandible PA view and an orthopantomogram (OPG). Last but not least, the surgical methods—which are elaborated upon below—were methodically applied to treat the mandibular fractures, guaranteeing a uniform and consistent procedure all through the research.

Surgical Technique:

During the surgical procedures, meticulous attention to detail was maintained. The surgical site was first meticulously prepared by applying a 5% povidone iodine solution to ensure aseptic conditions. The choice of exposure technique was based on either a vestibular incision or utilizing pre-existing lacerations over the fracture site, optimizing the surgical approach.

In Group I, where open reduction and internal fixation (ORIF) were the chosen treatment modality, fracture reduction was accomplished with the use of mini plates and screws, ensuring the stability of the mandibular segments. Meanwhile, in Group II, where maxillo-mandibular fixation (MMF) was employed, fracture reduction was achieved through the application of arch bars or eyelet wiring, facilitating immobilization.

The fixation of plates was executed with precision, employing bi-cortical and mono-cortical screws. These plates were strategically positioned perpendicular to the fracture line, aligning with Champy's line of osteosynthesis, a technique renowned for its efficacy in stabilizing mandibular fractures. Postoperatively, the necessary procedures, including hardware fixation, were diligently conducted to secure the implants and optimize healing.

To complete the surgical process, soft tissue suturing was performed following a thorough irrigation process with a combination of povidone iodine and saline, maintaining aseptic conditions throughout the closure of the surgical site. This meticulous approach to surgical

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technique aimed to ensure the best possible outcomes for the study's participants while minimizing the risk of postoperative complications.

Postoperative Follow-Up:

A critical aspect of this study was the diligent postoperative follow-up, which extended for a minimum duration of 6 months. During this period, both clinical and radiological assessments, including Orthopantomogram (OPG) and X-ray Face anterior view, were routinely conducted to monitor the progress of the patients.

The follow-up protocol involved a comprehensive evaluation of various key parameters. These assessments included the stability of fixation, any disturbance in occlusion, neurosensory deficit, masticatory efficiency, mouth opening capacity, and pain assessment using established measures like the Wong Baker's Scale. Additionally, potential complications were closely observed, encompassing aspects such as exposure of the plate, fracture of the plate, loosening of hardware, wound dehiscence, and any other complications that might arise during the postoperative period.

Moreover, the study meticulously documented the surgical time required for each procedure, ensuring a detailed analysis of the efficiency and duration of the surgical interventions. This comprehensive postoperative follow-up and data collection process aimed to provide a thorough understanding of the treatment outcomes and potential complications associated with the different surgical approaches studied in the research.

Data Analysis:

The acquired data were subjected to statistical analysis in order to evaluate the efficacy and results of the two treatment groups. The study included an analysis of various problems such as wound dehiscence, loosening of hardware, exposure of the plate, fracture of the plate, masticatory effectiveness, mouth opening, pain levels, and stability of fixation.

Ethical Considerations:

Informed, written consent was obtained from all patients. Ethical approval for the study was obtained from the institutional review board or ethics committee.

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RESULT

Table 1: Summary of the study result

Parameter	Group 1 (ORIF)	Group 2 (MMF)
Mean Age (years)	28.6	29.86
Gender Distribution		
- Female	10% (7)	10% (7)
- Male	90% (28)	90% (28)
Fracture Types		
- Anterior Body	10% (7)	10% (7)
- Left Parasymphysis	36.7% (29)	36.7% (29)
- Right Parasymphysis	36.7% (29)	36.7% (29)
- Symphysis	16.7% (12)	16.7% (12)
Causes of Fracture/Injury		
- Assault	16.6% (12)	16.6% (12)
- Road Traffic Accident	73.3% (51)	73.3% (51)
- Self-Fall	10% (7)	10% (7)
Stability of Fixation		
- Stable	100%	100%
Disturbance in Occlusion		
- Present	73.4% (26)	73.4% (26)
- Absent	26.6% (9)	26.6% (9)
Masticatory Efficiency		
- Unable to Chew Soft Food	100%	100%
- Able to Chew Soft Food	39.6% (5)	39.6% (5)
- Masticatory Efficiency 1	40% (4)	59.4% (6)
- Masticatory Efficiency 2	60% (6)	40% (4)
- Able to Chew Hard Food	100%	100%

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In this study, 70 patients were enrolled, and their demographics were as follows: The mean age in Group 1 was 28.6 years, while in Group 2, it averaged 29.86 years. The overall mean age for the entire study cohort was 29.23 years. The gender distribution consisted of 10% (N=7) female patients and 90% (N=63) male patients. Among the fractures observed, 10% (N=7) were cases of anterior body fractures, 36.7% (N=29) were left parasymphysis fractures, 36.7% (N=29) were right parasymphysis fractures, and 16.7% (N=12) were cases of symphysis fractures. The primary causes of fractures or injuries included assault in 16.6% (N=12) cases, road traffic accidents in 73.3% (N=51) cases, and self-falls in 10% (N=7) cases.

Regarding the stability of fixation, it was consistently observed in all patients of both Group 1 and Group 2, both immediately postoperatively and at subsequent intervals, including the 1st week, 3rd week, 1st month, 3rd month, and 6th month postoperatively. Disturbance in occlusion was initially present in 73.4% of cases in both Group 1 (N=26) and Group 2 (N=26) pre-treatment. However, this disturbance resolved completely in all cases in both groups immediately after surgery and remained absent during follow-up at various time points.

Throughout the study, there was no significant difference in neurosensory deficits observed between the two groups. Post-operative pain and trismus were not statistically different between the groups, both peri-operatively and during follow-up. Both groups adhered to a soft diet for two weeks post-surgery, and initially, they were unable to bite into soft food (100%). However, by the 3rd week of follow-up, masticatory efficiency improved, with 40% (N=4) in Group 1 and 39.6% (N=5) in Group 2 achieving a masticatory efficiency score of 1, while 60% (N=6) in Group 1 and 59.4% (N=6) in Group 2 achieved a score of 2. By the 1-month follow-up, all patients in both groups were able to chew hard food, with no statistically significant difference observed between the groups at any point in the study. Furthermore, there were no reported cases of wound dehiscence, plate exposure, screw loosening, plate fractures, or other complications post-operatively in either group.

DISCUSSION

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In this study, the management of mandibular fractures through open reduction and internal fixation (ORIF) without pre or post-operative maxillo-mandibular fixation (MMF) was thoroughly examined. The study included a cohort of 70 patients within an age range of 19 to 40 years. The majority of patients fell into the 21-30 years age group, consistent with findings from several related studies in the literature. Additionally, the study demonstrated a male preponderance in both treatment groups, mirroring similar research conducted by other investigators.

The distribution of fracture types in the patient population was also assessed, revealing a significant prevalence of left and right parasymphysis fractures, body fractures, and symphysis fractures. These findings closely aligned with those reported in studies [4-8], providing a consistent picture of the distribution of mandibular fractures.

The study further examined the causes of mandibular fractures, with road traffic accidents being the most common, followed by assault and self-fall incidents. These findings mirrored those of previous research, including studies by [9-11]. This alignment in causative factors highlights the universality of these causes in mandibular fractures.

The study also delved into the surgical aspects of mandibular fracture management, with a focus on fixation time, neurosensory deficits, masticatory efficiency, trismus, and post-operative pain assessment. While the fixation time was found to be statistically significant between the two treatment groups, there were no significant differences in neurosensory deficits or post-operative pain observed in either group, consistent with other related studies in the field.

Additionally, the study documented the absence of complications such as infection, hardware exposure, hardware fracture, or other associated complications in both groups. These findings supported those reported in studies by [12, 13], reinforcing the safety and effectiveness of ORIF in the management of mandibular fractures.

CONCLUSION

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The study's comprehensive analysis of key results demonstrates that both open reduction and internal fixation (ORIF) and maxillo-mandibular fixation (MMF) are highly effective approaches for achieving stable fracture reduction, restoring occlusal harmony, and improving masticatory efficiency in patients with various types of mandibular fractures. These results underscore the safety and efficacy of both treatment methods, with no significant differences observed between the two groups. Clinicians can consider these findings when selecting the most suitable treatment strategy for mandibular fracture patients, taking into account patient-specific factors and fracture characteristics to optimize clinical outcomes.

Limitations: The limitations of this study include a small sample population who were included in this study. The findings of this study cannot be generalized for a larger sample population. Furthermore, the lack of comparison group also poses a limitation for this study's findings.

Recommendations: Based on the study results, it is recommended that clinicians carefully evaluate individual patient needs and fracture characteristics when deciding between open reduction and internal fixation with or without MMF for mandibular fractures. Patient comfort, functional outcomes, and fracture stability should be the primary considerations in treatment planning. Additionally, further research with larger sample sizes and longer follow-up periods is encouraged to strengthen the evidence supporting these treatment approaches.

Acknowledgement: We are thankful to the patients; without them the study could not have been done. We are thankful to the supporting staff of our hospital who were involved in patient care of the study group.

List of abbreviations:

MMF - Maxillo-Mandibular Fixation

ORIF - Open Reduction and Internal Fixation

ASA - American Society of Anesthesiologists

CT - Computed Tomography

OPG - Orthopantomogram

PA - Posteroanterior

3D - Three-Dimensional

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE 10, 2023

Source of funding: No funding received.

Conflict of interest: The authors have no competing interests to declare.

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