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Original Article

Comparison between two Surgical Approaches for the Management of Mandibular Angle Fracture among Adults at Altamash Dental Hospital in Karachi, Pakistan – A Randomized Clinical Trial

Saeed Ullah Shah[1], Maria Muhammad Shabbir[2], Hina Jabeen[3], Rahima Yousofi[4], Anum Ayub[5], Raahim Salman Abdul Ghaffar[6]

1. Oral Medicine Department, Altamash Institute of Dental Medicine, Karachi, Pakistan.
2. Shaheed Muhtarma Benazir Bhutto Institute of Trauma, Karachi, Pakistan.
3. Department of Oral Surgery, Bahria University Dental College Karachi, Pakistan.
4. Research Development and Review Cell, Altamash Institute of Dental Medicine, Karachi, Pakistan.
5. Operative Dentistry Department, Altamash Institute of Dental Medicine, Karachi, Pakistan.
6. School of Nursing and Midwifery, Aga Khan University, Karachi, Pakistan.

ABSTRACT

Objective: This study aims to compare the frequency of complications between two surgical approaches for managing mandibular angle fracture.
Materials and Methods: The study was carried out in department of oral surgery, Altamash Dental Hospital Karachi, Pakistan from June 2020 to December 2020. Adult patients between the age of 18-65 years from both genders presenting with unilateral and bilateral mandibular angle fractures were included in the study. Participants were divided into two equal groups i.e., intraoral and extra oral based on the surgical approach they would be receiving. The diagnosis was based on clinical history, examination, and dental radiographs.
Results: Among the 140 participants enrolled, the average age was 33.87 ± 11.39. There were 118 (84.3%) males and 22 (15.7%) females. Both the infection rate and nerve injury were statistically significant in the extra-oral group, 7 (5%) and 18 (12.9%), respectively as compared to the intraoral group (p = 0.007).
Conclusion: The risk of postoperative complications was higher in the extra oral approach as compared to the intraoral approach. In addition, the intraoral approach exhibited an enhanced radiographic reduction in the fracture gap along with less external scarring, indicating that it is a better approach to the management of mandibular fracture.
Keywords: Extra oral, Fracture, Intraoral, Mandibular condyle, Mandibular nerve injury, Trismus

Corresponding Author
Raahim Salman Abdul Ghaffar
School of Nursing and Midwifery, Aga Khan University, Karachi, Pakistan
Salmanraahim4@gmail.com

INTRODUCTION

The maxillofacial region is the most eminent and the most susceptible feature of the human body to be injuries[1]. Studies have shown that facial fractures comprise 23-97% of all body fractures out of which mandibular fractures are the most frequently occurring ones and constitute about 15.5% to 59%. [2,3] The angle of the mandible is the most susceptible site of facial fracture i.e. 20%.[4] Many factors make this area vulnerable to fractures this includes; the presence of impacted 3rd molar, decreased cross-sectional area at the angle, biomechanical movement of the mandible like a "lever" because of the masticatory action of the muscles i.e. posteriorly at the ramus and suprahyoid and anteriorly at the symphysis/ body.[5-7]

When the mandible is subjected to lateral forces, this exerts stresses causing abrupt changes to occur in the horizontal to vertical direction.[5,6] Thus when the mandible is subjected to a lateral blow, not only does the angle tends to fracture at this point of junction but also involves the body of the mandible on the opposite side.[7] Mandibular angle fracture can be managed through different surgical approaches including intraoral and extra-oral open reduction and internal fixation.

In intraoral Open Reduction Internal Fixation (ORIF), Champy's et al (1976) described the ideal line for the placement of the single non-compression mono-cortical plate on the superior aspect of the mandible along with the external oblique ridge. The advantage of this technique is that it provides direct accessibility and visualization of the occlusion during the procedure, no scar formation on the face and reduce chances of injury to the marginal mandibular nerve; however, there is a higher degree of infection due to contamination of the sterile plate from the oral cavity. [8-10] In contrast the extra-oral (sub-mandibular) approach is used when a more stable fixation is required, during this technique two mono-cortical non-compression mini-plates are used to fix the fracture line, and one plate is placed on the superior aspect of the mandible and other on the outer cortex. The advantage of this technique is the decreased probability of infection because the sterile plate is sealed from the oral cavity, but it leaves an unaesthetic scar in some patients and there is a risk of marginal mandibular nerve injury.[11,12] Selection of surgical approach is based on the type of case such as type of fracture, extent of bony dislocation, expertise and knowledge of the operating surgeon and association with other maxillofacial fractures.[13-16]

Mandibular angle fractures are highly susceptible to postoperative complications whose incidence ranges from 1% to 32%. The extra oral surgical approach is associated with an 8% high likelihood of damage to the marginal mandibular nerve and increased chances of a post-operative unappealing scar.[17]

Although studies have been done internationally, comparing the efficacy of these two surgical approaches, [18] no relevant local data is available to the best of the author's knowledge and the result of both surgical approaches may exhibit a different outcome owing to the altered levels of bone density and dietary habits of the local population. Therefore, there is a need to conduct studies in our national population to compare the postoperative results of both these approaches and be able to choose the better procedure for managing patients with mandibular angle fractures.

The aim of this research is to evaluate and compare the efficacy in terms of postoperative outcome among smokers and non-smokers between two surgical approaches, intraoral and extra oral reduction for the management of mandibular angle fracture.

MATERIALS AND METHODS

A randomized clinical trial study design was opted for this study. Data was collected from Altamash Dental Hospital, Karachi from June 2020 to December 2020 after receiving approval from the ethical review committee. A total of 140 participants sample size i.e., 70 participants in each group was calculated.[10] A consecutive sampling technique was used to select participants who fulfilled the eligibility criteria and were assigned one of the two surgical approaches. Participants aged range between 18 to 65 years from either gender having unilateral or bilateral mandibular angle fractures with or without other facial fractures as diagnosed from a CT scan not more than a week old were included to maintain the accuracy of the condition.[17] However, participants experiencing certain comorbid diseases such as diabetes mellitus, osteoporosis and other chronic disease, prescribed long-term corticosteroids were excluded. Also, those participants with pathological bone fracture and habitual consumption of pan, gutkka or chalia were not included in this study.

The patients were randomly divided using computer-generated random number table into two equal groups, each of the two groups was assigned romans digits: the first group was labelled as "I" and had participants subjected to an intra-oral surgical approach while the second group labelled as "II" underwent extra-oral surgical approach.

A semi-structured questionnaire was used to collect demographic information along with details about the participant's medical complaint and history and any complications regarding any of the surgical approaches. The data were entered and analyzed in SPSS version 22. Quantitative values for gender, fracture side unilateral and bilateral, complication trismus and any infection or mandibular nerve injury was reported. Chi-square test was applied keeping the confidence interval at 95% and by taking $p \leq 0.05$ as significant.

RESULTS

A total of 140 participants with mandibular fractures were included in the study. The participants were equally divided into two groups based on the approach being used for treating the mandibular angle fracture i.e. 70 in the intraoral approach and 70 in the extra approach group.

The average age was 33.87 ± 11.39 with a minimum of 18 and a maximum of 59 years. The mean (SD) age among the intraoral group was 33.94±12.5) and among the extra oral group was 33.8 ±10.15.

There were 118 (84.3%) males and 22 (15.7%) females. The male-to-female ratio was 5.4:1. There were 63 (45%) males and 7 (5%) females in the intraoral group and 55 (39%) males and 15 (11%) females in the extra oral group.

Participants who were smokers mostly belonged to the intraoral group 23 (16.4%) as compared to extraoral group 11(7.9%) Figure 1.

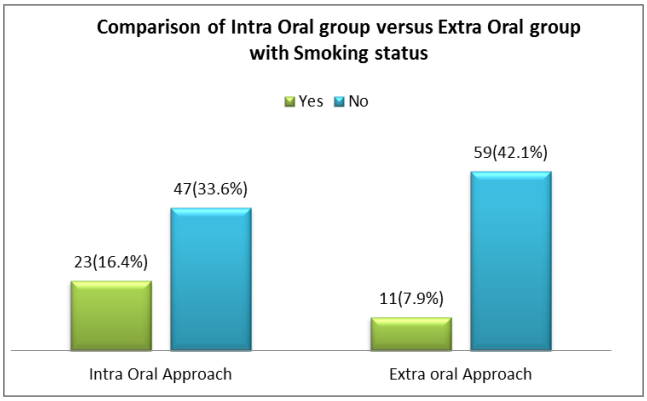

Figure 1: Smoking status among intra and extraoral groups

The average fracture duration was 14.35 ± 2.12 with a range of 10 to 20 days. About 120 (86%) participants had a unilateral fracture and only 20 (14%) had a bilateral fracture. The number of participants among the two surgical groups based on the location of the fracture can be seen in Figure 2.

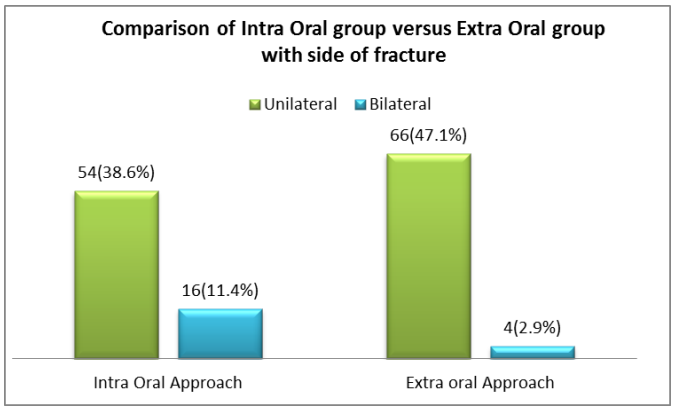

Figure 2: Comparison of unilateral and bilateral fractures among intra and extraoral groups

Upon stratification of age into groups containing less than 30 years and greater than 30 years old participants, a significant (p<0.001) and 0.022 was observed between the intra and extraoral approaches for nerve injury and infection respectively.

Gender stratification i.e. male and female, revealed a significant difference of p<0.001 for nerve injury and 0.007 for infection among the two types of surgical approaches.

Apart from the aforementioned findings another interesting aspect that was noted was the duration of fracture regardless of it being for less than or greater than 14 days and the presence of either unilateral or bilateral fractures both showed significant outcomes in terms of (p<0.001) for nerve injury and 0.025 and 0.014 for infection respectively across the intra and extra oral surgical approaches.

The presence of trismus also exhibited a significant (p=0.004) and 0.049 for both duration of fracture (less than or greater than 14 days) and unilateral or bilateral fractures amid the different surgical treatments.

As smoking plays an important role in the overall outcome between the surgical approaches, in our study we segregated participants into smokers and non-smokers and assessed the different results along with p-values individually as illustrated in Table 1.

Table 1: Analysis of intra (IOA) and extra oral (EOA) approaches among smokers and non-smokers

Smoking	Variables	Response	Mandibular Fracture Groups		p-value
			IOA	EOA	
Yes n=34	Trismus	Yes	15(10.7%)	5(3.6%)	0.013*
		No	8(5.7%)	6(4.3%)	
	Nerve Injury	Yes	-	5(3.6%)	0.000*
		No	23(16.4%)	6(4.3%)	
	Infection	Yes	0(0%)	0(0%)	------
		No	23(16.4%)	11(7.9%)	
No n=106	Trismus	Yes	3(2.1%)	10(7.1%)	0.099
		No	44(31.4%)	49(35%)	
	Nerve Injury	Yes	-	13(9.3%)	0.001*
		No	47(33.6%)	46(32.9%)	
	Infection	Yes	-	7(5%)	0.015*
		No	47(33.6%)	52(37.1%)	

*Significant $p \leq 0.05$

DISCUSSION

The most prevalent bony dislocation in the maxillofacial region is the fracture of the angle of the mandible. Among two-thirds of all the maxillofacial fractures (nearly 70%), the fracture of the angle of the mandible constitutes about 26-35%.[19]

Studies conducted by Hamill et al., Raveh et al., and Ellis and Karas also focused on the various outcomes experienced by using either the intraoral or the extraoral approach for managing mandibular angle fractures, and deduced that the success of any fixation solely depends upon the choice of the approach employed. [20-23]

Post-operative complications observed in this study amid patients treated using the extraoral approach included damage to the mandibular nerve among 12.9% (18/ 140) and trismus experienced by 14.3% (20/ 140) patients altogether. These findings are concurrent to other studies which have reported the advantages of the intraoral route over the extraoral route. [24,25]

Another finding observed in this study was the presence of infection encountered during the extraoral approach 7(5%) compared to the patients treated through the intraoral approach who experienced no infection. A similar end result was seen in research from India, in which the infection rate was 12.5% higher among patients who underwent treatment using open reduction and internal fixation for mandibular fractures. [23]

Many attributable factors can be related to these findings including inappropriate surgical technique, significantly extensive operative time, inadequate post-operative care including poor oral hygiene, failure to adhere to proper post-operative instructions along with poor patient wound maintenance and dehiscence. A few practitioners tend to blame

unsuccessful fixation on the hardware that was used during the procedure. [24]

Many patients complained of malocclusion post-operatively. Approximately 6.6% of the cases operated by the intra-oral approach had some malocclusion, and about 13.3% of cases operated using the extra-oral approach.[28] The presence of this malocclusion and nerve damage either sensory or motor neuropathies or both was confirmed solely through verbal confirmation from the patient.

The incidence of trismus 20(14.3%), was also assessed postoperatively among the 140 fractures treated during this study i.e. 5(3.6%) among the intraoral group and 15(10.7%) among the extraoral group. The higher number of trismus in the extraoral approach might be related to the dissection through multiple tissue layers and the closure with the extraoral approach, which increases the time duration of the surgery. Similar findings were seen in other studies where limited mouth opening was more among participants treated using the extraoral technique. [26]

In our study facial nerve damage was encountered with the extraoral approach and this finding was similar to another study which evaluated the level of facial nerve function. In that study, researchers observed that 26.5% (range, 0 % to 53%) participants had facial nerve weakness when mandibular fractures were reduced using an extraoral approach. [23,25]

In many instances, blunt trauma is plausible as facial tissues are retracted for a significant length of time. Impairment to the facial nerve can also occur during tissue dissection when approached externally as compared to an intraoral technique. [27]

A plausible limitation that might hinder or change the course of the direction of the choice of treatment method could be the duration of the surgery. This aspect may or may not have affected the success or failure of the treatment selection and needs to be addressed in another upcoming research.

But as this study was a follow-up to another research which incorporated an experimental study design the number of patients enrolled in this study was sufficient enough to demonstrate significant results which eventually aided in fulfilling the outcomes and aims of this study.

CONCLUSION

In conclusion, this research exhibits that by deploying an intraoral approach for the management of mandibular angle fractures a decreased number of complications were observed as compared to an extra oral approach. Though our study supports the use of the intraoral technique, this is solely based on the type of fractures, the extent of the fracture line, the involvement of the type of bones, and the amount of nerve damage.

Authors Contribution

S.U.S: analyzed and interpreted the data, writing of the manuscript, comprehended the study, and participated in drafting the data collection and coordination. M.M.S: conceived the idea of the study, analyzed and interpreted the data, writing of the manuscript. R.Y: Conceived the idea of the study, adapted the survey after a thorough literature review and developed the design and methodology, and analysis plan, analyzed and interpreted the data. H.J: comprehended the study and participated in drafting the data collection and coordination. A.A. comprehended the study and participated in drafting the data collection and coordination. M.M.S; R.Y; R.S.A.G, and A.A: contributed to writing the paper, and finalized the manuscript through critical edits. R.S.A.G: comprehended the study and participated in drafting the data collection and coordination.

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Institutional ethical board approval

The study was approved by the Ethical Review Committee of Altamash Institute of Dental Medicine, Karachi, Pakistan. AIDM/ERC/05/2020/03.

Informed Consent

The written consent was obtained from all participants in this study.

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Conflict of Interest

The authors report no conflict of interest.

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