



Original Article



Comparative Analysis of Outcomes: Intra-Oral and Transbuccal Approach Using Trocar for Fixation of Mandibular Fractures

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ABSTRACT

Mandibular fractures are frequent maxillofacial injuries. Open reduction and internal fixation may be intraoral or transbuccal, with each having varying access, visualization, and aesthetic effects. **Objectives:** To compare intraoral and transbuccal methods of fixation of mandibular fractures. **Methods:** It was a prospective interventional study among 70 patients with unilateral displaced fracture of the mandible, who were divided into intraoral (n=35) and transbuccal (n=35) groups. All cases were subjected to standard intraoral access. The fixation was done intraorally & using a transbuccal trocar. They were assessed in relation to surgical time, ease of accessibility (VAS 13), post-operative occlusion, and radiographic fracture reduction (adequate 3 mm gap or below). The continuous variables were evaluated using the Mann-Whitney U test, and the chi-square test was applied to the categorical variables with a level of significance at $p < 0.050$. **Results:** Fracture reduction (82.9 vs. 80.0; $p = 0.759$) and post-operative occlusion (both 88.6; $p < 0.001$) did not reveal any significant difference. The transbuccal group had better access to surgery. The intraoral method was shorter in terms of the time of operations (median 45 vs. 70 minutes; $p < 0.001$). **Conclusions:** The transbuccal method enhances the accessibility of the surgery, and the intraoral method is faster. The choice of approach must take into account the position of fractures and the experience of the surgeon.

INTRODUCTION

The mandible is positioned prominently among the face bones and is, hence, a common target for both intended and inadvertent injuries. Almost two-thirds of all facial traumas are mandible fractures, accounting for nearly 70% for almost, with angle fractures contributing 26-35% for of all mandibular fractures [1]. Various strategies have been put forth depending on the type of fracture and financial circumstances. The best course of action for angle fractures remains up for debate. The decision on which strategy to use is typically based on variables like

accessibility, fracture parts displacement, and visualization. The operators' decision regarding the best course of action is based on several factors, including the patient's preferences, the simplicity of the treatment, the surgeon's skills, the instruments, and the accessibility to the area of the fracture. Two of the most popular methods for managing fractures are intraoral and transbuccal. The transbuccal trocar approach combines the biomechanical benefits of lateral fixation of plates with minimum visible scars by allowing percutaneous lateral accessibility for



screw installation while maintaining an intra-oral approach. Transbuccal approach frequently enhances plate/screw placement and aesthetic results, according to clinical trials and literature reviews; however, reports of variations in infection, malunion, as well as cumulative rate of complications as compared to purely intra-oral management vary. Every technique has its pros and cons of its own [2]. Management of angle fractures is difficult and uncertain due to their substantial complication incidence and biomechanical complexity [3]. The mandibular angle fractures are often treated with open reduction and internal fixation [4]. According to Champy et al., putting simply one plate to the optimal line for osteosynthesis is sufficient to endure the stresses that are commonly applied to the lower jaw bone [5]. To compensate for displacement pressures from the musculatures, particularly in unfavorable fracture patterns, some people prefer to utilize thicker plates along the lower end of the jaw [6]. The mandibular angle fractures could be surgically accessed using intraoral or transbuccal approaches [7]. In numerous situations, an intraoral technique including fixation with plates at the inferior borders necessitates the use of a transbuccal trocar via a tiny puncture on the skin for introduction of the cannula [8]. Infection, misalignment, or nonunion, which may vary from 0 to 32%, result from improper anatomical correction of the angle fracture in appropriate conditions [9]. Researchers discovered the transbuccal route as a substitute for the transoral technique due to its drawbacks. With this method, a transbuccal trocar is used to allow tools like the drill and screw driver to navigate via an incision that is made on the skin on the face, in addition to an intraoral puncture. Benefits include avoiding external wounds, fixing the plates against the mandible's thicker lateral cortex in the sagittal view increasing the amount of tissue protection, reducing the risk of plate damage because over bending weakens the plates, lowering the rate of infection because fewer bacteria from the third molar region move around, and directly visualizing and confirming the intended occlusion while fixation [10].

Although several studies have been conducted on the comparison of intraoral and transbuccal techniques, the available evidence is still incongruent as to their comparative efficacy concerning their relative accessibility to surgery, their operative duration, their ability to reduce fractures, and their ability to achieve post-operative occlusion. The majority of the studies available have small sample sizes, are not standardized in assessment criteria, or are not compared directly between the two techniques in a similar clinical setting. This brings a literature gap in the form of which is the best approach when offering clinical results, especially when dealing with mandibular angle fractures. Thus, this study had an

objective of comparing intraoral and transbuccal techniques of open reduction and internal fixation of fractures of the mandible angle. This study aimed to assess and compare surgical time, fracture reduction quality, post-operative occlusion, and accessibility of surgery in fixation. The current research offers recent comparative statistics to justify evidence-based choices of surgical methods to use in mandibular angle fractures.

METHODS

This prospective interventional study comparing two techniques was conducted at the Department of Oral and Maxillofacial Surgery, The University of Lahore, from January 2025 to June 2025. Ethical approval was obtained from the Institutional Review Board of The University of Lahore (Ref. number UCD/ERCA/24/1566; dated 10th December 2024). The primary outcome variable used to estimate the sample size was the operative time since it is an objective, continuous, and clinically significant variable of the two surgical methods. The sample size was estimated by the use of the already published comparative data, which showed that the mean difference in the operative time between intraoral and transbuccal methods is about 20 minutes with a pooled standard deviation of 25 minutes [11]. Based on the two-sided test to compare the means, with a significance level of 0.05 and a power of 80%, the sample size of 35 patients per group was obtained. A non-probability convenience sampling technique was used to recruit participants who met the inclusion criteria. The patients who met the eligibility criteria were recruited sequentially and placed into two groups (intraoral or transbuccal) until 35 patients per group were recruited according to the clinical judgment and discretion of the operating surgeon, because there were no preset criteria that allowed patients to be assigned a particular group. Inclusion criteria were patients with displaced unilateral mandibular angle fractures. Patients with bone disorders affecting healing, contraindications for general anesthesia, active infection at the fracture site, or other facial fractures were excluded. Written informed consent was obtained from all participants after explaining the procedure, risks, benefits, and alternatives. Participants were allocated into two equal groups (n = 35 each) based on the surgical approach planned by the attending surgeon: Group 1 (intraoral approach) and Group 2 (transbuccal approach). All patients underwent preoperative evaluation, including routine blood tests and anesthesia assessment. All surgeries were performed under general anesthesia with nasotracheal intubation, supplemented with 2% lignocaine with 1:100,000 adrenaline at the surgical site for hemostasis for both groups. After general anesthesia and sterile draping, a conventional intraoral vestibular incision was made to expose the fracture. In Group 1, fracture

reduction was performed intraorally and fixed with a 5-hole miniplate and screws. In Group 2, a transbuccal cannula with a trocar was used in addition to the intraoral incision to insert screws through a small skin stab incision while protecting facial nerve branches. Surgical accessibility was evaluated using a visual analogue scale (1 = good, 2 = fair, 3 = poor) [12], and the duration of surgery was recorded. All patients had panoramic radiographs on the first postoperative day. A senior registrar, who was blinded by the surgical approach, measured fracture reduction. The interval between the fractures at the angle point was measured digitally on the X-ray. A fracture gap of ≤ 3 mm was considered adequate, while >3 mm was inadequate [13]. The reduction of fractures in representative postoperative panoramic radiographs in both groups is illustrated. There was adequate fracture reduction (≤ 3 mm gap) in transbuccal group. Panoramic radiographs were obtained using a Sirona Orthophos® orthopantomograph machine (Sirona Dental Systems, Bensheim, Germany). The fracture gap was measured on the Sirona software digitally. Postoperative occlusion was evaluated on the first postoperative day and categorized as satisfactory (minimal/no deviation from pre-trauma occlusion, normal intercuspation, comfortable mastication) or non-satisfactory (malocclusion, open bite, premature contacts, or functional difficulty). Postoperative panoramic radiograph (orthopantomogram) that shows the patient who was treated with a transbuccal approach has an adequate reduction of the fracture (less than 3 mm gap) (Figure 1).

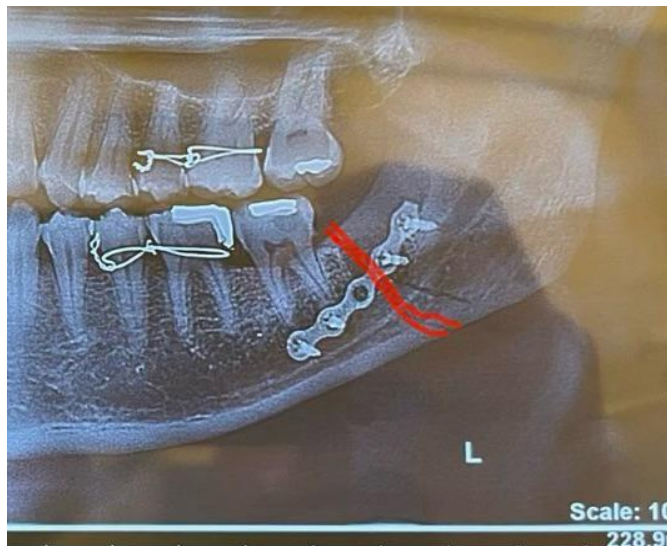


Figure 1: Postoperative Panoramic Radiograph (Orthopantomogram)

The study shows inadequate reduction (>3 mm gap) in the intraoral group. All the measurements were taken, and data were utilized to work out percentages of satisfactory reductions in each group (Figure 2).

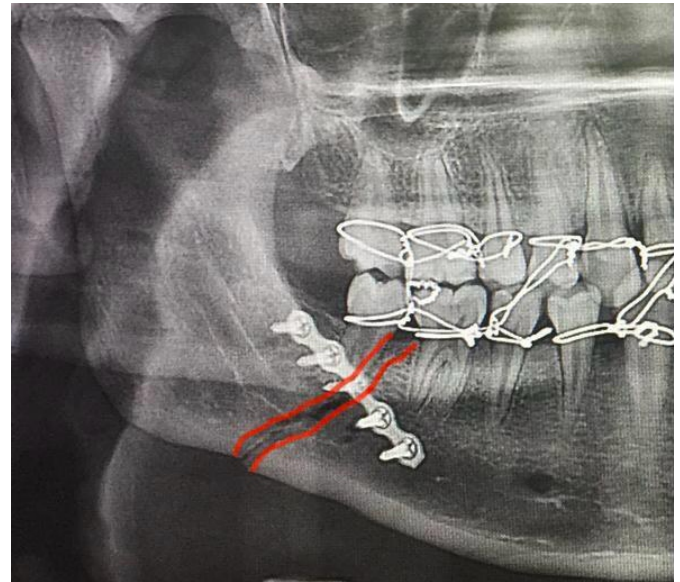


Figure 2: Panoramic Radiograph (Orthopantomogram) Showing Inadequate Fracture Reduction (>3 mm) Used in the Intraoral Technique

Continuous variables (age, surgical time) were assessed for normality using the Shapiro-Wilk test. As they were not normally distributed, the Mann-Whitney U test was used for group comparisons. Categorical variables (postoperative occlusion, fracture reduction, and surgical accessibility) were compared using the Chi-square test. All analyses were performed using SPSS version 24.0, with $p < 0.050$ considered statistically significant.

RESULTS

A total of 70 patients were included, with 35 in the intraoral group and 35 in the transbuccal group. The study evaluated surgical time, fracture reduction, post-operative occlusion, and surgical accessibility, corresponding to the stated objectives. The fracture reduction was measured on the digital software of the radiograph. Adequate fracture reduction was observed in 82.9% of the intraoral group and 80.0% of the transbuccal group. There was no statistically significant difference between the two groups ($\chi^2 = 0.094$, $p = 0.759$), indicating that both approaches are equally effective in achieving anatomical alignment of the mandible. Satisfactory occlusion was achieved in 88.6% of patients in both groups, with no statistically significant difference ($\chi^2 = 0.000$, $p < 0.001$). This demonstrates that both techniques reliably restore pre-trauma occlusion. The transbuccal approach provided significantly better surgical accessibility compared to the intraoral approach, with 77.1% rated as "good" versus 17.1% in the intraoral group ($\chi^2 = 25.675$, $p < 0.001$). The intraoral approach was predominantly rated as "fair" (71.4%), highlighting the advantage of transbuccal access for plate placement, especially in posterior fractures (Table 1).

Table 1: Comparison of Categorical Variables between Intraoral and Transbuccal Approaches

Variables		Intraoral, n (%)	Transbuccal, n (%)	χ^2 (df)	p-value
Post-Operative Occlusion	Satisfactory	31 (88.6%)	31 (88.6%)	0.000 (1)	<0.001
	Unsatisfactory	4 (11.4%)	4 (11.4%)		
Fracture Reduction on Radiograph	Adequate	29 (82.9%)	28 (80.0%)	0.094 (1)	0.759
	Inadequate	6 (17.1%)	7 (20.0%)		
Ease of Accessibility	Good	6 (17.1%)	27 (77.1%)	25.675 (2)	<0.001
	Fair	25 (71.4%)	6 (17.1%)		
	Poor	4 (11.4%)	2 (5.7%)		

χ^2 = Pearson Chi-square statistics

The median surgical time was significantly shorter for the intraoral group (45 minutes [IQR 42–48]) compared to the transbuccal group (70 minutes [IQR 65–75], $p < 0.001$), reflecting the additional steps required for transbuccal instrumentation. Age distribution did not differ significantly between groups ($p = 0.090$), ensuring comparability (Table 2).

Table 2: Comparison of Continuous Variables (Age and Surgical Time) Between Intraoral and Transbuccal Groups

Variables	Intraoral (n = 35) Median [IQR]	Transbuccal (n = 35) Median [IQR]	p-value
Age (Years)	28.0 [24.0–33.0]	27.0 [23.0–32.0]	0.090
Surgical Time (Minutes)	45.0 [42.0–48.0]	70.0 [65.0–75.0]	<0.001**

IQR: Interquartile range; the Mann-Whitney U test was used for all comparisons. **Statistically significant at $p < 0.050$

DISCUSSION

Open reduction and internal fixation of mandibular fractures can be achieved using various techniques, including intraoral, extraoral (submandibular/retromandibular), or transbuccal approaches. These techniques are often compared based on accessibility, operative duration, ease of use, and the skill required by the surgeon [14]. This study specifically evaluated the clinical outcomes of intraoral versus transbuccal approaches for mandibular angle fractures. In terms of fracture reduction, 82.9% of patients in the intraoral group and 80.0% in the transbuccal group achieved adequate reduction ($\chi^2 = 0.094$, $p = 0.759$). Similarly, post-operative occlusion was satisfactory in 88.6% of patients in both groups ($\chi^2 = 0.000$, $p < 0.001$). These findings indicate that both approaches are equally effective in achieving anatomical alignment and functional rehabilitation of the mandible. These results are consistent with previous studies by Said and Lee et al. which reported similar outcomes in occlusion and fracture reduction between intraoral and transbuccal techniques [15, 16]. However, a significant difference was observed in surgical accessibility, with 77.1% of patients in the transbuccal group rated as having “good” accessibility compared to 17.1% in the intraoral group ($\chi^2 = 25.675$,

$p < 0.001$). The improved exposure and mobility provided by the transbuccal approach facilitated accurate plate placement, particularly in posterior mandibular regions. Similar findings have been reported by Wusiman et al. and Kumar et al. highlighting the advantage of the transbuccal technique in reducing technical challenges during fixation [17, 18]. Regarding operative duration, the transbuccal approach required longer surgical time due to additional instrumentation. This balance between improved accessibility and procedural complexity aligns with previous studies [11]. Chari also reported longer operating times for transbuccal procedures [19], although recent evidence suggests that surgical time decreases as surgeons gain experience with this technique [20].

There are a few limitations associated with this study. First, it was performed in one center, and the sample size is quite small, which can restrict the extrapolation of the results. Even though surgical accessibility was chosen as the main outcome in the estimation of the sample size since only limited access to similar data used as categories of outcomes existed in the literature, this might have decreased the statistical power to observe the difference in the secondary outcomes, which included postoperative occlusion, adequacy of fracture reduction, and the operative time. Second, the allocation of patients was not randomized and was done linearly depending on the clinical judgment and preference of the operating surgeon, and the patient selection method presents a possible risk of selection bias. Third, assessment of radiographic outcomes, surgical accessibility, and postoperative occlusion was done by one evaluator, and this could have been used to influence observer bias despite the use of standard assessment criteria. Lastly, the limited time of postoperative follow-up did not allow for the prolonged analysis of the functional stability, occlusal, and aesthetic outcomes. To enhance the evidence base and add to the validity of comparative outcomes, future studies need to involve multicenter designs, larger sample sizes, randomized allocation, multiple blinded assessors, and longer follow-up.

CONCLUSIONS

Intraoral and transbuccal techniques are equally effective in the fixation of mandibular angle fractures with similar results in fracture correction and subsequent occlusion. The transbuccal technique is more surgically available, especially in posterior fractures, yet it has a high operative time. The choice of the operational methodology is to be determined by the fracture site, level of experience, and patient-related aspects such as anatomy and cosmetic interests. Irrespective of these results, the single-center design, non-randomized assignment, and short-term follow-up of the study restrict the extrapolation of findings,

and bigger, multicenter studies with extended post-treatment follow-up should support these findings.

Authors' Contribution

Conceptualization: MR

Methodology: MR, AUR, AKN, AM, ARN

Formal analysis: AUR

Writing and Drafting: MR, MAB, AUR, AKN, IT, AM

Review and Editing: MR, MAB, AUR, AKN, IT, AM, ARN

All authors approved the final manuscript and take responsibility for the integrity of the work

Conflicts of Interest

All the authors declare no conflict of interest.

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