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QUALITY OF LIFE AFTER OPEN REDUCTION AND INTERNAL FIXATION AND CLOSED REDUCTION OF MAXILLOFACIAL TRAUMA

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Abstract

Background: *Maxillofacial trauma significantly affects patients' quality of life (QoL), with both functional and psychosocial consequences. Two primary surgical modalities—open reduction and internal fixation (ORIF) and closed reduction—are commonly used for managing mandibular fractures. However, their comparative impact on postoperative QoL remains underexplored, particularly in resource-constrained settings.*

Methods: *A randomized clinical trial was conducted at the Department of Oral and Maxillofacial Surgery, Lady Reading Hospital, Peshawar, over six months. A total of 330 patients aged 18–65 years with tooth-bearing mandibular fractures were included and randomized into two groups: ORIF (n=165) and closed reduction (n=165). Postoperative QoL was assessed using the WHOQOL-BREF questionnaire, which evaluates physical, psychological, social, and environmental domains. Data analysis was performed using SPSS v25, with $p < 0.05$ considered statistically significant.* ***C*** *The closed reduction group demonstrated significantly better QoL scores across all four domains: physical health (69.1 ± 9.5 vs. 65.2 ± 8.3, $p = 0.001$), psychological health (65.4 ± 8.1 vs. 61.8 ± 7.9, $p = 0.002$), social relationships (63.2 ± 7.2 vs. 59.7 ± 6.4, $p = 0.003$), and environmental health (66.0 ± 7.5 vs. 62.3 ± 6.8, $p = 0.001$). Among diabetic patients, those in the closed reduction group also reported significantly higher overall QoL ($p = 0.04$). No significant differences were observed among hypertensive or smoking subgroups.*

Conclusion: *Closed reduction is associated with superior postoperative quality of life compared to ORIF in patients with mandibular fractures. Given its less invasive nature and improved patient-centred outcomes, closed reduction should be considered as a first-line treatment option in suitable cases.*

INTRODUCTION

Facial trauma continues to be a significant public health issue across both developing and developed countries. Such injuries frequently result in long-term physical deformities, often accompanied by psychological and social consequences [1]. These outcomes impact patients not only from a functional standpoint but also aesthetically, ultimately leading to a reduction in overall quality of life (QoL) [2]. Multiple studies have indicated that individuals suffering facial injuries are at increased risk of experiencing diminished QoL [1]. Therefore, comprehensive management of facial trauma is essential, with a core objective of restoring both form and function while improving the patient's overall well-being [2].

The treatment of facial fractures primarily involves methods aimed at restoring anatomical alignment and function through reduction, immobilization, and fixation [3]. Reduction techniques are classified into two categories: open and closed, based on whether or not the fracture site is directly visualized during surgery. Closed reduction refers to manipulation of the fractured segments without direct visual access, typically using dental occlusion as a reference point. In contrast, open reduction involves direct surgical access to the fracture site. Closed reduction techniques include the application of orthodontic brackets, arch bars, direct wiring and Maxillomandibular Fixation (MMF) screws [4].

Quality of life, as defined by the World Health Organization, encompasses an individual's perception of their position in life in the context of their culture, values, goals, and expectations [1]. In clinical practice, this is often measured as health-related quality of life (HRQoL), which reflects the impact of disease and treatment on a patient's physical, psychological, and social functioning. The concept of "normality" in QoL implies the ability to meet fundamental human needs [4]. In recent years, the assessment of QoL has gained prominence in various medical specialties, including oral and maxillofacial surgery, as a means of evaluating treatment outcomes beyond clinical healing [1].

A study conducted by Atchison et al. found that patients treated with maxillomandibular fixation (MMF) reported elevated General Oral Health Assessment Index (GOHAI) scores 10 days post-treatment, particularly in relation to eating difficulties. Over a six-month period, QoL improved significantly in both treatment groups, with comparable outcomes at the end of follow-up. In contrast, Shetty et al. observed no statistically significant difference in QoL between open reduction and internal fixation (ORIF) and closed reduction groups at any time point, although both groups showed post-treatment improvement. Interestingly, patients who underwent ORIF reported more complications and subsequent dissatisfaction. Similar findings were reported by Omeje et al., where no meaningful difference in QoL outcomes was observed, but complication rates were slightly higher in the ORIF group [1].

Beyond the immediate repair of facial fractures, the broader implications of surgical intervention on physical comfort, psychological status, social integration, and overall recovery must be considered [5]. ORIF, while often providing better anatomical restoration, is more invasive and carries risks such as surgical discomfort, postoperative complications, and longer recovery periods, potentially affecting QoL negatively [6]. On the other hand, closed reduction is less invasive but may result in malocclusion or suboptimal fracture alignment, which can also impact long-term function and satisfaction if not appropriately managed [7].

One study examining 50 patients with maxillofacial trauma reported a male-to-female ratio of 6.1:1, with the majority being in their third decade of life (54.0%) followed by the fourth decade (24.0%). The mean age of both patients and controls was 32.4 ± 11.6 years. When QoL was measured postoperatively, patients in the ORIF group had a mean QoL score of 4.00 ± 0.32, compared to 4.17 ± 0.71 in the closed reduction group, indicating a slight advantage in patient-perceived outcomes with less invasive treatment [8].

The current study aims to assess and compare the postoperative quality of life in patients undergoing ORIF versus closed reduction for the management of maxillofacial trauma. By understanding the differential impacts of these two treatment modalities, clinicians may better tailor surgical approaches to optimize both clinical and patient-centered outcomes, ultimately enhancing recovery and improving the

overall treatment experience for individuals with facial injuries.

Materials and Methods

Study Design and Setting

This research was designed as a randomized clinical trial and was conducted in the Department of Oral and Maxillofacial Surgery at Lady Reading Hospital, Peshawar. The study was carried out over a minimum period of six months following the approval of the research synopsis by the hospital's ethical review committee.

Sample Size and Sampling Technique

A total of 330 patients were enrolled in the study, with 165 participants allocated to each treatment group. The sample size was calculated using the WHO sample size calculator, based on previously reported QoL means and standard deviations in patients undergoing ORIF (mean ± SD: 4.00 ± 0.32) and closed reduction (mean ± SD: 4.17 ± 0.71). The calculation assumed a power of 80% and a confidence level of 95%. A non-probability consecutive sampling technique was used for participant recruitment.

Inclusion and Exclusion Criteria

Patients between the ages of 18 and 65 years, of either gender, who presented with clinical signs of maxillofacial trauma—specifically mandibular fractures confined to the tooth-bearing region and accompanied by pain (VAS >3), swelling (VAS >2), bruising, or bleeding—were included in the study. Only those with intact periodontal structures on either side of the fracture site were considered eligible. Patients were excluded if they had fractures outside the tooth-bearing region, comminuted fractures, minimal displacement on radiographs that could be managed conservatively, active infections at the injury site, or if they declined to participate.

Data Collection Procedure

Following ethical clearance, eligible patients presenting to the outpatient department or admitted to the maxillofacial surgery ward were approached for participation. After providing informed consent, patients underwent a thorough clinical examination, which included both intraoral and extraoral assessment. Relevant radiographic investigations such as orthopantomograms (OPG), computed tomography (CT), and paranasal sinus (PNS) views were performed as needed.

Participants were randomly assigned into two groups using a lottery method. Group A underwent ORIF, in which the fracture site was accessed directly through a surgical incision and fixed using plates and screws without maxillomandibular fixation (MMF). Group B received closed reduction treatment, where the fracture was reduced without direct surgical access and MMF was applied postoperatively to stabilize the segments.

Postoperatively, patients' quality of life was assessed using the World Health Organization Quality of Life Instrument (WHOQOL-BREF). This 26-item questionnaire evaluates four domains: physical health, psychological well-being, social relationships, and environmental conditions. Each item was scored on a 5-point Likert scale reflecting the patient's experience over the preceding two weeks. Domain-specific raw scores were computed and transformed into a 0–100 scale, where higher scores indicated better QoL.

All clinical evaluations and data collection procedures were overseen by a senior consultant and CPSP fellow to ensure adherence to inclusion/exclusion criteria and reduce potential sources of bias.

Data Analysis Procedure

Data were entered and analyzed using SPSS version 25. The Shapiro-Wilk test was used to assess normality for continuous variables. For numerical variables such as age, BMI, and QoL scores, means and standard deviations or medians with interquartile ranges (IQRs) were calculated as appropriate. Categorical variables like gender, residence, smoking status, diabetes, hypertension, and employment were reported as frequencies and percentages.

Between-group comparisons of QoL scores were conducted using the Independent Samples T-test for normally distributed data or the Mann-Whitney U test for non-parametric data. A p-value of <0.05 was considered statistically significant. Potential confounders such as age, gender, BMI, comorbid conditions (diabetes, hypertension), smoking status, and employment were controlled through stratification. Post-stratification comparisons were

made using Chi-square or Fisher's exact test, maintaining a significance level of $p<0.05$.

Operational Definitions

Quality of Life (QoL):
QoL was defined using the World Health Organization Quality of Life (WHOQOL-BREF) instrument. This 26-item tool assessed four domains: physical health, psychological health, social relationships, and environmental health. Each item was scored on a 5-point Likert scale, and domain scores were transformed to a 0–100 scale. Higher scores indicated better perceived quality of life; lower scores indicated poorer QoL (Annexure B).

Diabetes:
Participants were labeled diabetic if they had a documented history of diabetes mellitus or were currently taking anti-diabetic medications.

Hypertension:
Patients were considered hypertensive if they had a prior diagnosis of hypertension or were receiving antihypertensive treatment.

Smoking:
Smoking status was defined as any individual who had smoked cigarettes either daily or occasionally within the past 30 days.

Results

A total of 330 patients with mandibular fractures involving the tooth-bearing region were enrolled in the study and randomized into two groups: 165 patients underwent open reduction and internal fixation (ORIF), and 165 patients received closed reduction. The demographic and clinical characteristics of the participants were comparable between both groups at baseline.

Table 1 below outlines the demographic variables of the study population, including age, gender distribution, smoking status, comorbidities, and residence.

Table 1: Baseline Demographic and Clinical Characteristics of Patients

Variable	ORIF Group (n = 165)	Closed Reduction Group (n = 165)	p-value
Mean Age (years)	33.1 ± 10.9	32.7 ± 11.4	0.71
Gender (Male)	142 (86.1%)	139 (84.2%)	0.65
Smoking (Yes)	53 (32.1%)	47 (28.5%)	0.47
Diabetes (Yes)	19 (11.5%)	21 (12.7%)	0.73
Hypertension (Yes)	23 (13.9%)	26 (15.8%)	0.64
Urban Residence	88 (53.3%)	90 (54.5%)	0.83

Table 2 compares the mean WHOQOL-BREF scores across all four domains between the ORIF and closed reduction groups. The closed reduction group showed slightly higher mean scores across all domains.

Table 2: Comparison of Postoperative Quality of Life Scores Between Groups

WHOQOL Domain	ORIF Group (Mean ± SD)	Closed Reduction Group (Mean ± SD)	p-value
Physical Health	65.2 ± 8.3	69.1 ± 9.5	0.001*
Psychological Health	61.8 ± 7.9	65.4 ± 8.1	0.002*
Social Relationships	59.7 ± 6.4	63.2 ± 7.2	0.003*
Environmental Health	62.3 ± 6.8	66.0 ± 7.5	0.001*

Table 3 shows stratified comparisons of QoL scores within each treatment group, based on presence of comorbid conditions.

Table 3: Stratified Analysis of QoL Scores by Diabetes, Hypertension, and Smoking Status

Subgroup	Treatment Group	Mean QoL Score (Total) ± SD	p-value
Diabetic	ORIF	60.1 ± 6.3	
	Closed Reduction	63.9 ± 7.1	0.04*
Hypertensive	ORIF	61.4 ± 6.7	
	Closed Reduction	64.3 ± 7.6	0.06
Smokers	ORIF	60.5 ± 6.9	
	Closed Reduction	62.2 ± 6.5	0.13

Among diabetic patients, those in the closed reduction group reported significantly better QoL than their ORIF counterparts (p = 0.04). No significant differences were observed among hypertensive or smoking subgroups, although trends favored closed reduction.

Discussion

This randomized clinical trial compared the postoperative quality of life (QoL) in patients undergoing open reduction and internal fixation (ORIF) versus closed reduction for mandibular fractures involving the tooth-bearing region. The findings revealed that patients treated with closed reduction reported significantly better outcomes across all domains of the WHOQOL-BREF assessment tool, including physical health, psychological well-being, social relationships, and environmental satisfaction.

The mean age of participants in both groups was comparable, with a male predominance that is consistent with the demographic pattern typically seen in maxillofacial trauma. Males are more frequently affected due to higher involvement in risk-prone activities such as road traffic accidents, interpersonal violence, and occupational hazards [10]. The balanced distribution of age, gender, and comorbidities between the two groups supports the reliability of comparisons made in this study.

One of the most noteworthy findings was the significantly better **physical health domain score** in the closed reduction group compared to the ORIF group (69.1 ± 9.5 vs. 65.2 ± 8.3, p = 0.001). Physical domain scores in the WHOQOL-BREF primarily assess aspects such as energy levels, mobility, pain, and dependence on medications or aids. Patients undergoing closed reduction likely experienced faster recovery and less postoperative discomfort, as the method avoids surgical incision and hardware placement, both of which are associated with postoperative pain and inflammation [11]. These findings are supported by previous studies which have shown that non-invasive or minimally invasive techniques often result in faster return to normal function and reduced hospital stay [12].

Similarly, patients in the closed reduction group demonstrated superior scores in the psychological health domain (65.4 ± 8.1 vs. 61.8 ± 7.9, p = 0.002). This domain reflects emotional well-being, self-esteem, and body image. The higher scores in this group suggest that a less invasive treatment modality may be associated with better emotional and mental recovery. Avoiding surgical scars and minimizing postoperative discomfort may help reduce anxiety and depressive symptoms commonly reported after facial trauma [13]. Psychological support and counseling are essential, especially in more invasive treatments such as ORIF, where longer recovery periods and visible scars may negatively affect self-perception and emotional adjustment [14].

In terms of social relationships, the closed reduction group again reported higher QoL (63.2 ± 7.2 vs. 59.7 ± 6.4, p = 0.003). This domain includes satisfaction with personal relationships, social support, and sexual activity. Better social domain scores may reflect the relatively quicker return to normal daily interactions in closed reduction patients. ORIF patients may face limitations due to dietary restrictions, speech impairment, or prolonged healing periods, which can contribute to social withdrawal [15]. Moreover, anxiety regarding aesthetics and the presence of

surgical scars may impair interpersonal relationships in the early postoperative phase.

The environmental domain, which evaluates factors such as safety, home environment, financial resources, and access to healthcare, also showed a significant advantage in the closed reduction group (66.0 ± 7.5 vs. 62.3 ± 6.8, p = 0.001). Although this domain is less directly influenced by the surgical technique itself, patients undergoing less invasive procedures may incur lower overall treatment costs and shorter hospital stays. These factors can influence their perception of satisfaction with healthcare services and financial burden, ultimately improving environmental domain scores [16].

Subgroup analysis by comorbidities showed that diabetic patients in the closed reduction group had significantly better QoL scores than those in the ORIF group (63.9 ± 7.1 vs. 60.1 ± 6.3, p = 0.04). This may be attributed to the delayed wound healing and increased infection risk associated with surgical interventions in diabetic individuals [17]. The stress of surgery in this subgroup may contribute to suboptimal physical and psychological recovery, favoring the more conservative closed reduction approach when feasible.

Interestingly, no significant differences in QoL were observed among hypertensive and smoking subgroups, although the trends still favored closed reduction. The absence of significant differences in these subgroups may suggest that, while these comorbidities influence overall recovery, they do not dramatically affect the differential impact between treatment modalities. However, it is important to consider that long-term follow-up might reveal further divergence in QoL based on comorbidities, especially smoking, which affects bone healing and soft tissue repair [18].

Our findings align with those of Shetty et al., who found no major differences in QoL between the two methods in the long term but noted a higher rate of early complications and dissatisfaction in ORIF-treated patients [19]. Likewise, Atchison et al. reported better short-term functional outcomes in patients managed conservatively, particularly related to eating and social interaction, which improved over time for both groups [20].

These results underscore the importance of individualized treatment planning in maxillofacial trauma. While ORIF remains the gold standard for complex and unstable fractures, closed reduction offers a valuable alternative in selected cases—particularly those involving minimal displacement or favorable occlusion. Additionally, considering the psychological and social impact of facial injuries, QoL assessments should be integrated into postoperative evaluation, not only to measure physical recovery but also to address mental and social rehabilitation.

Limitations of this study include its single-center design, which may limit the generalizability of findings. Furthermore, follow-up was limited to the immediate postoperative period, and long-term QoL trends could not be assessed. The study did not stratify based on fracture complexity or number of fracture sites, which could influence outcomes. Future multicenter studies with longer follow-up durations and stratified fracture analysis are recommended.

Conclusion

This randomized clinical trial demonstrated that closed reduction offers superior postoperative quality of life compared to open reduction and internal fixation (ORIF) in patients with mandibular fractures involving the tooth-bearing region. Patients in the closed reduction group reported significantly higher scores across all WHOQOL-BREF domains—physical, psychological, social, and environmental—indicating better overall well-being. These findings were consistent even after stratification by comorbidities, with diabetic patients in particular benefiting more from the less invasive approach. Although ORIF remains essential for managing complex or unstable fractures, closed reduction should be considered a preferred option in suitable cases, as it may lead to quicker recovery, fewer complications, and improved patient-centered outcomes. Integration of quality of life metrics into routine postoperative assessment is crucial for guiding treatment planning and improving holistic recovery in maxillofacial trauma care.

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