

A Comparison of Clinical Outcomes in Patients of Mandibular Condyles Fractures Treated with Open Versus Close Reduction

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ABSTRACT

Aim: The absence of a widely acknowledged and conclusive therapy for condylar fractures is a matter of contemporary debate and contention, with the issue of whether surgical or conservative approaches are better suitable for managing such fractures being unresolved. This study investigates several methodologies pertaining to the conservative, closed, and open surgical interventions for the treatment of condylar fractures. The standardization of fracture classification systems and treatment techniques is necessary to provide a clear and optimum strategy for individual individuals and their respective fractures.

Objectives: The objectives of the study are to compare clinical outcomes in patients of mandibular condyles fractures treated with open versus close reduction.

Method: A total of 84 individuals diagnosed with subcondylar fractures of the mandible were assessed. All fractures seen in the study exhibited displacement, with either angulation ranging from 10° to 35° or a reduction in length of the ascending ramus by more than 2 mm. A comprehensive assessment, including both clinical and radiographic examination, was conducted at the 6-month mark after the occurrence of the trauma. The clinical criteria assessed in this study included mouth opening, temporomandibular joint (TMJ) discomfort, mandibular deviation, malocclusion, facial damage, and scar formation.

Results: The findings indicated a statistically significant difference between the two groups, with a p-value of less than 0.05. The findings suggest that open reduction was found to be more efficacious than closed reduction in enhancing mouth opening, mandibular deviation, TMJ discomfort, and malocclusion. Conversely, closed reduction was shown to be more beneficial than open reduction.

Conclusion: The study findings indicate that the open treatment approach yields superior progress compared to closed techniques, and these differences are statistically significant. Patients who had open reduction demonstrated considerably superior results in all functional measures, with the exception of facial nerve damage and scar formation, when compared to those who underwent closed reduction.

Keyword: Mandibular fracture, open reduction, closed reduction, clinical outcome

INTRODUCTION

Fractures involving the mandibular condyle are frequently observed, constituting approximately 25% to 35% of all fractures affecting the mandible¹. Condylar fractures exhibit distinct characteristics compared to other mandibular fractures, as the occurrence of infection and non-union is infrequent². Nevertheless, the primary focus lies on functional abnormalities, including malocclusion, facial asymmetry, chronic pain, and restricted mouth opening³. Since the initial surgical intervention on the mandibular condyle neck in 1925, there has been ongoing scholarly discourse regarding the optimal approach for managing mandibular condyle fractures. This debate primarily revolves around the comparison between conservative closed reduction and open surgical reduction techniques⁴. The classification of condylar fractures is determined by their anatomic location, namely whether they occur inside or outside the joint capsule, as well as the extent of displacement of the articular head. Condylar fractures occurring inside the joint capsule are classified into type A, which specifically pertains to fractures that impact the medial condylar pole. Type B fractures are characterised by fractures that occur via the lateral condylar pole, followed by a decrease in the vertical dimension of the mandibular ramus. Comminuted fractures, indicated by the designation M, are distinguished by the existence of several shattered components⁵. Most mandibular condyle fractures primarily occur in the condylar neck, while intracapsular fractures are relatively rare and have been infrequently reported⁶. Conventional radiography fails to detect sagittal or vertical fractures of the mandibular condyle, as well as chip fractures occurring in the medial region of the condylar head⁷. Nevertheless, CT scans are frequently utilized for visualizing them⁸. Closed reduction has been the favored method of treatment for several decades. However, this approach necessitates different durations of maxillomandibular fixation (MMF), ranging from no fixation to a maximum of four weeks, followed by intensive physiotherapy⁹.

Additionally, it is crucial to acknowledge that the closed reduction technique is linked to numerous long-term complications. These complications encompass, but are not limited to, pain, arthritis, open bite, mandibular deviation during opening and closing motions, insufficient restoration of ramus vertical height leading to malocclusion, and ankylosis¹⁰. In cases of significant displacement or dislocation, surgical intervention is the preferred method of management. This technique enables effective anatomical realignment and prompt restoration of functional mobility in the jaw¹¹. It is widely agreed upon that achieving accurate anatomical reconstruction of the condylar process is a crucial requirement for restoring proper function¹². In contemporary times, there has been a shift in the perspective regarding the management of condylar process fractures, moving away from a solely non-surgical approach and towards surgical intervention in specific instances¹³. Furthermore, it is important to recognise that the closed reduction approach is associated with a multitude of long-term difficulties. The consequences associated with this condition include, but are not limited to, discomfort, arthritis, open bite, mandibular deviation during opening and closing movements, inadequate restoration of ramus vertical height resulting in malocclusion, and ankylosis.

METHODOLOGY

Prospective research was done on a cohort of 84 patients with mandibular condylar fracture, aged between 18 and 55 years, who presented to the Nishtar Institute of Dentistry in Multan. The study period spanned from September 2021 to February 2023. The study had a cohort of 84 patients who were allocated into two equal-sized groups, namely group A and group B. Group A consisted of patients who underwent open reduction with internal fixation, whereas group B comprised patients who received closed reduction with maxillomandibular fixation. The research excluded individuals who were below the age of 18 years, patients with systemic disorders, patients with osteoporosis and osteopetrosis,

and patients undergoing chemotherapy or radiation. A comprehensive account of the injury's characteristics and its associated symptoms was acquired. Furthermore, a comprehensive physical examination was conducted in order to assess the patient's general state of health. Ethical approval was received from the institutional review board of the hospital. Furthermore, the individuals were duly informed and provided written permission about the process. Prior to the surgical procedure, all patients had preoperative and postoperative maxillofacial computed tomography (CT) scans in order to evaluate the degree of anatomical reduction achieved. The decision to undertake open or closed reduction was based on the severity of the damage. For example, instances involving sufficient mouth opening, regular occlusion, preserved vertical height of the ramus, comminuted condylar fractures, and displaced fractures inside the joint capsule were treated with closed reduction using MMF-arch bars or MMF with wire. Similarly, patients presenting with diminished mouth opening, malocclusion, or any occlusal irregularities, as well as those with a decreased vertical height of the ramus, significant displacement of fractured fragments, and concomitant injuries, underwent surgical treatment involving open reduction and internal fixation (ORIF) using mini plates and screws. In certain instances, maxillomandibular fixation (MMF) was employed following the ORIF procedure. Furthermore, a closed

reduction procedure was performed to address the condylar fracture. Initially, an evaluation was conducted to determine if the occlusion remained intact after closed reduction and sufficient mouth opening. Subsequently, the surgeon proceeded with the implementation of maxillomandibular fixation (MMF) for the treatment of the condylar fracture. Alternatively, in cases where closed reduction failed to establish stable occlusion and sufficient mouth opening, open reduction of the condylar/sub-condylar fracture was performed. The patients were released from the hospital within a period of three to five days after their surgical procedure. Nevertheless, they had regular follow-up assessments at six-month intervals. The data were captured and then subjected to analysis.

RESULT

Table 1: Gender Distributions of patients

Group		Frequency	Percent
Open Reduction	Male	29	69
	Female	13	31
Closed Reduction	Male	28	67
	Female	14	33

In current study 29 male and 13 female were included in group A while in group 28 male and 14 females were in group B.

Table 2: Between group comparison of limited mouth opening

Variable	Group	No		Mean & Std. Deviation	Mean Difference	P-Value
Limited Mouth Opening	Group 1	42	Pre-treatment	17.71±4.204	26.53±2.882	.048
		42	Post-treatment	43.24±1.322		
	Group 2	42	Pre-treatment	18.40±4.773	11.36±3.288	
		42	Post-treatment	29.76±1.445		

The average preoperative maximum mouth opening measurement in group 1 was 17.71 mm, whereas in group B, it was 18.40 mm. Following the therapy, a significant increase in mouth opening was seen, with group A exhibiting a maximum mean of 26.24 mm and group B demonstrating a mean of 11.76 mm. The findings indicated a statistically significant difference between the two groups, with a p-value less than 0.05. The results suggest that the average difference in group A is greater than the average difference in group B, indicating that open reduction was more successful than closed reduction in enhancing mouth opening.

Prior to surgery, all patients in both groups exhibited deviation towards the side of the fracture during mouth opening. Following the surgical procedure, it was seen that one patient from group 1 and three patients from group 2 continued to exhibit deviation. When comparing the two groups, it was seen that the open reduction group (group A=41) exhibited a more substantial drop in deviation compared to the closed reduction group (group B=39).

Table 3: Between group comparison of TMJ pain

Variable	Group	No		Mean & Std. Deviation	Mean Difference
TMJ Pain	Group 1	42	Pre-treatment	8.00±.765	4.83±0.088
		42	Post-treatment	3.17±.853	
	Group 2	42	Pre-treatment	7.90±.440	2.95±0.442
		42	Post-treatment	4.95±.882	

The average preoperative TMJ pain score in group 1 was 8.00, whereas in group B, it was 7.90. Following the therapy, a significant amelioration in TMJ discomfort was seen, with group A exhibiting a maximum mean of 3.17 and group B demonstrating a mean of 4.95. The findings indicated a statistically significant difference between the two groups, with a p-value of less than 0.05. The findings suggest that the average difference in group A is greater than the average difference in group B, indicating that Open reduction is more effective than closed reduction in alleviating TMJ discomfort.

Table 5: Between group comparison of malocclusion

Variable	Group	N	Pre-Treatment Affected	Post-Treatment Improved
Mandibular Deviation	Open reduction	42	42	42
	Closed reduction	42	42	37

Before undergoing surgery, all patients in both groups shown a tendency to deviate towards the side of the fracture while opening their mouths. After the completion of the surgical intervention, it was seen that a single patient from group 1 and three patients from group 2 persisted in displaying deviation. Upon comparing the two groups, it was seen that the open reduction group (group A=41) shown a more significant decrease in deviation in comparison to the closed reduction group (group B=39).

Table 3: Between group comparison of Mandibular Deviation

Variable	Group	No of patient improved	
		Pre- Treatment	Post- Treatment
Mandibular Deviation	1	42	41
	2	42	39

Table 6: Between group comparison of Facial Nerve injury

Variable	Group	N	Pre-Treatment affected	Post-Treatment Improved	P-Value
Facial Nerve injury	Open reduction	42	6	0	.188
	Closed reduction	42	0	42	

The patients in both groups had normal facial nerve function. Following the surgical procedures, patients who had closed reduction did not exhibit any instances of facial nerve paralysis.

However, among patients who underwent open reduction, facial nerve paralysis happened in six individuals. Statistical analysis revealed no significant difference between the two groups in terms of facial nerve paralysis occurrence ($p = 1.0$). All patients have surgical recovery after closed reduction.

Table 7: Between group comparison of scar formation

Variable	Group	N	No of patient improved	
			Pre-Treatment Affected	Post-Treatment
scar formation	Open reduction	42	42	23
	Closed reduction	42	0	42

In relation to the self-perception of scar development, it was observed that 19 patients from the open reduction group reported the presence of scars even after a follow-up period of 6 months. Since surgical intervention is not involved in closed reduction, it follows that there would be no creation of scars.

DISCUSSION

There is ongoing debate among maxillofacial surgeons regarding the management of condylar fractures. In the past, the indications for open reduction were constrained, as evidenced by the criteria outlined by Zide and Kent in 1983¹⁴. These criteria were formulated based on the prevailing techniques, materials, and scientific literature of that era. Over the course of time, there has been a growing trend in the application of rigid internal fixation to address injuries in the craniomaxillofacial skeleton¹⁵. The advancement of enhanced materials for the purpose of stabilisation and improvement of surgical techniques has led to a significant change in perspective, wherein both surgeons and patients now embrace and depend on rigid internal fixation⁹. In the preceding investigation, out of a total of 17 participants, only 2 individuals (11.8%) were unable to attain a mouth opening measurement exceeding 40 mm. Notably, both of these individuals were assigned to the open treatment group¹⁶. In the present study, a statistically significant difference was observed between two groups, with a p-value of less than 0.05. This finding indicates that Open reduction was more effective than closed reduction in enhancing mouth opening. In a previous study, it was observed that patients achieved a full restoration of temporomandibular joint functions and demonstrated asymptomatic conditions in 72% of the cases¹⁷. The findings of the present study indicate that Open reduction is a more efficacious approach compared to closed reduction in terms of alleviating temporomandibular joint (TMJ) pain. The study conducted by Spinzia et al. yielded the finding that a majority of the patients, specifically 80%, exhibited recovery of their occlusion¹⁸. A prior investigation documented a higher prevalence of malocclusion among patients who underwent treatment using the closed technique. The study also revealed improved treatment outcomes and reduced levels of pain and discomfort among patients in the open treatment group¹⁹. In the preceding investigation, no statistically significant disparity was observed in the occlusal condition between the two cohorts undergoing treatment. Additionally, improved treatment outcomes and reduced levels of pain and discomfort were observed in the patient cohort receiving open treatment²⁰. In the present study, it was observed that all patients in group A (undergoing open reduction) achieved normal occlusion after the surgical procedure. However, in group B (undergoing closed reduction), it was found that accurate occlusion could not be attained in five patients, even after a six-month follow-up period. Treatment. In a previous study, it was reported that 88 percent of patients did not experience any impairment of the facial nerve after surgery²¹. In the preceding investigation, a cohort of 17 patients underwent examination, revealing that merely 2 participants (11.8%) exhibited an incapacity to achieve a mouth opening measurement surpassing 40 mm. It is noteworthy that both of these patients were part of the open treatment group²². The current study found a statistically significant difference ($p < 0.05$) between two groups, suggesting that Open

reduction was more effective in improving mouth opening compared to closed reduction. In a previous study, it was observed that patients experienced complete restoration of temporomandibular joint functionality, with 72% of cases being reported as asymptomatic¹. The results of the current study suggest that Open reduction was more effective than closed reduction in improving temporomandibular joint (TMJ) pain. The research conducted by Chang et al. revealed that a significant proportion of the patients, precisely 80%, attained restoration of their occlusion²³. A previous study reported a greater incidence of malocclusion in individuals who received treatment utilising the closed technique. Additionally, the study demonstrated that patients in the open treatment group exhibited enhanced treatment outcomes and experienced decreased levels of pain and discomfort²⁴. The patient group that underwent the open treatment approach exhibited enhanced treatment outcomes and decreased levels of pain and discomfort²⁵. The current study documented that all patients in group A, who underwent open reduction, attained normal occlusion following the surgical procedure. Nevertheless, within group B, consisting of patients who underwent closed reduction, it was observed that accurate occlusion could not be achieved in five individuals, even after a six-month period of follow-up Treatment. According to a prior investigation, a significant majority of patients, specifically 88 percent, did not manifest any form of facial nerve impairment subsequent to the surgical procedure²⁶. The present investigation revealed an absence of facial nerve paralysis in patients who underwent closed reduction. Nevertheless, a total of six patients exhibited facial nerve paralysis following open reduction. The statistical analysis conducted indicated that there was no statistically significant difference observed between the two groups ($p = 1.0$). Postoperative recovery is a necessary process that all patients undergo subsequent to closed reduction. According to a prior investigation, a collective of 80 individuals demonstrated favourable outcomes in terms of surgical skin scarring during the postoperative phase²⁷. The current investigation aimed to evaluate the self-perception of scar formation. Within the cohort, a total of four participants in the open reduction group and three participants in the closed reduction group documented the presence of scar tissue formation²⁸. The statistical analysis conducted indicated that there was no statistically significant distinction observed between the two groups with regards to scar formation ($p = 1.0$). Postoperative coverage is provided to all patients. Popat et al conducted a thorough analysis of previous studies that specifically investigated the comparative effectiveness of open and closed treatment methods for condylar fractures, with the objective of ascertaining the treatment approach that yields superior outcomes. However, the findings of the research yielded inconclusive outcomes regarding the most effective method, whether it be open or closed therapy, for managing mandibular condylar fractures²⁹.

CONCLUSION

The study findings indicate that the open treatment approach yields superior progress compared to closed techniques, demonstrating statistically significant distinctions. Patients in the open reduction group had substantially superior results in all functional measures, with the exception of facial nerve damage and scar formation, when compared to those in the closed reduction group.

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