Management of Mandibular Condylar Fractures: A Comparison of Closed *versus* Open Reduction

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ABSTRACT

Objective: To compare the closed reduction approach with open reduction (transparotid approach) in the management of condylar fractures for parameters such as postoperative facial nerve injury, trismus, and malocclusion.

Study Design: An analytical comparative study.

Place and Duration of the Study: Department of Oral and Maxillofacial Surgery, The Armed Forces Institute of Dentistry, Rawalpindi, Pakistan, from 10th January 2022 to 1st October 2023.

Methodology: Patients with condylar fractures were included and divided into two groups (30 each) and condylar fractures were managed under general anaesthesia. After obtaining informed consent, condylar fractures were managed with closed reduction (maxillomandibular fixation with Eyelets or Arch Bar) in one group. In the other group, open reduction and internal fixation (ORIF) *via* transparotid approach were performed. Postoperatively, facial nerve injury was recorded five days after the procedure. Postoperative trismus and malocclusion were recorded three months after the procedure.

Results: Better treatment outcomes in terms of postoperative malocclusion and trismus were recorded for open reduction and internal fixation i.e. transparotid approach as compared to closed reduction. Facial nerve injury was recorded for the initial period in transparotid approach but long-term results among both techniques were comparable.

Conclusion: Transparotid approach in comparison with closed reduction provides good results in the management of condylar fractures.

Key Words: *Condylar fractures, Open reduction, Closed reduction, Facial nerve injury, Transparotid approach.*

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INTRODUCTION

Facial fractures comprise of almost 44.4% of total fractures encountered by human beings.[1] Among these 30% are mandibular in nature with condylar fractures having 16.5 - 56% incidence being the most common.[2] There is a lot of standardisation in the field of maxillofacial surgery but still no census for standard management of condylar fractures.[3] This is because of the complex anatomy of the region, having vital structures such as facial nerve, middle meatus, and middle cranial fossa.[4-6] There are some absolute and some relative indications for open reduction and interval fixation (ORIF) of condylar fractures. Absolute indications involve displacement of condylar head in the middle cranial fossa or laterally out of the capsule, inability to obtain stable occlusion with closed, reduction and the incursion of foreign body in the condylar fossa.[7]

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Relative indications involve bilateral condylar fractures, any medical condition impeding maxillomandibular fixation (MMF), panfacial trauma, and surgeon's preference.[8] Closed reduction is favoured in cases with minimal displacement of the condylar head and no impeding ailment for MMF.[9]

Open reduction carries the risk of facial nerve impairment, sialocele, EOM perforation, and scar formation.[10,11] Closed reduction carries the risk of malocclusion, weight loss, increased chances of trismus, and facial asymmetry after the therapy.[12-14] Open reduction can be performed by different methods depending on the site of fracture but most commonly transparotid approach is used.[15]

The study aimed to compare transparotid technique of ORIF with closed reduction in the management of condylar fractures for parameters such as facial nerve injury, postoperative trismus, and malocclusion.

METHODOLOGY

The prospective analytical comparative study was conducted in the Maxillofacial Surgery Department, The Armed Forces Institute of Dentistry, Rawalpindi, Pakistan, from 10th January 2022 to 1st October 2023. WHO sample size calculator was used to calculate sample size (level of significance was kept 5 and power of test was 80). After receiving Ethical Committee

permission, 60 patients from both genders ageing between 18-50 years, having unilateral condylar fractures involving the condylar neck and base (with 10-45 degrees of displacement of the condyle in frontal or sagittal plane and/or shortening of ramal height of >/= 2mm) were included in the study. Patients having pre-existing skeletal discrepancies with malocclusion, pathological conditions of the temporomandibular joints, and patients who were not responsive were excluded from the study.

Patients fulfilling inclusion criteria who gave consent were divided into two groups by consecutive non-probability sampling method. In one group, the condylar fractures were treated by transparotid approach i.e. ORIF, and in the other group IMF was performed.

Radiographs were utilised to assess the type of condylar fracture and the amount of displacement / dislocation of the condylar head. Loukota *et al.* classification system was used to classify the fractures.[16] Segmental overlap of >2mm or deviation >10 degrees was considered as significant displacement.

After marking, a 2cm incision starting below the earlobe was made parallel and posterior to the ramus of the mandible. After dissecting through the skin and subdermal layers, parotid capsule was identified. Dissection was carried out in the layer between superficial musculoapneurotic system (SMAS) and parotid capsule (nerve-free zone) (Figure 1).

Capsule was incised followed by dissection through the parotid mass in the direction of the facial nerve i.e. anteromedially up to posterior border of mandible. No deliberate efforts were made to identify facial nerve but if any branch was encountered it was retracted. After dissecting pterygomandibular sling, subperiosteal dissection was carried out from sigmoid notch to the angle of the mandible. The ramus was retracted inferiorly to create space for condylar head to sit in its position.

After reducing the condylar head per-operatively, IMF was performed followed by fixation using (4H, 4S) titanium mini plate on the posterolateral border. A second (3H, 2S) was used on the anterior border at 45 degrees to the first plate. In some instances where reduction was difficult to achieve a plate was fixed on the proximal fragment prior to reduction. Subsequently, this plate was used to get an adequate reduction. After fixation, IMF was released and occlusion was assessed. In three cases occlusion got deranged following IMF release and re-reduction was performed. After careful assessment of the occlusion, wound was closed in layers. Special care was given to close the parotid capsule in a water-tight fashion. Any accompanied fractures, if present, were managed concomitantly according to the standard operating protocols. No patient was kept in IMF after the procedure and a soft diet was advised for the following two weeks. Standard postoperative medications were prescribed. Patients were discharged with advise to follow-up after the 1st, 3rd, 6th, and 8th weeks.

Five-point intermaxillary fixation was performed on patients of this group. Patients were informed preoperatively about the procedure and inability to open the jaws after the procedure. They were discharged after 2 days with postoperative instructions and medications. IMF was released after 3-4 weeks. They were advised to follow-up after 1st, 3rd, 6th, and 8th week (Figure 2).

Trismus was defined as maximum interincisal distance (measured in mm) of the injured joint together with the contralateral joint assessed after 8 weeks. Malocclusion was assessed by an examiner and described by the patient after 8 weeks. Facial nerve injury was assessed on 7th day by using House-Brackmann grading system for facial nerve injury assessment.

Statistical analysis was done by using SPSS version 23. Quantitative variables were expressed as mean and SD and qualitative variables were expressed as frequency and percentages. For qualitative variables such as malocclusion, facial nerve injury, and trismus, chi-square test was used for two groups. For the level of significance, p-value was used. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Of total 60 patients, 35 (58%) were male and 25 (42%) were female with a mean age of 29 years (Table I).

Facial nerve paresis was reported initially in transparotid group but it improved significantly over a period of time. However, in closed reduction group paresis was minimum. No patient showed 4th, 5th, and 6th degree neurological damage (p = 0.14 at 3 weeks, 0.6 at 6 weeks, and 0.5 at 8 weeks, Table II).

Range of jaw motion was restricted initially in closed reduction group and it improved over a period of time but in transparotid group it was adequate immediately after the surgery and it also improved after 8 weeks (p = 0.01 at 03, 06, and 08 weeks, Table II).

Significant malocclusion was noticed in closed reduction group in comparison to transparotid group (p-value 0.047 at 3 weeks, Table II).

Table I: Demographic data of the patients.

Parameters	Transparotid approach (n = 30)	Closed reduction approach (n = 30)
Age	28.17 ± 7.51	30.27 ± 6.45
Quantitative variables		
Gender		
Male	21 (35%)	14 (23.3%)
Female	9 (15%)	16 (26.7%)

DISCUSSION

Eckelt *et al.* in their multi-centre randomised study concluded that ORIF approach is better than closed reduction for parameters such as pain, successful anatomical reduction, and trismus.[17] They found both approaches effective but open reduction with more predictable and promising results. However, the type of open reduction approach and various complications associated with it were not mentioned.

Table II: Facial nerve paresis, range of jaw motion, and malocclusion.

Parameters	Study Parameters		p-value*
	Transparotid approach (n = 30)	Closed reduction (n = 30)	
Facial nerve injury			
No injury	18 (30%) 26 (43.3%) 28 (46.7%)	24 (42.3%) 27 (45.0%) 29 (48.3%)	
Slight weakness (Up to 75% normal work)	10 (16.7%) 3 (5.0%) 2 (3.3%)	6 (10%) 3 (5.0%) 1 (1.7%)	0.145 0.6 0.5
Obvious weakness (50 % of normal work)	2 (3.3%) 1 (1.7) 0 (0%)	0 (0%) 0 (0%) 0 (0%)	
Postoperative jaw range of motion			
40 - 45 mm	16 (26.7%) 21 (35%) 23 (38.3%)	1 (1.7%) 3 (5%) 8 (13.3%)	<0.001 <0.001 <0.001
35 - 39 mm	10 (16.7) % 8 (13.3%) 7 (11.7%) 3 (5) %	6 (10%) 17 (28.3%) 16 (26.7%) 10 (16.7%)	
30 - 34 mm	1 (1.7%) 0 (0%)	10 (16.7%) 6 (10%)	
25 - 29 mm	1 (1.7%) 0 (0%) 00 (0%)	13 (21.7%) 0 (0%) 00 (0%)	
Postoperative malocclusion			
No malocclusion	25 (41.7) %	17 (28.3) %	0.047
Malocclusion	5 (8.3) %	13 (21.7) %	

*3rd week: Black; 6th week: Blue; 8th week: Red. *p-value was measured using Chi-square test.*

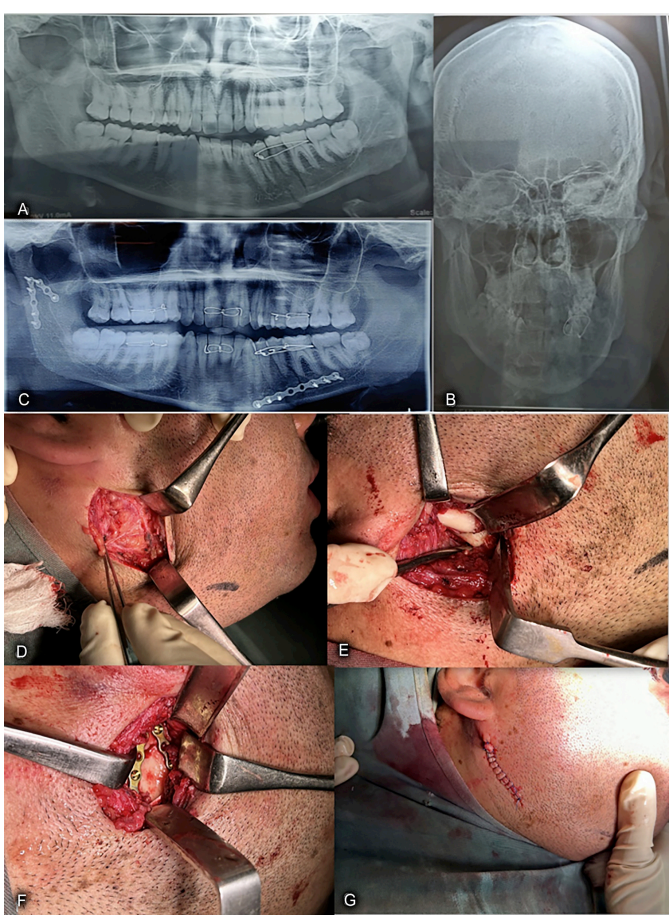

Figure 1: Transparotid approach (A,B) Showing preoperative radiographs (C) Showing postoperative radiograph (D,E,F,G) Showing procedure.

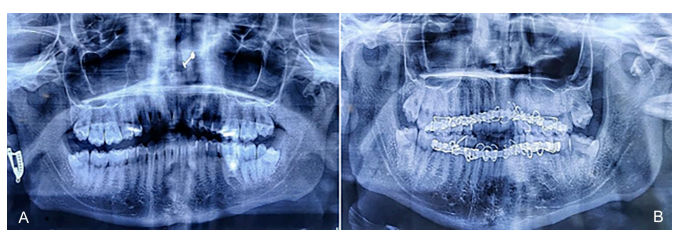

Figure 2: Closed reduction approach (A) Preoperative radiograph (B) Postoperative radiograph.

Mohan *et al.* studied the efficacy of pre-auricular approach and retromandibular approach.[18] Their results showed comparative benefits between the two techniques. For complicated fractures, pre-auricular approach was recommended otherwise retromandibular approach is a better option. They did not comment on the type of retromandibular approach.

Retromandibular approach can either be anteroparotid (tranmasseteric) or transparotid. Parihar *et al.* stated that there were no significant differences between both approaches in terms of complications but the transparotid approach provided direct access to the condylar neck fractures.[19] Scar formation and possible damage to the facial nerve and its branches were expected complications.

This study compared the closed reduction technique i.e. MMF with transparotid approach which is considered best amongst the open reduction approaches. Koirala *et al.* performed a study in which transparotid approach was studied for facial nerve injury and they found 11.4% of patients had facial nerve paresis with this approach.[20] But

there was no comparison with any other techniques for the same parameter.

The strength of this study is that two of the most common approaches were compared for the most possible complications. However, the limited sample size poses a challenge in identifying risk factors which was a notable limitation. Nevertheless, this study might prove fruitful in the formulation of standard guidelines in the management of condylar fractures.

CONCLUSION

The transparotid approach is a much safer approach in the management of displaced subcondylar fractures. It provides a direct vision of displaced segments which helps in predictable outcomes in terms of occlusion. If performed safely, chances of facial nerve injury are very rare, and there is no need for MMF, decreasing the incidence of trismus.

ETHICAL APPROVAL:

Ethical approval of this study was obtained from the Ethical Review Board of the Armed Forces Institute of Dentistry, Rawalpindi (Reference No. 918/Trg, Dated 13 May 2020).

PATIENTS' CONSENT:

Informed consent was taken from the patients to publish the data of this study.

COMPETING INTEREST:

The authors declared no conflict of interest.

AUTHORS' CONTRIBUTION:

SAY: Conceptualised the study, performed all the interpretation of data, drafted and revised the manuscript.
AA: Conceptualised and supervised the study.
SS: Collected data and assisted in the procedures and conduction of the study.
NA: Reviewed the article critically and analysed the work.
HA, BN: Collected data and conducted the study.
All authors approved the final version of the manuscript to be published.

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