Original Article - Comparative Study

Unilateral Subcondylar and Condylar Neck Fractures: Randomized Clinical Study

Tajamul Ahmad Hakim, Ajaz Ahmed Shah, Shahid Farooq, Shamina Kosar, Sumaira Gul, Nida Mehmood
Department of Oral and Maxillofacial Surgery, Government Dental College and Hospital, Srinagar, Jammu and Kashmir, India

Abstract

Aims and Objectives: The aim of the present study was to compare closed treatment with open reduction internal fixation (ORIF) for subcondylar and condylar neck fractures. **Materials and Methods:** This randomized prospective study was conducted on thirty patients who visited the Department of Oral and Maxillofacial Surgery, Government Dental College, Srinagar, with condylar fractures. All fractures were displaced; either angulated between 10° and 45° and the ascending ramus was shortened by >2 mm to <15 mm. Patients were divided into two groups after satisfying the inclusion and exclusion criteria – Group I (closed treatment) and Group II (open reduction) (15 implants in each group). In Group I, patients were treated by mandibulo-maxillary fixation using arch bar and elastics for 4 weeks, and in Group II, patients were treated by ORIF using two 1.5-mm miniplates. Follow-up was done at 1 month, 3 months, and 6 months. Our postoperative evaluation included five parameters – maximal interincisal opening, protrusion, lateral excursion on fractured and nonfractured sides, anatomical reduction, and pain and malocclusion. Nonparametric data were compared for statistical significance with Chi square test and parametric data with an independent sample's *t*-test ($P < 0.05$). **Results:** Correct anatomical position of the fragments was achieved significantly more accurately in the operative group in contrast to the closed treatment group. Regarding mouth opening/lateral excursion on fractured and nonfractured sides/protrusion, significant ($P < 0.05$) differences were observed between both groups (open 39.73/7.50/8.17/7.87 mm vs. closed 36.87/6.07/7.23/7.13 mm). Pain also revealed significant ($P = 0.025$) difference with less pain in the operative treatment group. **Conclusion:** Both treatment options for condylar fractures of the mandible yielded acceptable results. However, operative treatment was superior in all objective and subjective functional parameters except occlusion.

Keywords: Condylar fractures, open versus closed treatment, trauma

Introduction

Fractures of the mandible are the most common type of fractures occurring in maxillofacial region (57%).[1] Of the maxillofacial fractures acquired while playing sports, about one-third are mandibular fractures.[2] Among mandibular fractures, condylar region is the most frequent site accounting for almost 18%–57% of cases.[1,2] The topic of mandibular condylar fracture has generated more discussion and controversy than any other in the field of maxillofacial trauma. Depending on the direction and nature of the trauma, all types of fractures of the condylar process are possible.[3] Injury to the condylar region deserves a special consideration apart from the rest of the mandible because of anatomical differences and healing potential.[4] Disturbance of occlusal function, deviation of the mandible, internal derangements of the temporomandibular joint, and ankylosis of the joint with resultant inability to move the jaw are all sequelae of this injury.[5] Condylar fractures are classified according to their anatomical location and according to the degree of dislocation of the articular head. There are two methods of principal therapeutic modalities to these fractures: functional and surgical. Melkin said, "concerning the treatment of condylar fractures it seems that the battle will rage forever between the extremists who urge non operative treatment in practically every case and the extremists who advocate open reduction in almost every case."[6] In case of minimally displaced condylar fractures, closed treatment is generally recommended, whereas in severely displaced condylar fractures, open reduction is always recommended,[7] but there has still been

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Address for correspondence: Dr. Tajamul Ahmad Hakim, Department of Oral and Maxillofacial Surgery, Government Dental College, Srinagar, Jammu and Kashmir, India.
E-mail: tajamulhakim91@gmail.com

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Figure 1: Transparotid incision

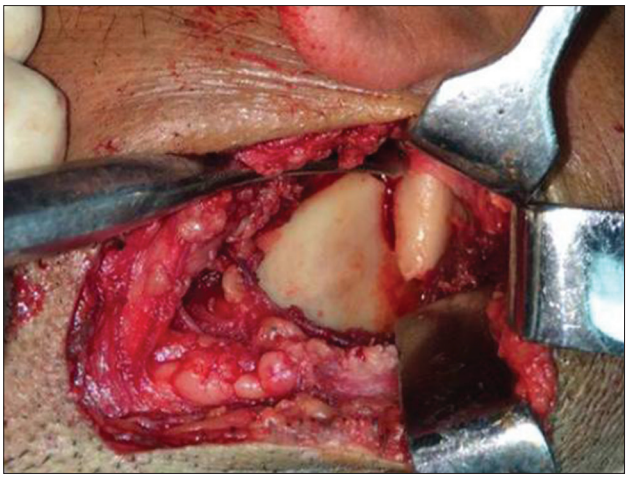


Figure 2: Condylar fracture

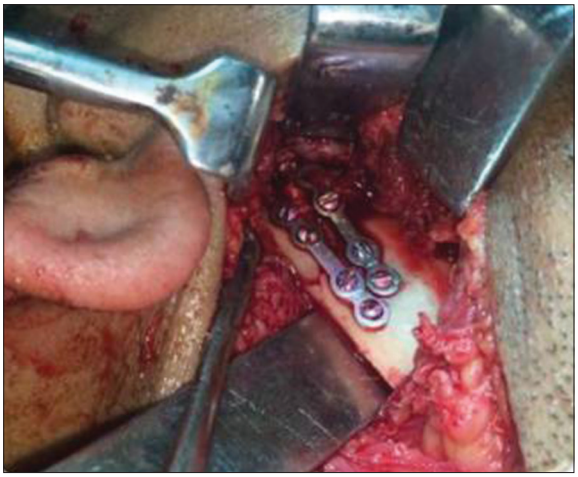


Figure 3: Miniplate fixation

Figure 4: Postoperative 3 months

Figure 5: Preoperative reverse Towne's view

Figure 6: Postoperative reverse Towne's view

no definitive study of superiority of one over the other in case of moderately displaced condylar fractures.

The aim of the present study is to compare closed treatment with open reduction internal fixation (ORIF) of moderately displaced subcondylar and condylar neck fractures.

Materials and Methods

After obtaining clearance from the institutional ethical committee, this randomized prospective study was conducted

Figure 7: Closed treatment with intermaxillary fixation

Figure 9: Posttreatment reverse Towne's view

Figure 11: Maximum interincisal opening after closed treatment

on thirty patients who visited the Department of Oral and Maxillofacial Surgery, Government Dental College and Hospital, Srinagar, with condylar fractures with or without associated mandibular fractures. All patients were treated on an inpatient basis. All patients were treated and observed by the same surgeon. The patients selected for the study were requested to sign informed consent form if conscious and adult

Figure 8: Pretreatment reverse Towne's view

Figure 10: Maximum interincisal opening after open reduction

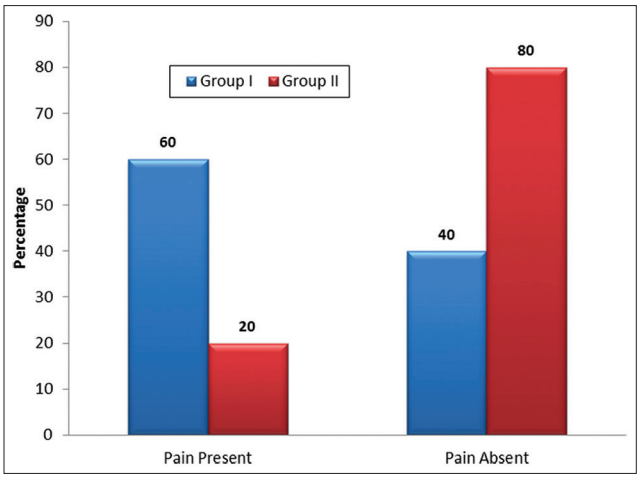
Figure 12: Parotid fistula

or by his/her attendant/guardian if minor, and ethical clearance was obtained from the institutional ethical committee.

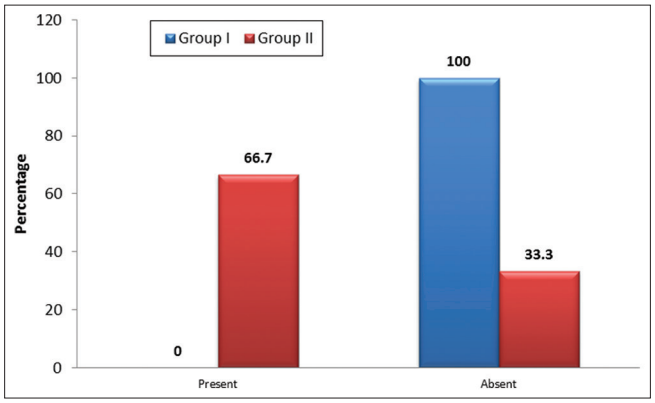
Inclusion criteria

1. All patients with age >16 years

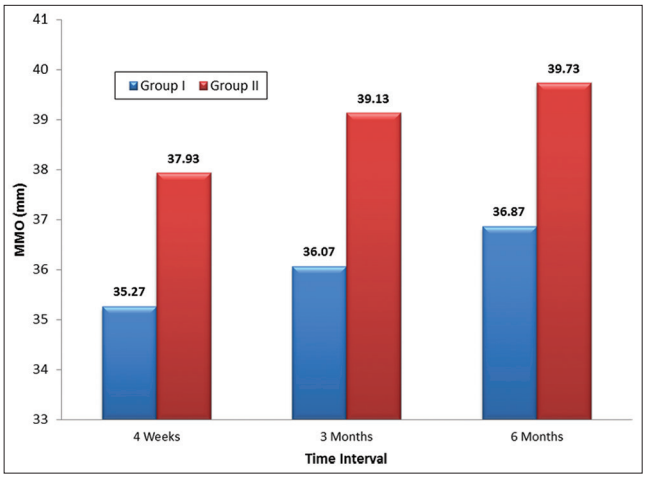
Figure 13: Fistula treated



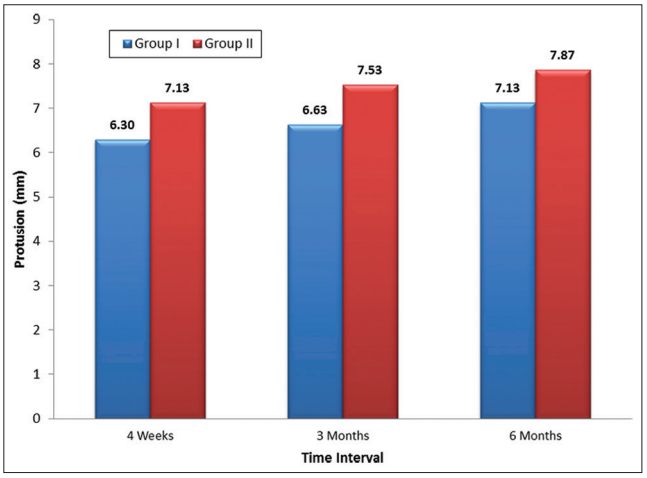
Graph 1: Comparison based on pain among two groups



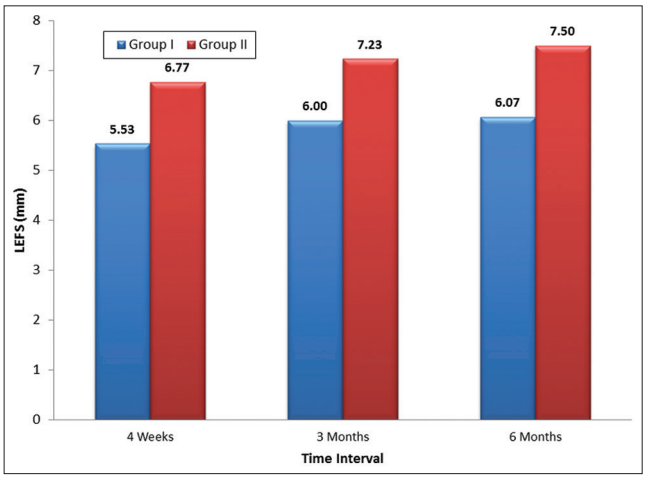
Graph 2: Anatomical reduction among two groups



Graph 3: Maximum mouth opening (mm) among two groups at various intervals of time



Graph 4: Protrusion (mm) among two groups at various intervals of time

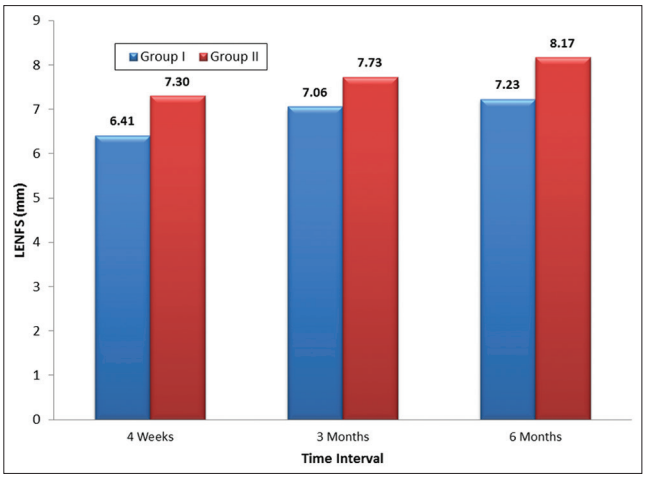


Graph 5: Lateral excursion on fracture side (mm) among two groups at various intervals of time

2. Unilateral subcondylar or condylar neck fractures
3. Degree of deviation between the condylar fragment and the ascending ramus of 10° and 45° either medially or laterally on the posteroanterior view of mandible with vertical ramus height shortening of 2–15 mm.

Exclusion criteria

1. Patients with condylar head fractures



Graph 6: Lateral excursion on non-fractured side (mm) among two groups at various intervals of time

2. Insufficient dentition to reproduce normal occlusion
3. All medically compromised patients
4. Associated midface fractures
5. History of temporomandibular dysfunction.

All patients included in the study fall under Class 2 (ramus height shortening 2–15 mm and degree of fracture displacement 10°–45°) and were treated by the same surgeon after informed consent, proper history, and examination. The patients were divided into two groups and randomization was done by lots using closed envelopes. Group I patients were treated with closed treatment by maxillomandibular fixation for 4 weeks which was extended if needed. The associated fracture of mandible was treated by ORIF using miniplates. The patients in Group II were treated with ORIF under general anesthesia using two 1.5-mm straight 4-hole with gap titanium miniplates [Figures 1-13].

Results

A total of thirty patients were included in the study. Of these patients, 20 (66.67%) were males and 10 (33.33%) were females. The patients were divided into two groups, with 15 patients in each group. Group I patients were treated with closed treatment and Group II patients were treated with ORIF. In this study, the mean age at the time of injury was 33.7 years in Group I and 36.7 years in Group II. The etiology of the fractures was road traffic accidents in 15 patients (50%), fall in 7 patients (23.33%), hit in 4 patients (13.33%), and assault in 4 patients (13.33%).

The mean maximal interincisal opening for Group I was 35.27 mm, 36.07 mm, and 36.87 mm at 4 weeks, 3 months, and 6 months, respectively, and for Group II, the mean maximal interincisal opening was 37.93 mm, 39.13 mm, and 39.73 mm at 4 weeks, 3 months, and 6 months, respectively. The results were statistically significant at 4 weeks ($P = 0.008$), 3 months ($P = 0.003$), and 6 months ($P = 0.002$) [Table 1].

The mean maximal protrusion for Group I was 6.30 mm, 6.63 mm, and 7.13 mm at 4 weeks, 3 months, and 6 months, respectively, and for Group II, the mean protrusion was 7.13 mm, 7.53 mm, and 7.87 mm at 4 weeks, 3 months, and 6 months, respectively. The results were statistically significant only at 3 months ($P = 0.047$) [Table 2].

The mean lateral excursion movement on the fractured side for Group I was 5.53 mm, 6.00 mm, and 6.07 mm at 4 weeks, 3 months, and 6 months, respectively, and for Group II, the mean lateral excursion movement on the fractured side was 6.77 mm, 7.23 mm, and 7.50 mm at 4 weeks, 3 months, and 6 months, respectively. The results were statistically significant at 4 weeks ($P = 0.001$), 3 months ($P < 0.001$), and 6 months ($P < 0.001$) [Table 3].

The mean lateral excursion movement on the nonfractured side for Group I was 6.41 mm, 7.06 mm, and 7.23 mm at 4 weeks, 3 months, and 6 months, respectively, and for Group II, the mean lateral excursion movement on the nonfractured side was 7.30 mm, 7.73 mm, and 8.17 mm at 4 weeks, 3 months, and 6 months, respectively. The results were statistically significant at 4 weeks ($P = 0.017$), 3 months ($P = 0.039$), and 6 months ($P = 0.003$) [Table 4].

When comparing both the groups, nine patients from Group I complained of pain (60%) whereas only three patients (20%) presented with pain from Group II. The results were found to be statistically significant [Table 5].

Anatomical reduction was not observed in any patients (0%) in Group I whereas it was found in 10 patients (66.7%) in Group II. The results were statistically significant ($P = 0.001$) when Chi-square test was done ($P = 0.025$) [Table 6] [Graphs 1-6].

Discussion

Traditionally managed by closed treatment methods, this type of fracture has not escaped the attention of clinicians attempting to achieve improved and more predictable outcomes by the techniques of ORIF.[8] Over time, however, the concept of rigid internal fixation has been increasingly applied to the injured craniomaxillofacial skeleton. With the development of improved materials for fixation and refinement of surgical techniques, a paradigm shift has occurred, with acceptance and even reliance on rigid internal fixation by both the surgeon and the patient. In our study, a total of thirty patients with Class 2 fractures were included which showed a high male predominance (66.67%) as compared to females (33.33%). The etiology of the fractures was road traffic accidents in 15 patients (50%), fall in 7 patients (23.33%), hit in 4 patients (13.33%), and assault in 4 patients (13.33%). The mean age at the time of injury was 33.7 years in Group I and 36.7 years in Group II. The above-mentioned parameters such as age, gender, and etiology of fracture showed no significant differences between the two treatment groups. These results were similar to other studies.[9,10]

In our study, all functional parameters such as maximal interincisal opening and protrusion and lateral excursion on

Table 1: Comparison based on maximal mouth opening (mm) among two groups at various intervals of time

MMO (mm)	Group I		Group II		*P*
	Mean	SD	Mean	SD	
4 weeks	35.27	3.17	37.93	1.79	0.008*
3 months	36.07	3.10	39.13	2.00	0.003*
6 months	36.87	2.88	39.73	1.58	0.002*

SD=Standard deviation; MMO=Maximal mouth opening, *=<0.05

Table 2: Comparison based on protrusion (mm) among two groups at various intervals of time

Protrusion (mm)	Group I		Group II		*P*
	Mean	SD	Mean	SD	
4 weeks	6.30	1.28	7.13	1.11	0.067
3 months	6.63	1.22	7.53	1.16	0.047*
6 months	7.13	1.16	7.87	1.26	0.108

SD=Standard deviation, *=<0.05

Table 3: Comparison based on Lower Extremity Functional Scale (mm) among two groups at various intervals of time

LEFS (mm)	Group I		Group II		*P*
	Mean	SD	Mean	SD	
4 weeks	5.53	0.88	6.77	1.03	<0.01*
3 months	6.00	0.71	7.23	0.84	<0.001*
6 months	6.07	0.75	7.50	0.91	<0.001*

SD=Standard deviation; LEFS=Lateral excursion on fracture side, *=<0.05

fractured and nonfractured sides showed significantly better outcomes in patients of the open treatment group. Our results are in accordance with the study conducted by Singh *et al*.[10] who observed statistically significant functional results in open group. Similarly, Palmieri *et al*.[11] reported that open reduction produces functional benefits for patients with severely dislocated condylar process fractures, and Rai[12] reported that ORIF allows appropriate anatomical repositioning and immediate functional movement of the mandible. Kim *et al*.[13] in their study also found that the difference between pre- and postoperative loss of ramus height in the ORIF group was statistically greater than that in the closed reduction group. However, our results were different from that of other studies[13,14] that observed no statistically significant differences in maximal interincisal mouth opening and protrusion and lateral excursion between the closed and open groups. Haug and Assael[15] in a prospective, but not randomized, study also showed no differences for maximum interincisal opening and deviation on opening between closed and open groups after treatment. In our study, similar moderately displaced fractures were compared between the two groups.

Surgical treatment allows proper anatomical repositioning and provides functionally stable fixation for fractures of

Table 4: Comparison based on LENFS (mm) among two groups at various intervals of time

LENFS (mm)	Group I		Group II		*P*
	Mean	SD	Mean	SD	
4 weeks	6.41	0.849	7.30	1.082	0.017*
3 months	7.06	0.821	7.73	0.862	0.039*
6 months	7.23	0.799	8.17	0.794	0.003*

SD=Standard deviation; LENFS= Lateral excursion on non fractured side, *=<0.05

Table 5: Comparison based on pain among two groups

Pain	Group I, *n* (%)	Group II, *n* (%)	*P*
Present	9 (60)	3 (20)	0.025*
Absent	6 (40)	12 (80)	
Total	15 (100)	15 (100)	

Table 6: Comparison based on anatomical reduction among two groups

Anatomical reduction	Group I, *n* (%)	Group II, *n* (%)	*P*
Present	0	10 (66.7)	<0.001*
Absent	15 (100)	5 (33.3)	
Total	15 (100)	15 (100)	

the condylar neck.[12] There is a consensus that correct anatomical repositioning of the mandibular condylar process is an important prerequisite for re-establishing function.[16] Anatomical reduction was not observed in any patients (0%) in Group I whereas it was found in 10 patients (66.7%) in Group II. The results were statistically significant ($P = 0.001$). Our results were in accordance with that of other studies.[14] Previously reported retrospective studies also demonstrated a better anatomical position after operative treatment, but they showed no significant difference in the functional clinical results.[17-19]

We also found better treatment results and less pain and discomfort in the patients of the open treatment group than those in the closed group and the results were statistically significant. These findings were similar to those of Singh *et al*.,[10] Danda *et al*.,[14] and Haug and Assael.[15] One patient in Group II treated via retromandibular transparotid approach developed parotid fistula after surgery and closure of fistula was achieved with warm hypertonic saline injections in 4 days. Follow-up was done for 5 months with no morbidity seen.[20] The occurrence of such a complication is rare. In a case series of 51 condylar fractures treated by transparotid approach, 1 case of sialocele and 1 case of parotid fistula were observed.[21] We did not encounter any plate fracture or any necessity for plate removal in any of the operated cases, but one patient in open group developed plate surgical site infection. The patient was treated via preauricular approach and pus discharge was noticed from the preauricular region after 3 weeks postoperatively. Culture and antibiotic sensitivity of the

discharge showed methicillin-resistant *Staphylococcus aureus*. The patient was put on intravenous linezolid for 7 days and infection resolved. However, a 3-month postoperative orthopantomogram of the same patient showed total condylar resorption. A number of local and systemic pathologies or diseases can cause mandibular condylar resorption. Local factors include osteoarthritis, reactive arthritis, avascular necrosis, infection, and traumatic injuries. Systemic connective tissue or autoimmune diseases that can cause condylar resorption include rheumatoid arthritis, psoriatic arthritis, scleroderma, systemic lupus erythematosus, Sjögren syndrome, and ankylosing spondylitis.[22] Extracorporeal fixation of the mandibular condyle also causes condylar resorption in some cases.[23,24] Infection was the most likely factor for condylar resorption in our case. The hardware was removed and the patient was put on physiotherapy. Our rate of infections and screw loosening is in accordance with the literature. Ellis *et al*.[25] reported no infections in their sample of 93 patients treated by open surgery. Hammer *et al*.[26] reported three infections associated with screw loosening. Retromandibular approach has been the recommended method to approach the condyle for ORIF by many authors as it is easier, associated with minimal complications, and provides better access.[27,28] The retromandibular approach used in this study provides adequate accessibility, lesser risk of facial nerve damage, and minimal scarring as compared to preauricular approach.

Conclusion

Considering all the above findings, we conclude that open reduction of moderately displaced subcondylar and condylar neck fractures led to excellent results both clinically and radiographically. Hence, we conclude that open reduction is better than closed reduction in case of moderately displaced subcondylar and condylar neck fractures. The retromandibular approach used in this study provides good accessibility and lower risk of facial nerve injury with good esthetic outcome.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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