

## Open Reduction and Internal Fixation Versus Closed Reduction and Maxillomandibular Fixation of Condylar Fractures of the Mandible: A Prospective Study

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### ABSTRACT:

**Introduction:** Condylar fracture, the most common fracture in mandible can be managed via two main modalities. The choice between either of the two depends on the displacement in fracture segments, occlusal changes, patient's adaptability, masticatory complex, dentate/edentate individual and deviation in mandible.

**Aim:** This prospective clinical study was conductive with an aim to compare conservative and open method in treating mandibular fracture and to evaluate the effectiveness of the same.

**Materials and methods:** The present study includes 20 patients with age range 16-56 years of condylar and sub condylar fracture. The reports cases were managed by either of the treatment modality based on the indication of the same. The outcomes of both the modalities were discussed on the following parameters: swelling, residual pain, hematoma and malocclusion. All the patients were called for a follow up.

**Results:** Among 20 reported cases, 8 cases unilateral condylar fracture, 8 unilateral sub condylar fracture, 3 bilateral condylar fracture and 1 bilateral sub condylar fracture. Amongst all, 8 cases were treated via ORIF, 3 cases ORIF with maxillomandibular fixation (MMF), 7 cases conservative approach and 2 cases MMF alone. No patient treated via ORIF showed malocclusion associated complication. The most common approach followed surgically was combined (preauricular + retromandibular). The post operative complications in ORIF group were swelling (40), residual pain (3) and temporary facial nerve palsy (2). The conservative group recorded complications as swelling (3), residual pain (3), malocclusion (4) and temporary facial nerve palsy (1).

**Conclusion:** The study concluded with the fact that surgical approach to manage fractures are far better than conservative. However, as the dilemma continues, the choice of method still depends on individual and fracture synchronously.

**Keywords:** Combined approach, condylar fracture, ORIF, MMF, malocclusion, hematoma.

### INTRODUCTION

With an ever so increasing trend of hustle society, time is one thing which has taken an integral part in everyone's life. Racing towards time has always led to traumatic instances and among them, trauma of facial region has taken the lead. Facial region has been accounted for, around 23% - 97% of all injuries.(1) The mandible, a bone of exceptional importance in defining occlusion, due to prominence in its anatomic position has been illustrated as the commonest fracture in orofacial complex. The fracture of this hard bone, mandible, is 36- 59% of maxillofacial fractures.(2) The varying etiologies include road traffic accidents, incidence of

interpersonal violence, radiation-based necrosis, neoplasms and other iatrogenic causes. Mandible though a single bone, exhibits various regions of weaknesses which henceforth increases its vulnerability for the same. The areas include junction of mandibular bone and alveolar bone, symphysis, parasymphysis, angle, condyle and teeth. (3) Amongst these vulnerable regions, condylar fracture followed by sub-condylar fracture is substantially increasing. Hagan and Huelke mentioned the following about mandibular fracture:

- i. Condylar fracture is the most common fracture site followed by angle of mandible.
- ii. If anyone fracture is present, then angle of mandible is the most common site.
- iii. Multiple fractures in the bone is more common than single fracture with most of the patients with dentate status.(1)

Thapa et al (2017) in a retrospective study concluded the following results:

- i. Mandibular condylar fracture unilaterally is the most common fracture followed by symphysis and parasymphysis fracture.
- ii. Male patients > female patients.
- iii. Maximum fractures recorded were due to fall from height.(4)

The site of bone fracture is the site of tensile strain as the resistance to compressive strength is high.

Managing this bone, of complex buttresses is still a controversy. The success of treatment is determined by re-establishment of occlusion, fixation and reduction of fractured segment, regaining TMJ anatomy and functions.(3) The principal approach in its treatment of condylar fracture includes conservative, functional and surgical methods. The two modalities included under this are, closed reduction (maxilla-mandibular fixation) and open reduction with internal fixation (ORIF). The fracture under various circumstances has been managed usually by closed reduction. Technique sensitivity, precision in skills, expertise knowledge about anatomy, proper planning and execution of technique has made open reduction and internal fixation a rare treatment modality to be used in the management. In recent years, it has gained importance with the introduction of plates and screws as fixation devices.

This prospective study, thereby, highlights open versus closed method in the management of condylar fracture.

AIM: The aim of this retrospective study is to define the management of condylar fracture under the guidelines of open versus closed reduction treatment regimen for the time period of 5 years.

#### MATERIALS AND METHODS:

A prospective study was carried out with, over, 20 patients in the Department of Oral and Maxillofacial Surgery, School of Dental Sciences, Sharda University stretching for a time period of over 5 years for the patients who were diagnosed with condylar fracture. The patients were diagnosed thoroughly via relevant case history, clinical examination and radiological evaluation.

#### INCLUSION CRITERIA:

The patients were admitted and were operated within the operation theatre in the Oral Maxillofacial Surgery unit of Sharda Hospital with mandibular fracture, aged 16 – 67 years, both male and female.

#### EXCLUSION CRITERIA:

The following exclusion criteria were included during the study:

- a) Patients with fracture other than condylar fracture.
- b) Condylar fracture other than road traffic accidents and interpersonal violence as etiological factors.
- c) Patients below 18 years and above 65 years.
- d) Systemically compromised patients.
- e) Edentulous patients

## RESULTS:

A total of 20 patients, 19 males and 1 female lying within the age range of 16- 56 years were selected randomly for the study. The most common age range was 16-26 years (55%) followed by 27-36 years (25%), 37- 46 years (15%) and 47-56 years (5%). (Table 2) The study concluded the most common etiology to be traffic accidents (55%), fall (25%) and interpersonal violence (20%). (Table 3) The following study was conducted to compare ORIF with conservative management and their associated complications.

Among 20 patients, 8 cases unilateral condylar fracture (5% right condylar & 35% left condylar), 8 unilateral sub condylar fracture (35% right sub condylar & 5% left sub condylar), 3 bilateral condylar fracture (15%) and 1 bilateral sub condylar fracture (5%). (Table 4) The site of fracture was diagnosed both clinically and radiographically. The condylar fractures were further assessed as intracapsular (55%) and extracapsular (45%). (Table 5)

Keeping in mind variable criteria like displacement in fracture segment, presence/ absence of teeth in the area, functional outcome and complications, the treatment modalities were chosen. Out of 20 cases, 40% managed via ORIF alone, 15% ORIF and MMF, 10% via MMF alone and 35% by closed reduction or conservative approach. (Table 7) The most common approach adopted for ORIF was combined (55%). (Table 8)

All the cases were observed post operatively. Malocclusion was significantly higher in conservatively treated group (57.1%) with no occlusal discrepancy in ORIF group. All the patients managed surgically developed facial edema within 3-5 days. One case developed hematoma when surgically treated where as no hematoma development was reported while conservatively managing condylar fracture. Two cases in ORIF group and one in conservative group developed temporary facial nerve palsy which resolved within few weeks. Cases managed surgically showed relatively less postoperative pain and swelling. The swelling was found in 5 cases among ORIF group and 3 cases in conservative group which subsided eventually with time and medications. The residual pain during mouth opening, mastication was observed in 4 cases of ORIF group and 3 cases of conservatively managed patients. The pain resolved with mouth opening exercises and medications. (Table 9)

## DISCUSSION:

Mandible is an archery bow shaped bone with its strength decreasing progressively from midline segment to condylar segment. As the condyle lies along the trajectories of force, this potentiates it to be the most fracture prone region than the rest of the mandible. Hence, condylar fractures gain an important momentum in an orofacial region fracture with an extensive line of treatment modality.

A study was conducted with over 20 patients and a case history pro forma was documented with several inclusion and exclusion criteria in hand. The diagnosis was further confirmed radiographically, viewing orthopantomogram.

The treatment regimen was divided into closed reduction and open reduction with internal fixation (ORIF). Keeping into account various indications and contraindications of the concerned regimen, the patients were treated accordingly.

Closed reduction with maxillomandibular fixation is indicated for comminuted, un displaced, infected fractures, fractures with minimal occlusal disturbances, adequate vertical height of ramus and with sufficient mouth opening, the age-related indications include pediatric and geriatric mandibular fractures(5) with its advantages involving no injury to major blood vessels and nerves (mandibular nerve and facial nerve) supplying the region, tooth germ (which leads to non-hinderance in the eruption of the deciduous teeth) and major disadvantages being the unmaintained oral hygiene, reduced mouth opening, injury to the tissues of the oral mucosa with several cases of facial asymmetry. (6)

The management via ORIF is indicated for fractures with limited occlusal stability, displaced segments, at risk for fibrosis, fractured region invaded by foreign body, edentulous mandibular fracture. The medically compromised individuals (e.g. status epilepticus, status asthmaticus, psychiatric or neurological disturbances) are treated using ORIF.(7) It's advantages eliminating the disadvantages placed by closed reduction (preventing disorders related to pronunciation, nutritional disturbances, direct approach into the favorable anatomical site for

fixation etc). On its flipped side, ORIF could cause severe injury to the blood vessels and nerves supplying the desired area, could lead to permanent scar (incision) and severe infection. (6)

With the evolving concern to esthetics, introduction of better surgical techniques and instruments and the advantage of early mobilization of the tissues traumatized has led the surgery to be widely accepted as a mode of treatment.

Various authors have also showed the acceptance of ORIF as a better treatment option.

Baker (1998) supported the surgical treatment in respect to excellent results considering post-surgical mouth opening and lateral excursive and protrusive movements. (8)

Garcia Guerrero et al in the literature review about intra and post operative complications by ORIF versus conservative treatment found that the differences in facial symmetry, residual pain, occlusion imbalance and TMJ associated discomfort were minimal in ORIF and also minimal.(9)

A prospective study by Hyde et al (2002) resulted that the maximum interincisal opening for the surgically treated patients was 42mm in against to 32mm in the patients treated by a conservative method.(10) A study on occlusal results by Ellis et al (2000) concluded the greater percentage of malocclusion occurred in patients treated conservatively rather surgically despite the fact that the initial displacement in patients treated surgically was higher.(11) The fractured fragments were reduced to their anatomical position precisely and significantly by ORIF in comparison to closed reduction, a study by Eckelt et al (2006).(12) A randomized control trial over 50 randomized fracture patients showed that though there was no significant statistical difference in interincisal opening, range of movements and pain in TMJ, however great difference was reported in condylar reduction anatomically, status of occlusion, deviation on mouth opening & post- operative stress immediately. (13) The study by Marker et al analyzed the results of closed reduction in terms of mouth opening, occlusion and deviation over 348 patients. The results stated 13% had reduced mouth opening or deviation, 3% had pain & 2% had malocclusion. (7) De Riu et al (2001) witnessed a reduction in ramus height greater than 3mm in 9% patients treated via closed reduction method in against to no reduction in surgically treated patients. (5)

Flipping the coin, the concerned treatment modality i.e. ORIF offers certain complications as well. Ellis et al (2000) in a study over 178 patients reported that at 6 weeks 17.2% had facial nerve weakness, 2.3% developed salivary fistulae & among 50% scar was visible. The scar was generally hypertrophied. (14) A retrospective study interpreted more longterm complications with most common being malocclusion (24%) followed with reduced mouth opening, disturbances in nerves, residual pain and asymmetrical face. (15) Another retrospective study over 2458 patients compared the complications with two different treatment approaches i.e ORIF and conservative. The results concluded go hand in hand with the results from this study. Facial asymmetry (6.4%/10.2%), pain (5.6%/6.5%), TMJ imbalance (10.3%/15.9%) and malocclusion (4.0%/11.1%).(9) A case series on the assessment of complications of open treatment noted transient facial paralysis (13%), unesthetic scar (11.9%) and a rare occurrence of salivary fistulae (1.4%).(16) With all these complications mentioned, some other reported were fibrous ankylosis, condylar resorption etc. The most common were malocclusion, temporary facial nerve involvement, residual pain and limited mouth opening.

Nevertheless, review over various literatures have made no different inference. The fact that the approach to be followed while managing the condylar fractures depends on site of fracture and degree of displacement in fractured segment. Apart from these the factors deciding the treatment line should be patient's systemic condition, age, skill and experience of the surgeon.

#### CONCLUSION:

No region of maxillofacial trauma poses more controversy than the mandibular fractures. The prevalence of condylar and sub condylar fracture is high with the most common etiology being road traffic accidents. Proper physical examination could identify the location of fracture which can further be confirmed radiographically. CT scan with three-dimensional reconstruction and orthopantomogram would further aid in an evaluation and assessment of the fractured segments. Advancement in surgical entities of medical sciences, patients with collateral injuries could be managed efficiently. The debate over conservative and ORIF in the treatment line of fractures has continued to be a point. Though reduction in the possibility of facial nerve injury and difficulty to

access, conservative method can be considered. However, owing to all the advancements be it in instrumentation, techniques and early functional and anatomical rehabilitation, surgery or ORIF is preferred.

Table 1

Distribution pattern according to gender	Number of patients (%)
Male	95
Female	5

Graph 1

Distribution pattern according to age (years)	Number of patients (%)
16-26	55
27-36	25
37-46	15
47-56	5

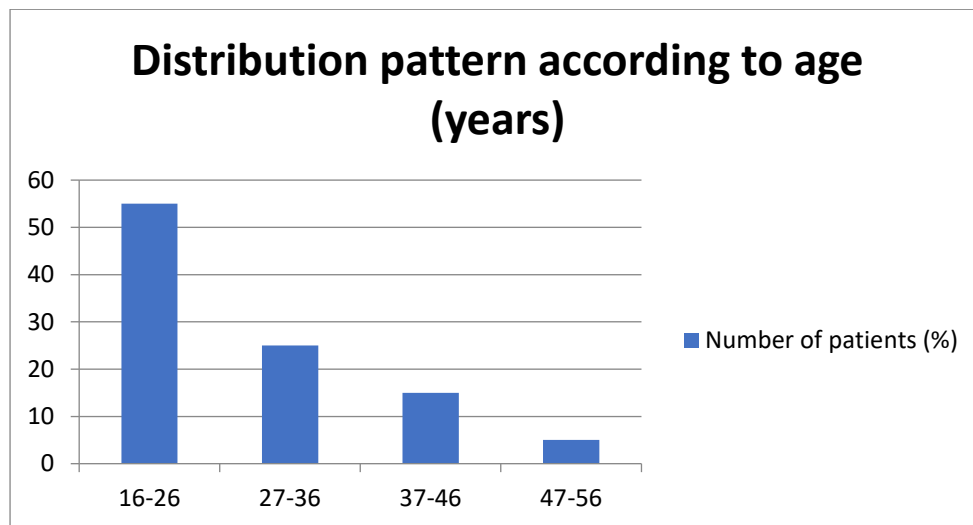


Table 2

According to etiological factors	Number of patients (%)
Traffic accidents	55
Fall	25
Violence	20

Table 3

Distribution for radiological assessment	Number of patients (%)
Right condylar	5

Left condylar	35
Right sub condylar	35
Left sub condylar	5
Bilateral condyle	15
Bilateral sub condylar	5

Table 4

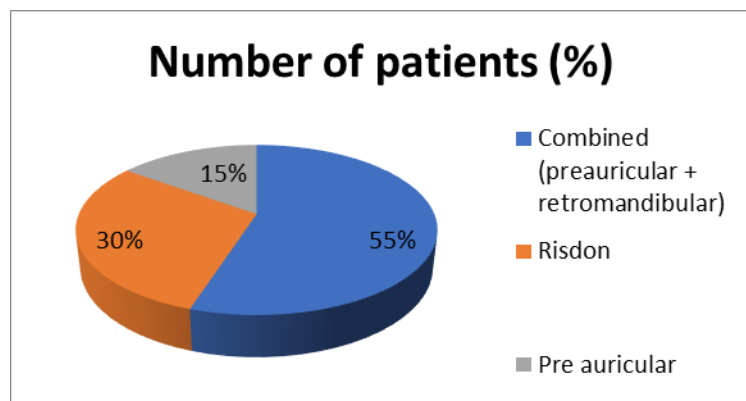
Distribution pattern of type of condylar fracture	Number of patients (%)
Intracapsular	55
Extracapsular	45

Table 5

Distribution of pattern of injury	Number of patients (%)
Segmented	55
Isolated	20
Combined	15
Pan facial	10

Table 6

According to treatment modality	Number of patients (%)
ORIF	40
ORIF+MMF	15
MMF	10
Closed reduction	35



Graph - 1

According to the approaches used	Number of patients (%)
Combined (preauricular + retromandibular)	55
Risdon	30
Pre auricular	15

Table 7

Complications	Number of patients (%)	
	ORIF	CR
Swelling	45.4	42.8
Residual pain	36.3	42.8
Haematoma	9.0	-
Malocclusion	-	57.1
Temporary facial nerve palsy	18.1	14.2

## REFERENCES:

1. Kumar R, Kulkarni P, Purohit J, Ann A. Patterns & Incidence of Mandibular Fractures: an Epidemiological Study. 2020;07(11):7144–9.
2. Sirimaharaj W PK. The epidemiology of mandibular fractures treated at Chiang Mai University Hospital: a review of 198 cases. J Med Assoc Thai. 2008;91(6):868–74.
3. Sm B. textbook of oral and maxillofacial surgery. 13th ed. elsevier;
4. Thapa S, Wang J, Hu H-T, Zhang F-G, Ji P. Epidemiology of Surgically Managed Mandibular Condylar Fractures at a Tertiary Referral Hospital in Urban Southwest China. Open Dent J. 2017;11(1):294–300.
5. Kumar PS, Kumar CR, Anandan H. A Study on Open Versus Closed Reduction of Mandibular Condyle Fractures and Their Management. Int J Sci Study. 2017;5(5):9–13.
6. Choi KY, Yang JD, Chung HY, Cho BC. Current concepts in the mandibular condyle fracture management part II: Open reduction versus closed reduction. Arch Plast Surg. 2012;39(4):301–8.
7. Valiati R, Ibrahim D, Abreu MER, Heitz C, De Oliveira RB, Pagnoncelli RM, et al. The treatment of condylar fractures: To open or not to open? A critical review of this controversy. Int J Med Sci. 2008;5(6):313–8.
8. Karan A, Kedarath NS, Reddy G, Kumar TVS, Neelima S, Bhavani M NA. Condylar Fractures: Surgical Versus Conservative Management. Ann Maxillofac Surg. 2019;9(1):15–22.
9. García-Guerrero I, Ramírez JM, Gómez de Diego R, Martínez-González JM, Poblador MS LJ. Complications in the treatment of mandibular condylar fractures: Surgical versus conservative treatment. Ann Anat [Internet]. 2018;60–8. Available from: <https://pubmed.ncbi.nlm.nih.gov/29223659/>
10. Hyde N, Manisali M, Aghabeigi B, Sneddon K, Newman L. The role of open reduction and internal fixation in unilateral fractures of the mandibular condyle: A prospective study. Br J Oral Maxillofac Surg. 2002;40(1):19–22.
11. Ellis E 3rd, Simon P TG. Occlusal results after open or closed treatment of fractures of the mandibular condylar process. J Oral Maxillofac Surg [Internet]. 2000;58(3):260–8. Available from: <https://pubmed.ncbi.nlm.nih.gov/10716106/>
12. Eckelt U, Schneider M, Erasmus F, Gerlach KL, Kuhlisch E, Loukota R, Rasse M, Schubert J TH. Open versus closed treatment of fractures of the mandibular condylar process-a prospective randomized multi-centre study. J craniomaxillofacial Surg. 2006;34(5):306–14.
13. Shiju M, Rastogi S, Gupta P, Kukreja S, Thomas R, Bhugra AK, Parvatha Reddy M CR. Fractures of the mandibular condyle--Open versus closed--A treatment dilemma. J craniomaxillofacial Surg. 2015;43(4):448–51.

14. Ellis E 3rd, McFadden D, Simon P TG. Surgical complications with open treatment of mandibular condylar process fractures. *J oral Maxillofac Surg.* 2000;58(9):950–8.
15. Nys, M., Van Cleemput, T., Dormaar, J. T., & Politis C. Long-term Complications of Isolated and Combined Condylar Fractures: A Retrospective Study. *Craniomaxillofac Trauma Reconstr.* 2021;
16. Asim MA, Ahmed W, Ibrahim MW, Bukhari GA KM. Assessment of complications of the open treatment of mandibular condylar fractures. *J PAKISTAN Med Assoc.* 2021;71(6).



Figure – ORIF - Pre-op OPG, Maxillo-Mandibular fixation, Fracture line, Fixation with mini-plate, Post-op OPG





Figure 2 – Closed Reduction – Pre-op OPG, Maxillo-mandibular Fixation