

## A Comparison Between Titanium Straight Miniplates Versus Titanium Y Plate in Fixation of Condylar Fracture-A Randomized Clinical Trial

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### Keywords:

Condylar fractures; Miniplates; retromandibular approach; Mouth Opening

### Abstract

**Introduction:** Following nasal bone, Mandible comes in the second position in facial fractures. It is fractured in spite of being the strongest and longest bone in the face. Fractures of Mandibular Condyle account for approximately 10%-40% at the time of its comparison with different anatomical sites. Presence of controversy occurs while managing the fractures of condylar. The specific aim of this current study refers to the evaluation of both stability along with complications present in Titanium Straight Miniplate and Y plate in condylar fractures. **Materials and Methods:** There were a division of 44 patients having condylar fractures into two groups in this specific study. Those specific groups include Straight Mini Plate and Y Plate. There were an evaluation of infection present in the mouth with mouth opening and plate position before one week, month and three months. There were the utilization of "Fisher Exact Test" and "Independent T Test" for assessing the relation in the middle of categorical and continuous variable. **Results :** The mean age of the patients in straight and Y plate group are  $21.45 \pm 5.67$  and  $20.98 \pm 4.23$  respectively. Also, 59.09% males and 40.91% females were present in the study. In the patients with Y plates, presence of infection was significantly lower and stability was significantly higher than the control group with straight mini plates. Similarly in the patients with Y plate, mouth opening was significantly higher than the patients with straight plates at  $p < 0.05$ . **Conclusion :** Results of satisfactory treatment have been assured by applying Titanium Y Plate in the case of stable osteosynthesis in Condylar fractures. The assurance has been given both by radiological perspective and clinical perspective.

### 1. Introduction

Greatest incidence has been possessed by mandible fractures of entire fractures of bones of face followed by nasal bone fracture, and condyle fracture is the most common condition of mandible

fracture. Between 30% and 37% of mandibular fractures are caused by condyle fracture. The usual fracture of the mandible is condyle fracture. The reason for this has been through indirect force. This indirect force from the symphysis has been transferred to the head of mandible condyle [1,2].

# Journal of Coastal Life Medicine

Inferior mandible is a highly impacted site possessed by blunt injury within several fractures of condylar. The persistent exterior causal reason refers to physical trauma and there has been a presence of different exterior causative elements. Accidents by automobile, violent acts, hazards in the workplace, and falls, are some of the exterior causative elements. Along with this, events of sports and wounds of gunshot are the remaining ones. [3]. Interior contributing reasons are Osteomyelitis, muscle spasm along with the malignant tumors. [4].

Despite how frequently condylar fractures occur, there is no "gold standard" therapy for them, and the question of whether to treat them surgically or conservatively is still up for debate. Patients with poorly treated condylar fractures may experience a variety of chronic issues. It's normal for malocclusion and deviation of jaw opening may happen [5]. The temporomandibular joint (TMJ) ankylosis and pain can intensify, and the interincisal distance can continue to show a reduced mouth opening. There have also been reports of facial asymmetries, osteonecrosis, and muscle spasm. 4–6 Sometimes, decades after the initial injury, sequelae like arthritis do not appear[6].

Intermaxillary fixation along with early exercises of jaw opening which continues through four to six weeks. These are efficient enough in providing positive outcomes. It is contended by advocate of intervention of surgery that ramus can be reduced by open reduction. There can be a prevention of facial asymmetry along with ankylosis of Temporomandibular Joint (TMJ) and decrease the recovery period for mastication and TMJ function[7].

Criteria is posted by Zide along with Kent for the time of surgical approach of condylar fractures. This include the time of grave displacement of bone outside *TMJ capsule* and within adjacent structures, along with the time of edentality of mandible or due to different causes, may not be treated with *Maxillomandibular fixation (MMF)* which is closed. [8–10]. Newer criteria advocate for closed management of condylar fractures with less than 2 mm shortening of the height of the ramus and less than 10 degrees of deviation. Open or endoscopic reduction and internal fixation (ORIF), however, is necessary when the height of the ramus is shortened

by more than 15 mm or there is more than 45 degrees of deviation[11,12]. Moderate fractures which come in the middle of these specific extremes are treated with closed, as well as, open methods. Employment of ORIF is done with higher frequency above past years. Expansion of indications in the case of management of open surgery has occurred.

[13–16]

Current enhancements for standard medication within implants in *maxillofacial surgery biomaterials* occurred the acquisition of fixation which is stable utilizing the system of titanium plate. [14]. Some cranio-maxillofacial surgeons initiate the utilization of suitable miniplate within surgical treatment require for maxillofacial fractures and their utility is reported by them

Greater biocompatibility is possessed by Titanium miniplate with good physical properties as compared to different metals tested. [17] From different techniques of RIF, the emergence of utilization of the mini plate has become a standard technique. The technique is considered as standard within medication of fractures of bones of the face by Champy et al. Mini plates can be difficult to place within condylar fragments because of small size. It is next to impossible for utilize this method within high fractures of condylar.

[18,19] .

Miniplates in different shapes have come and been in trials for fixation. It is depicted by study that great strength and and increase level of stable fixation is present within condylar plate of A-shape from trapezoid plate. The outcome was occurred due to multipoint fixation in 3 areas of plate. Support of reinforced bars is done through a connecting bar which is semi horizontal [20] . Clinical studies do not exist by which the utility of Y plate is proved. Proof of Multipoint fixation in three areas has not been proved by any studies.

Thus the study aims at comparing position of union of fracture and existence of infection amidst straight mini plates of Titanium along with Y Plates within fractures of condylar.

# Journal of Coastal Life Medicine

## 2. Materials and Methods:

**Design of Study:** Randomized Clinical Trial

**Setting of Study:** The study was done within the Department of *Oral and Maxillofacial surgery* in a private dental college in Chennai during October 2021 to October 2022.

### Study population:

Population of study comprised of patients having clinical along with radiographic diagnosis occur for fractures of mandibular condylar. The patients were randomly divided and assigned to Two groups utilizing allocation of random sequence within ratio of 1:1 below-ORIF utilizing *conventional straight miniplates*. (n=22) ; **GROUP B: ORIF** utilizing ORIF using Y shaped miniplates plate(n=22) (STRYKER).

### Inclusion criteria:

Patients above 16 years or more having unilateral, as well as, non-comminuted fractures of condylar and necessitated ORIF and those who had provided with signed consent.

### Exclusion criteria:

Unfit patients in the case of general anesthesia by whom condylar fractures are comminuted. Patients possessing infection of site of fracture on the initial representation.

### Clearance of Ethics:

- Before the beginning of the research, achievement of ethical clearance occurred from *Saveetha University*
- Achievement of written consent from participants of the research
- Maintenance of anonymity in the case of patient.

### Schedule:

### Surgical technique:

The patients were prepared according to the standard surgical protocol. Open reduction and internal

fixation under general anesthesia via naso-endotracheal intubation was performed on each patient. A retromandibular approach was used in all cases. The fracture was then reduced after establishment of the ideal occlusion with the help of intraoperative intermaxillary fixation. ORIF was done using 2.0-mm straight miniplates (Group A) or Y shaped delta plate (Group B).

### Sampling:

Simple random sampling was done by block randomization to select the study participants. Allocation ratio was kept at 1:1 into two groups. Blinding and allocation concealment were not applicable.

Irrigation of the surgical site was done copiously with metronidazole 500mg/ml solution. layer wise suturing was done utilizing *3-0 Vicryl sutures* along with *4-0 Prolene*. Pressure dressing for preventing hematoma and for maintaining the state of facial muscles which are repositioned. All patients had been prescribed with antibiotic protocol for 1 week. Removal of Sutures was done on the 7th *postoperative day*.

### Follow up:

Performance of clinical assessment along with comparative analysis had occurred in the middle of patients of *Group A and B* post-operatively on the basis of following criteria in one week and month along with three months in the case of as well as, radiographic assessment possessing reduction of fracture through panoramic radiographs.

### Calculation of Sample Size:

Calculation of sample size was done by G Power on the basis of study conducted through Ganguli et al., in 2021 [21] with p value 0.05 and 95 power with effect size 0.636. Our calculated sample size was calculated to be 44

### Analysis of Statistics:

Inclusion of data was done in *Microsoft Excel Spreadsheet*, along with the analysis done by the use of *SPSS software (version 23.0)*. Analysis of data through *Descriptive Statistics* included frequency, mean, standard deviation along with percentage with

# Journal of Coastal Life Medicine

95% confidence interval. Utilization of *Shapiro Wilk Test* was done for the assessment of regularity of distributing entire parameters. Analytical statistics included fisher exact test to assess the association between categorical variables and Independent t test was used For assessing the relation *categorical variables* along with *Independent T Test* had been for assessing the distinction of continuity  $p < 0.05$ .

### 3. Results

This research involved 44 patients involving condylar fractures with equal straight and Y plate groups. Mean of specific patients within straight along with *Y plate* group had been  $21.45 \pm 5.67$  and  $20.98 \pm 4.23$  respectively (table 1). In the present study, 59.09% males and 40.91% females were present (figure 1).

The infection and position of the plates were assessed at one week and month along with 3 months. Mouth opening had been measured at 1 and 3 months. In the assessment of

infection in patients with straight plates, 18.2%, 27.3% and 36.4% had Within the one week and month along with 3 months.. In the patients with Y plate, 9.1%, 18.2% and 13.6% had infection in 1

week, 1 month and 3 months respectively. . Exact test of Fisher revealed that in all the 3 timelines, patients with straight plates had a significantly higher number of infections present.

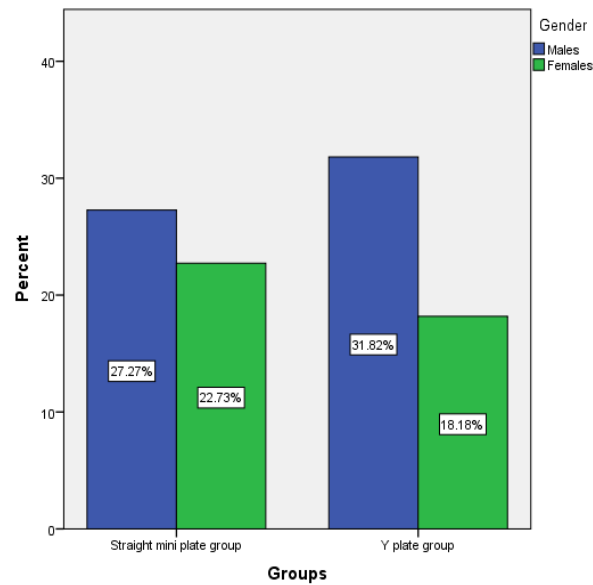
Similarly while assessing the position for patients with straight plate, 86.4%, 72.7% and 68.2% had proper positioning of the plate at (n) one week and month along with 3 months, respectively and within patients with Y plates, 90.9%, 81.8% and 90.9% had proper positioning of the plate at n 1 week, 1 month and 3 months respectively. Exact test of Fisher revealed that in all the 3 timelines, patients with Y plate had a significant higher number of plates with proper position and retention (table 2)

Utilization of *Independent T Test* had been done specific to measure the differences in the mouth opening of patients in 1 month and 3 months. At 1 month, patients with straight plate had a mean mouth opening of  $29.41 \pm 1.869$  while patients with Y plate had a mean mouth opening of  $33.68 \pm 1.427$  which is significantly higher than straight plate (table 3). Similarly, At 3 months, patients with straight plate had a mean mouth opening of  $31.73 \pm 3.279$  while patients with Y plate had a mean mouth opening of  $36.32 \pm 0.249$  which is significantly higher than straight plate (table 4).

Groups	N	Mean $\pm$ SD (Age)
Straight miniplate	22	$21.45 \pm 5.67$
Y plate	22	$20.98 \pm 4.23$

**Table 1 :** Distribution of age among the study participants

# Journal of Coastal Life Medicine



**Figure 1:** Distribution of gender in both groups among study population

	Straight plate		Y plate		Chi square value	p value
	Present	Absent	Present	Absent		
Infection at 1 week	4(18.2)	18(81.8)	2(9.1)	20(90.9)	11.226	0.04
Infection at 1 month	6(27.3)	16(72.7)	4(18.2)	18(81.8)	15.364	0.03
Infection at 3 months	8(36.4)	14(63.6)	3(13.6)	19(86.4)	23.121	0.000
	Straight plate		Y plate		Chi square value	p value
	Proper position	Improper position	Proper position	Improper position		
Position at 1 week	19(86.4)	3(13.6)	20(90.9)	2(9.1)	1.321	0.008
Position at 1 month	16(72.7)	6(27.3)	18(81.8)	4(18.2)	15.893	0.03

Position at 3 months	15(68.2)	7(31.2)	20(90.9)	2(9.1)	24.786	0.000
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**Table 2:** Fisher exact test showing the presence of infection and position of the straight and Y plate groups at 1 week, 1 month and 3 months

Independent t test		N	Mean (SD)	F value	p value
Mouth opening at 1 month	Straight plate	22	29.41 (1.869)	0.692	0.000
	Y plate	22	33.68 (1.427)		

**Table 3:** Independent t test showing the mouth opening of the straight and Y plate groups at 1 month

Independent t test		N	Mean (SD)	F value	p value
Mouth opening at 3 months	Straight plate	22	31.73(3.279)	0.338	0.000
	Y plate	22	36.32(0.249)		

**Table 4:** Independent t test showing the mouth opening of the straight and Y plate groups at 3 months

#### 4. Discussion

Distinct approaches to techniques of surgery utilizing systems of fracture fixation are being elucidated within the literature. Thus, preferred fixation in the case of fracture of mandibular condyle has been debatable. Design of plate and selection of material in the case of rigid fixation of the condyles which are fractured have a vital role within the effectiveness or non-success of the method of the **Open Reduction** along with **Rigid Fixation**. [22]. In this study, the Immediate post operative radiographs showed excellent reduction in both Straight plate And Y plate Osteosynthesis, except for 2 with Straight plates. The rate of infection occurring in people with the Straight plates had become more as compared to Y plates.

Bilateral condylar fractures even after treatment can cause **malocclusions**. It has been after occurrence of condylar nonunion, conservative medication is not effective along with is susceptible to arthritis **sequelae** [23]. Condylar Fractures of may be treated through Open Reduction along with Internal Fixation, which avoids late-term consequences

include reduction of ramus, decrease of jaw above opening, **occlusal discrepancies**, and construction of a joint which is false in the case of movement of condylar within glenoid fossa.. Interfragmentary movement can cause **Nonunion, fibroid union, or temporomandibular** problems, hence stable fixation is crucial[24].

More stability is offered by Fixation having miniplates as compared to **transosseous** wiring. Even though one miniplate can be sufficient, proper alignment of fragments. The usage of two or more has been suggested since forces of function actually increase by a single miniplate [25]. Alternatively, condylar fractures can also be fixed with an individual **2.4mm plate** or the individual **2.0 mm mini-dynamic compression plate** since they provide defiance to rotation, as well as, bending of 3-point. Nevertheless, there may not always be enough bone in the condylar neck to allow for the insertion of 2-3 screws per fragment. Various plate designs have been proposed to address this issue[26].

Manoj Chaudhary et al studied the effectiveness of trapezoid 3D plates and assessed the efficiency,

# Journal of Coastal Life Medicine

rigidity along with the stability of **3-D plates** which is in the shape of trapezoid in the case of osteosynthesis within fracture patients of mandibular subcondylar in adult. It was concluded in the study Patients having gross displacement possessing condylar fragment, a great reduction within height of posterior face along with **deranged occlusion** may be effectively managed through open reduction and internal fixation .[27]

In our study, stable fixation was found significantly in patients with Y plate. Similarly, Byung-Ho Choi et al studied the complications involved in the treatment of fractures of condylar utilizing 1 miniplate, miniplate mini dynamic compression and 2 mini plates. There has been an observance of fracture of plate or loosening of screw in matters stabilized along with individual miniplate or plate of compression. Observance of matters including inadequate stability had occurred at the time of utilization of two miniplate. The method of fixation of two miniplate bestows stable fixation in the case of fractures occurring in the condylar neck in a functional manner. [28].

In our study, unilateral and bilateral subcondylar fractures have been studied. The Y plate can better encounter torsion of the neck due to tripod effect and better when there is a little or no space in the neck of the condyle for 2 holes in horizontal direction. Similarly Triveni Palani et al evaluated that success of trapezoidal plates which are 3D within Open Reduction along with internal fixation by fractures of subcondylar.. It was concluded in the comparative study that 3D plates which are trapezoidal can be taken into consideration as viable option in the case of treatment of fractures of subcondylar of mandible within the view of accessibility of surgery. Along with this, the stability, smoothness of placement of device, and stability acquired by decreased fractures is present. Moreover, decreased requirement of material of osteosynthesis along with less destruction to tissues surrounding it [29]. They also used the retromandibular approach similar to our study. In the current scenario, approaches that are made to condyle are utilized and elucidated within literature. The benefits of retromandibular technique consist of: less distance of working from skin, higher access to posterior border possessed by mandible along with sigmoid notch. In addition to that, there has been an involvement of less risk possessed by

damage of nerve of face. Furthermore, minimal facial scar along with easy reduction has been included too. [30].

Another parameter measured in the present study was mouth opening. In the present study, patients with Y plate had greater in a significant manner mouth opening as compared to the control group within one month along with three months **post operative time**.

Similarly in Marbon Joevitson et al also evaluated the mouth opening of patients undergoing condylar fracture management using 3D Strut plates. [31]. It was concluded that significant difference was present within the opening of mouth of fracture of suncondyle of patients **post operatively** just at **two months** along with **six months**.

The present study had merits and demerits. The main advantage of the study is that the study had a control group to compare which most of the studies lacked. Another advantage of the study is its sample size. Nevertheless there were some shortcomings of the study. The follow up time of the study is limited. Longer follow-up and more sample size is needed to conduct a future study. Also, there should be a study to compare different types of plates and its stability and complications

## 5. Conclusion

It can be concluded that **Titanium Y Plate** has been applied in the case of stable osteosynthesis, and has ensured entirely satisfactory results of the treatment of both a clinical and radiological point of view. In addition, the use of Y plates does not involve any significant complications. There is practically no risk for mouth opening. Failure in the form of loosening of the retaining screws and infection are very rare and do not cause any significant disturbance in the fracture healing.

## CONFLICT OF INTEREST

*Nil*

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