INTRODUCTION

Among facial bone fractures, mandible is one of the frequently fractured site with condylar fractures ranging between 17.5% and 52%. The condylar fracture is not caused by direct trauma, rather indirect forces are transmitted to condyle from a blow elsewhere. Its displacement is dependent on degree, magnitude, direction and precise point of application of the force. It also depends on dentition and the occlusal position.\[1\]

The management of condylar fracture remains a topic of controversy. Two main treatment modalities include conservative and surgical approach. Both the approaches have indications and contraindications as well as their own advantages and disadvantages.\[2\] In recent years the surgical approach i.e open reduction with internal fixation has become more common mainly because of better understanding of anatomy and use of newer instrument and techniques. With open treatment the condylar process can regain pretraumatic position or close to position which will re-establish normal mandibular position and bring teeth in proper occlusal relation.\[3\] Zide and Kent have thrown more light on the absolute and relative indications of open reduction and internal fixation.\[4\]

By following the principles of Champy et al, single miniplate is commonly used for fixation of condylar fracture.\[5\] However use of two plates have also been advocated.\[6,7\] In vitro studies have shown better results with two miniplates for fixation of the condylar fractures.\[8\]

At the same time it is believed that incorporation of more hardware in a very small anatomic area can lead to many other postoperative complications such as infection or compromised vascularity. Our study compares the outcome following open reduction and internal fixation of the condylar fractures using either single plate or with two miniplates on various postoperative parameters.

AIM

To evaluate the functional outcome and stability by comparing the single miniplate verses two miniplates for open reduction and internal fixation of mandibular condylar fractures.

ABSTRACT

Aim: To evaluate the functional outcome and stability by comparing the single miniplate verses two miniplates for open reduction and internal fixation of mandibular condylar fractures. Materials and methods: The prospective clinical study was performed on 36 patients (26 males and 10 females) with mandibular condylar fractures. These patients were divided into two groups of 18 each. In first group fixation was achieved with single miniplate and in second group fixation was achieved with two miniplates. Fractures were classified based on classification given by Spiessel and Schroll (1972). All the fractures included in the study were subjected to open reduction and internal fixation. The choice of approach and fixation was planned depending upon the level of fracture by the operating surgeon before surgery. All these patients were assessed for follow up over a period of 6 months postoperatively.

Results: The study showed that complications like occlusal derangement, change in fracture segment position after achieving good intraoperative reduction and deviation of mouth towards the fracture side were more commonly seen in the patients treated with single miniplate. Though other complications were also seen more in patients treated with single miniplate the number was statistically insignificant. Conclusion: Patients treated with two miniplates showed fewer complications when compared to patients treated with single miniplate. Follow up period showed better occlusal stability and TMJ function with two miniplates. As our study sample size is small, it is difficult to comment about the statistical significance of the plating system used. We suggest that whenever possible two miniplates should be used to fix the condylar fractures as it provides more stable fixation.

KEYWORDS: Condyle fracture, miniplates, open reduction internal fixation. Incisal opening.
MATERIAL AND METHOD

Selection criteria

Inclusion criteria

1) Age of the patient above 18 years.
2) Condylar fracture classified according to Spiessel and Schroll classification (1972).
3) Sufficient dentition to reproduce the occlusal relationships.
4) Informed Consent to participate in the study and for long term followup.
5) Patient’s acceptance to open reduction even after explanation of postoperative facial scar, possible facial nerve weakness and other possible complications of surgery.

Exclusion criteria

1) Previous history of temporomandibular joint dysfunction.
2) Severe pretraumatic dysgnathia.
3) Undisplaced or intracapsular type of condylar fractures.
4) Patients with associated midfacial fracture (to limit the causes of occlusal derangement postoperatively because of other associated midfacial fractures).
5) Patients with medically compromised condition were excluded from the study to avoid limitations in the treatment planning.

Method of collection of data

36 adult patients with mandibular condylar fractures requiring open reduction and internal fixation were included in this study (which also qualified our inclusion criteria).

Out of 36, 26 were male 10 were female patients. Most of these patients had other mandibular fractures mainly in the parasymphyseal region.

The procedure to be performed was explained along with the benefit and risk it carries. Written informed consent was taken. These patients were divided into two groups.

In first group fixation was achieved with single miniplate and in second group fixation was done with two miniplates. Detailed history and clinical examination was recorded in a specially prepared case history proforma. 2mm stainless steel miniplate osteosynthesis technique was used for fixation of these fractures.

The radiographs taken were OPG and Reverse Towne’s projection. Whenever required 2D or 3D CT scans were taken as diagnostic adjuvant.

Condylar fractures were classified based on classification given by Spiessel and Schroll (1972).[9]

Type I: Fractures without displacement
Type II: Low fractures with displacement
Type III: High fractures with displacement
Type IV: Low fractures with dislocation
Type V: High fractures with dislocation
Type VI: Intracapsular fracture

All these patients were treated by open reduction and internal fixation. The choice of approach and fixation was planned according to the level of fracture. In the postoperative period, these patients were evaluated on various parameters for a followup period of 6 months at intervals of day 1, day 2, day 8, 15 days, one month, two months and six months. Maxillomandibular fixation was applied postoperatively in patients with gross occlusal derangement. Guiding elastics were used to guide occlusion in cases where derangement was mild.
Group 1 patient treated with single miniplate

Preoperative pictures

Post operative pictures
Group 2  two miniplate fixation
Preoperative pictures

Post operative pictures
Intraoperative pictures

Two miniplate fixation

Single miniplate fixation

Methodology of assessment
All the fractures included in the study were subjected to open reduction and internal fixation. The choice of approach and fixation was planned depending upon the level of fracture by operating surgeon before surgery. 20 out of 36 fractures were approached through the standard preauricular approach and 16 through retromandibular approach.

All these patients were reviewed over a period of 6 months postoperatively according to the following criteria:
1. Reduction in interincisal distance.
2. Occlusal derangement.
3. Change in the fracture segment position after good intraoperative reduction.
4. Deviation of mandible during mouth opening.
5. Facial nerve weakness.

7. Postoperative Pain
8. TMJ dysfunction.
11. Loosening of the screw.
12. Fracture of the bone plate.
13. Resorption of the condylar head.

RESULT
Out of 36 patients 30 had unilateral condylar fractures in which 12 were right sided and 18 were left. 26 were men and 10 were women. Highest number (i.e 16) of fractures observed belonged to low displaced subcondylar fracture pattern (Spiessel and Schroll type II). Most of these patients were having other mandibular fractures mainly in parasymphyseal region on the contralateral side.

Results were tabulated and subjected to statistical analysis comparing the two groups.

Table 1: Immediate complications (observed during the first postoperative week).

<table>
<thead>
<tr>
<th>Criteria for post operative evaluation</th>
<th>Group 1 (Single Plate)</th>
<th>Group 2 (Two Plates)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction in maximum interincisal distance</td>
<td>4(22.22%)</td>
<td>4(22.22%)</td>
</tr>
<tr>
<td>Occlusal derangement</td>
<td>6(33.33%)</td>
<td>NIL</td>
</tr>
<tr>
<td>Change in the fracture segment position after good intraoperative reduction</td>
<td>6(33.33%)</td>
<td>NIL</td>
</tr>
<tr>
<td>Facial nerve weakness</td>
<td>8(44.44%)</td>
<td>8(22.22%)</td>
</tr>
<tr>
<td>Edema</td>
<td>4(22.22%)</td>
<td>4(22.22%)</td>
</tr>
<tr>
<td>Deviation of mandible during mouth opening</td>
<td>6(33.33%)</td>
<td>NIL</td>
</tr>
<tr>
<td>Postoperative pain</td>
<td>6(33.33%)</td>
<td>4(22.22%)</td>
</tr>
<tr>
<td>TMJ dysfunction</td>
<td>NIL</td>
<td>NIL</td>
</tr>
<tr>
<td>Infection</td>
<td>NIL</td>
<td>NIL</td>
</tr>
<tr>
<td>Plate bending</td>
<td>NIL</td>
<td>NIL</td>
</tr>
<tr>
<td>Screw loosening</td>
<td>NIL</td>
<td>NIL</td>
</tr>
<tr>
<td>Plate fracture</td>
<td>NIL</td>
<td>NIL</td>
</tr>
<tr>
<td>Resorption of the condylar head</td>
<td>NIL</td>
<td>NIL</td>
</tr>
</tbody>
</table>
Table 2: Late postoperative complications seen from 8th postoperative day to six months.

<table>
<thead>
<tr>
<th>Criteria for post operative evaluation</th>
<th>Group 1 (Single Plate)</th>
<th>Group 2 (Two Plates)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction in maximum interincisal distance opening</td>
<td>NIL</td>
<td>NIL</td>
</tr>
<tr>
<td>Occlusal derangement</td>
<td>6(33.33%)</td>
<td>NIL</td>
</tr>
<tr>
<td>Change in the fracture segment position after good intraoperative reduction</td>
<td>6(33.33%)</td>
<td>NIL</td>
</tr>
<tr>
<td>Facial nerve weakness</td>
<td>8(44.44%)</td>
<td>8(44.44%)</td>
</tr>
<tr>
<td>Edema</td>
<td>NIL</td>
<td>NIL</td>
</tr>
<tr>
<td>Deviation of mandible during mouth opening</td>
<td>6(33.33%)</td>
<td>NIL</td>
</tr>
<tr>
<td>Postoperative Pain</td>
<td>NIL</td>
<td>NIL</td>
</tr>
<tr>
<td>TMJ dysfunction</td>
<td>4(22.22%)</td>
<td>NIL</td>
</tr>
<tr>
<td>Infection</td>
<td>2(11.11%)</td>
<td>2(11.11%)</td>
</tr>
<tr>
<td>Plate bending</td>
<td>2(11.11%)</td>
<td>NIL</td>
</tr>
<tr>
<td>Screw loosening</td>
<td>2(11.11%)</td>
<td>NIL</td>
</tr>
<tr>
<td>Plate fracture</td>
<td>NIL</td>
<td>NIL</td>
</tr>
<tr>
<td>Resorption of the condylar head</td>
<td>2(11.11%)</td>
<td>NIL</td>
</tr>
</tbody>
</table>

Table 3: Outcome of Postoperative complications.

<table>
<thead>
<tr>
<th>Criteria for post operative evaluation</th>
<th>Group 1 (Single Plate)</th>
<th>Outcome</th>
<th>Group 2 (Two Plates)</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction in interincisal distance</td>
<td>4</td>
<td>Improved after one week with physiotherapy</td>
<td>4</td>
<td>Improved after one week with physiotherapy</td>
</tr>
<tr>
<td>Occlusal derangement</td>
<td>6</td>
<td>Improved after maxillomandibular fixation for 15 days</td>
<td>NIL</td>
<td></td>
</tr>
<tr>
<td>Change in the fracture segment position after good intraoperative reduction</td>
<td>6</td>
<td>Healed by remodelling within six months</td>
<td>NIL</td>
<td></td>
</tr>
<tr>
<td>Deviation of mandible during mouth opening</td>
<td>6</td>
<td>Improved with guiding elastics after 2 weeks</td>
<td>NIL</td>
<td></td>
</tr>
<tr>
<td>Facial nerve weakness</td>
<td>8</td>
<td>Improved over a period of 8-12 weeks</td>
<td>8</td>
<td>Improved over a period of 8-12 weeks</td>
</tr>
<tr>
<td>Edema</td>
<td>4</td>
<td>Resolved by itself within a week</td>
<td>4</td>
<td>Resolved by itself within a week</td>
</tr>
<tr>
<td>Postoperative pain</td>
<td>6</td>
<td>Reduced after two weeks</td>
<td>4</td>
<td>Pain reduced after 2 weeks</td>
</tr>
<tr>
<td>TMJ dysfunction</td>
<td>4</td>
<td>Improved with physiotherapy within one month</td>
<td>NIL</td>
<td></td>
</tr>
<tr>
<td>Infection</td>
<td>2</td>
<td>Resolved after drainage of pus and antibiotic therapy</td>
<td>2</td>
<td>Resolved after drainage of pus and antibiotic therapy</td>
</tr>
<tr>
<td>plate bending</td>
<td>2</td>
<td>Under observation</td>
<td>NIL</td>
<td></td>
</tr>
<tr>
<td>screw loosening</td>
<td>2</td>
<td>Loose screw were removed</td>
<td>NIL</td>
<td></td>
</tr>
<tr>
<td>plate fracture</td>
<td>NIL</td>
<td>NIL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>resorption of the condylar head</td>
<td>2</td>
<td>Under observation</td>
<td>NIL</td>
<td></td>
</tr>
</tbody>
</table>

These results were subjected to statistical analysis and compared by using the GRAPH PAD PRISOM 8.2.1 software.

This analysis showed statistically significant difference in three parameters namely deviation of the mandible towards the fractured side, occlusal derangement and change in the fracture segment position, were seen in 6 out of 18 patients treated using single miniplate, all the above mentioned complications were seen in same six patients. These complications were not present in the group treated using two miniplates.
**DISCUSSION**

Treatment of mandibular condyle fracture is controversial in oral and maxillofacial trauma. In the past, closed reduction i.e intermaxillary fixation along with active physical therapy was the treatment of choice. The possible disadvantage of this procedure include abnormal occlusion due to improper fixation, metastasis of bone that is fractured by muscle strength and may affect the functioning of temporomandibular joint(TMJ) due to disuse muscle atrophy which is caused by long term intermaxillary fixation. Recently more attention has been given to open reduction. Because of advancement in surgical instrument and surgical approaches, the complications such as mouth opening limitation, TMJ pain and arthritis has been minimized. This can be achieved by accurate reduction of bony fragment.\(^\text{10}\)

Miniplate system is among one of the various treatment option available for open treatment giving the benefit of early mobilization and decreased morbidity.\(^\text{11}\) Single non compression miniplates are frequently used inspite of the drawbacks such as screw fracture and plate loosening.\(^\text{12}\) Superior stability in fixation of condylar fractures has been demonstrated by double plates.\(^\text{8,13,14,15,16,17,18}\)

In our study the postoperative outcome of the patients with single and double miniplates have been evaluated. Similar to other studies more number of complications have been observed in patients with single miniplate.

Postoperatively occlusal derangement, change in fracture segment position after good intraoperative reduction and deviation of mandible towards fracture side were seen only in patients treated by single miniplate. Though other complications were seen more in the patients treated with single miniplate than with two miniplates, results were statistically insignificant.
We have observed resorption of the condylar segment in one patient treated with single miniplate whereas no patient showed this complication in group treated by using two miniplates. This finding is in contrast to the belief that two miniplates incorporates extra hardware in smaller anatomic area which can lead to compromised vascularity and necrosis of the condylar segment.

OPG and Reverse Towne’s view are commonly used for diagnosis of condylar fracture. Two dimensional and three dimensional computed tomography (2D and 3D CT) are useful when plane radiographs are insufficient to visualize the fracture pattern.

In our study we have taken 2D as well as 3D CT scans of the patients whenever there was any diagnostic dilemma regarding the fracture pattern encountered, we have also observed that the 3D CT scans provide better visualisation of the fracture pattern and hence help in treatment planning.

Age of the patient has a bearing on treatment. In children under 3 years, because of stubbiness of condyle, fracture is usually of compression type. In children between 3 and 11 years of age, fracture are linear and remodelling of distal stump may occur with formation of architecturally normal condyle in fairly normal anatomic position. In adults, the capacity to remodel is diminished. The need for open reduction is greater so that optimal anatomic alignment can be achieved. In our study individuals above 18 years of age have been included.

The standard preauricular approach for high and medially displaced condylar fractures and retromandibular for the low level condylar fractures. The preauricular approach was used in 11 patients whereas retromandibular approach was used in 7 of the patients.

As known with standard preauricular approach, the chances of transient facial nerve palsy is very common when compared to other approaches, our study recorded 6 patients with transient facial nerve palsy treated with standard preauricular approach, when observed during the immediate postoperative period irrespective of the type of plating system used. These patients were managed medically with steroid therapy without any surgical intervention, which has totally reversed within span of 8-12 weeks.

Oedema, decreased interincisal distance, facial nerve weakness and infection were similar in both the groups affecting equal number of patients. TMJ dysfunction was seen in 2 patients treated using single miniplate whereas none of the patients in the second group had TMJ dysfunction. This was seen in patients with changes in the fracture segment position after achieving good intraoperative reduction.

The delayed complications like plate bending, screw loosening and resorption of the condylar head were seen in one of the patients treated with single miniplate, also this patient presented with infection. Another patient in two miniplates group also presented with infection without any other delayed complications as seen in the previous case.

Though all these complications were seen during early postoperative period they were resolved during subsequent followup. Our study showed more complications seen in the group treated using single miniplate than in group treated using two miniplates.

The small sample size and limited follow-up could be considered the limitation of the study.

CONCLUSION
The following conclusions can be drawn from our study.

Patients with two miniplates had fewer complications when compared to patients treated with single miniplate. Follow up of the patients suggested better occlusal stability and TMJ function with two miniplates. As our study sample size is small, it is difficult to comment about the statistical significance of the plating methods used.

Though all the complications resolved during subsequent follow up in both single and two miniplate groups, every opportunity should be utilised whenever possible to use two miniplates for the fixation of displaced condylar fractures as it provides stable fixation compared to use of single miniplate.

REFERENCES
8. Asprino L, Consani S, and Moraes M: A comparative biomechanical evaluation of


