

Retrospective Analysis on the Outcome of Open versus Closed Reduction of Unilateral Mandibular Condyle Fracture

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ABSTRACT

Purpose: To retrospectively analyse and compare the treatment outcomes achieved between open reduction and internal fixation (ORIF) and closed reduction with maxillomandibular fixation (CRMMF) for unilateral mandibular condylar fractures in adult patients. **Materials and methods:** 15 patients who met the inclusion criteria were reviewed at 1 month and 1 year after treatment to assess the outcomes like occlusion, mouth opening, deviation on mouth opening, ramus height reduction, facial symmetry and contour, bite force, scar perception, pain, motor and sensory nerve function. The patients were divided into ORIF group and CRMMF treatment group. The data obtained was statistically analysed using an unpaired t-test ($P < 0.05$). **Results:** No statistical significant differences were noted for occlusion, pain, motor and sensory nerve evaluation, bite force and symmetry and contour. However 63% in CRMMF group experienced chronic pain in contrast to 29% in ORIF group. Scar was perceivable in all patients in ORIF group, but none of the scars were detracting or deforming. One year post-operative ramus height examination revealed a height reduction of 1.4 mm in ORIF group and 3.5 mm in CRMMF and the difference was statistically significant ($P = 0.0085$). Deviation of the mandible was noted in 75% of patients in CRMMF group while only 14% in ORIF group had deviation on opening. The mean bite force of patients treated by ORIF group was 6.7 Kgs, and CRMMF group was 6.4 Kgs. No statistical difference was noted between both the groups ($P = 0.68$). **Conclusion:** Both ORIF and CRMMF methods for unilateral mandibular condyle fracture produced acceptable results. There were no significant long term major complications in both the groups. Our treatment protocol gives acceptable outcomes in both the groups.

KEYWORDS: Unilateral Condyle Fractures, Open Reduction And Internal Fixation, Closed Reduction And Maxilla Mandibular Fixation

INTRODUCTION

Fractures of the mandibular condyle varies from 19% to as high as 67% of all mandibular fractures.^{1,2,3} Unilateral condylar fractures are managed either by conservative observation, closed reduction with maxillomandibular fixation (CRMMF) or by an open reduction and internal fixation (ORIF). In young patients with minimal displacement and intracapsular condylar fractures, there is a good chance that CRMMF therapy will lead to remodelling of condyle with good functional results because growth centers in the bone are still active. If dislocated fractures in adults are not surgically restored, lasting impairment of the temporomandibular joint function may result, even if not noticed subjectively by the patient. In addition, the compensatory strain on the healthy opposite side can lead to secondary discopathy and chronic pain years later.

The introduction of plate osteosynthesis for the treatment of maxillofacial fractures has made the closed reduction with maxillomandibular fixation (CRMMF) largely redundant. The stress caused to the patient by maxillomandibular fixation, including associated hygiene problems, enormous difficulties in eating, fear of suffocating at night and slow rehabilitation, which can be

significantly reduced with the help of stable osteosynthesis. With the initial application of rigid internal fixation techniques to the craniomaxillofacial skeleton, new indications and contraindications have slowly evolved, based on perceived advantages or disadvantages of one technique over another (Richard Haug et al.).⁴

The objective of condylar fracture treatment is the restoration of anatomic form and function, with particular care to re-establish the occlusion. However with regards to the condylar segment, a series of controversies have been debated between the proponents and opponents of ORIF and CRMMF of condylar fractures. Newmann et al.⁵ had found that maxillomandibular fixation causes reduced mouth opening in CRMMF group while Marker et al.⁶ could not find any association between maximum mouth opening and maxillomandibular fixation in these groups. Luc Smets et al.⁷ reported more malocclusions in patients treated using the CRMMF whereas Richard Haug et al.⁴ found no differences in malocclusion. The aim and objective of the study is to assess the post-operative outcome of unilateral mandibular condyle fracture in CRMMF group and ORIF group in terms of

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functional and aesthetic result thereby facilitating the treatment decision which provides better quality of life and less morbidity to the patient.

MATERIALS AND METHODS

All the patients treated for the unilateral mandibular condylar fracture in the department of oral and maxillofacial surgery were retrospectively evaluated for the post treatment outcome. All the patients fulfilling inclusion criteria were recalled and reviewed at one month and one year post treatment to assess the treatment outcome. Ethical committee approval was obtained from institutional review board. The patients included in the study were adults above 16 years of age, unilateral condylar fractures with or without other associated mandibular fractures and non-infected fractures at the time of surgery. The exclusion criteria were pre-existing skeletal dysgnathia, pre-existing pathological conditions of the temporomandibular joints and completely edentulous patients. Patients with midface fracture, patients who were unable to follow the given instructions and patients with mentally challenged conditions were excluded from this study.

Any patients with deranged occlusion or subcondylar fracture were advised open reduction and internal fixation (ORIF). In the ORIF group, the standard surgical procedure were followed in all our cases with retromandibular- transparotid approach and fixation with two "4 holed" straight titanium miniplates and monocortical screws. Post-surgically, none of the patient, received maxillomandibular fixation (MMF). Those patients with normal occlusion, condylar head or neck fracture were treated by CRMMF for 2 - 3 weeks followed by soft diet and physiotherapy. The physiotherapy consisted of isometric exercises and mouth opening exercises for a period of 6 weeks. Other associated fractures of the mandible in both the groups were treated by ORIF.

Records of patients who met the inclusion criteria were reviewed, and demographic information was collected in all patients including age, sex, side of condylar process fracture, the level of the condylar process fracture (head, neck, and subcondylar) and other associated mandibular fracture. The surgical and immediate post surgical details were collected using standard proforma which included hemorrhage, the encounter with the facial nerve, and overt damage to branches of the facial nerve, wound infection, Frey's syndrome, salivary fistula or sialocele. The patients were recalled periodically for review.

At the one month and one year follow-up assessment, the clinical examination was primarily aimed at evaluating functional limitation and discomfort of temporomandibular joint. Both TMJs were assessed for protrusive and excursive movements, pain, clicking, locking or crepitus. Maximum mouth opening and deviations from the midline during mouth opening was recorded. Facial symmetry and dental midline deviation were documented. The anteroposterior position of the

mandible, sagittal and vertical open bite was recorded. An evaluation of occlusion and pain in the temporo mandibular joint was evaluated using 5 unit scale where 1 indicates a good outcome and 5 indicating worst outcome. Motor and sensory nerve evaluation and post-operative scar were also taken into consideration. Using a bite force measuring device maximum voluntary bite forces was recorded at both the fractured side and non-fractured side at one month and one year post treatment period. The values of both the sides were taken and were compared between both the groups.

Radiographic assessment: Condylar fractures were assessed based on Lindahl's classification⁸ as head, neck and subcondylar fracture. Pre-treatment and Post-treatment panoramic radiographs made after one month and one year were evaluated for all the patients for shortening of ramus as evaluated by Uwe Eckelt at al.⁹ Tracings were made of the condylar head, neck, ascending ramus and mandibular angle. Ramus height was calculated between the mandibular plane and a tangent drawn to the superior most point of the condyle and measured along the ramus line on both the fractured and non-fractured sides. Reduction of height was determined by the difference in length between both the sides in millimeters. The differences in mean values between ORIF and CRMMF groups were statistically analyzed using unpaired t tests in SPSS software for windows. Differences were considered statistically significant when $p < 0.05$.

RESULTS

A total of 15 patients who fulfilled the inclusion criteria were included in the study of which 13 were males, and 2 were female patient. The mean age of the patient was 29 years. The etiological factor for the fracture was road traffic accidents and

assaults in 80% cases. Out of 15 patients, five patients had isolated unilateral condyle fracture, and ten patients had synchronous parasymphysis, body or angle fracture.

In this study 3 patients had the condylar head fracture, 2 patients had condylar neck fracture, and the remaining 10 patients had the subcondylar fracture. In which, 8 patients underwent CRMMF and 7 patients underwent ORIF. In the CRMMF group, 3 patients had the condylar head, 2 patients had condylar neck, and the other 3 patients had subcondylar fracture whereas in the ORIF group all were subcondylar fracture patients.

At 1 month review, the Pre traumatic occlusion was achieved in all the patients except in one patient in the CRMMF group. At one year review, one patient in each group had a slight difference in occlusion ($P = 0.93$). Eight patients had no pain and seven patients complained of the variable amount of occasional pain in the joint region at one year follow up, in which five patients belong to CRMMF group, and two patients belong to ORIF group. At 1 month post-operative examination average ramus height reduction of 1.1 mm in the ORIF

group and 2.1 mm in CRMMF group were noticed. One year post-operative examination revealed a height reduction of 1.4 mm in ORIF group and 3.5 mm in CRMMF, which was statistical significant (P = 0.01).

75% of the patients in the CRMMF group had the deviation of the mandible during opening and closing movement in contrast to 14% of patients in ORIF group. At 1 month post treatment 57% in ORIF group and 25% in CRMMF group had restricted mouth opening of less than 30mm. At 1 year follow up the mean post treatment maximum mouth opening in ORIF was 42.6 mm (range, 39 to 48 mm; SD, 3.26) and in the CRMMF group was 50.5 mm (range, 41 to 67 mm; SD, 10.0). The mean bite force of patients treated by ORIF group was 6.7 Kgs, and CRMMF group was 6.4 Kgs. No statistical difference was noted between both the groups (P = 0.68).

None of the patients treated in our study had any facial nerve weakness, wound infection, sialocele, Frey's syndrome, paresthesia, plate fracture, screw loosening or any other kind of complications. Though the scar was perceivable, none of the patients complained it as detracting or deforming. A summary of values obtained and the statistical values and its corresponding significances have been listed in Table 1 and 2.

Parameters	ORIF group (1 month) (Total: 7 patients)	ORIF group (1 year) (Total: 7 patients)	CRMMF group (1 month) (Total: 8 patients)	CRMMF group (1 year) (Total: 8 patients)
Occlusion				
1. Identical to pretraumatic occlusion	7	6	7	7
2. Slight difference		1	1	1
3. There was a malocclusion during function				
4. Needed an orthodontic or occlusal correction				
5. Gross malocclusion				
TMJ pain index				
1. None	2	5	7	3
2. Occasional pain	5	2	1	4
3. Tolerable pain				1
4. Pain occasionally limitis their daily activity				
5. Pain limits their daily functions				
Mouth opening				
20mm – 30mm	4		2	
31mm – 40mm	3	3	2	
41mm – 50mm		4	4	5
51mm – 60 mm				1
>60mm				2
Ramus height reduction				
0-3 mm	7	7	7	4
4-6 mm			1	3
7-9mm				1
Deviation on mouth opening	1	1	6	7

Table 1. individual data of Post operative evaluation summary

Parameters	ORIF group	CRMMF group	P value
Mouth opening	42.6 ± 3.3	50.5 ± 10.0	0.068
Occlusion	1.1 ± 0.4	1.1 ± 0.4	0.93
Pain	1.3 ± 0.5	1.8 ± 0.8	0.17
Bite force	6.7 ± 1.5	6.4 ± 1.0	0.68
Ramus height shortening	1.4 ± 0.5	3.5 ± 1.7	0.008

Table 2. Statistical analysis of post operative outcome between the two groups at one year follow up

DISCUSSION

Complications of trauma to the temporomandibular joint (TMJ) are far-reaching in their effects and not always immediately apparent. The common post treatment complications of condylar fracture includes occlusal disturbance, pain in TMJ region, deviation during opening or closing of the mandible and ankylosis of the TMJ in some cases. Previously CRMMF of condylar fractures was favoured. The introduction of miniplates, compression plates, locking plates, lag screws and anchor screws¹⁰ along with development of the newer surgical approaches¹¹ have made the ORIF safer and have the functional advantage of earlier mobilization of the traumatized tissues. However when reduction of the condylar fragment is unsatisfactory, and the condyle is more rigidly fixed in a non-physiologic position, the risk of postoperative remodelling and degenerative change is too high because of the increased functional loading. The risk of facial nerve injury, salivary fistulae, hypertrophic scar formation and wound infection are other possible complications associated with ORIF of the condylar fracture. Edward Ellis et al.¹² reports that at 6 weeks 17.2% had facial nerve weakness, (2.3%) had developed salivary fistulae, in 50% a visible scar was seen. 2% of the surgical scar were hypertrophied.

With CRMMF, adaptations occur in the neuromuscular, skeletal and dental structure which helps in a functional and esthetically acceptable outcome. With displacement, dislocation or even condylectomy, a complex series of changes occur within the TMJ which has the potential of producing a new mandibular condyle. Lindahl and Hollender¹³ called this process condylar "restitution", and it has been demonstrated by dozens of investigators in both animals and humans. The main objective of the treatment is to achieve good occlusion, normal TMJ movements, prevention of temporomandibular joint derangement and joint pain and prevention of growth disorders in patients with mandibular fracture by selecting an appropriate treatment method between closed reductions (CRMMF) and open reductions (ORIF).

Zide and Kent,¹⁴ Klotch, Lundy and Choi et al.¹⁵ and various other authors have all suggested various indication for ORIF in mandibular condyle fracture which includes condyle displacement into middle crania fossa or lateral extracapsular displacement, edentulous patients with bilateral condylar fracture, condyle fracture with

comminuted midface fracture, gap between fracture segment more than 5mm without any contact between the segment, angulation more than 30 degrees between fracture segment. Considering newer fixation techniques American Association of Oral and Maxillofacial Surgery¹⁶ in 2003 suggested an international guideline on the treatment of mandibular condyle fracture. In our study, we had the following protocol for the unilateral condyle fracture management, patients with deranged occlusion or subcondylar fracture were offered ORIF, and those patients with normal occlusion or condylar head or neck fracture were treated by CRMMF.

In this study, condylar fractures treated by closed reduction had a significantly shorter vertical height as compared to patients treated by ORIF of the fracture. It is comparable to Edward Ellis III and Gaylord Throckmorton's¹⁷ studies which have reported significant differences in ramus height between both the groups at 6 weeks and 6 month interval, however, no differences were noted thereafter. Giacomo De Riu et al.¹⁸ noticed a ramus height reduction of greater than 3mm in 9% of the closed group patients while no reduction was seen in the surgically treated group. The mean vertical heights were similar in both groups as reported by Suzana Carneiro et al.¹⁹ Between 1 month to 1 year we found CRMMF group had the significant reduction in ramus height than in the ORIF group.

Still there is controversy regarding the stability of the miniplates in fixation of the condylar fracture and whether to use single miniplate or double miniplate. However, it is considered that double miniplate fixation is the stable fixation technique.²⁰ In our study, we used two numbers of 2.0mm titanium mini plates for the stable fixation of condyle fractures.

Approach for mandibular condyle fracture depends on fracture site and degree of bone fragment displacement. In general, they include pre-auricular approach, post-auricular approach, submandibular approach, Risdon approach, combined approach, and retromandibular-transparotid approach. Among the various surgical approaches reported in the literature, the retromandibular-transparotid and submandibular approaches emerge as the most commonly used procedures to expose the condylar fracture¹¹, and the intraoral approach has been suggested only for low condylar fractures. In our study, we used retromandibular transparotid approach for all our cases.

In our study, there was no statistically significant difference between both the groups on mouth opening. In both the groups the patients had more than 40mm of mouth opening. Landes and Lipphardt²¹ found a mean mouth opening of 38mm in CRMMF group and 55mm in the ORIF group. Pedro M. Villarreal et al.²² and Yasuharu Takenoshita et al.²³ found that the patients treated under ORIF group had less mouth opening (mean 39mm) than CRMMF group (mean 50mm). However Gert Santler et al.²⁴ found both the treatment groups having equally distributed and satisfactory results. In our study for deviation, 75% of patients in the CRMMF

group had the deviation of the mandible during jaw movement in contrast to 14% in the ORIF group. Hyde. N et al²⁵ reports that of the 33 patients treated with ORIF, none had developed postoperative malocclusion showing a 100% result. Edward Ellis III and Gaylord Throckmorton¹⁷ noticed no significant differences in both the treatment groups and also no differences between the fractured and normal side was noted. Studies by Luc M. H. Smets et al⁷ found 92% of patients treated with ORIF with acceptable occlusion and 2% of the patients treated under CRMMF had malocclusion. In our study, there was no statistically significant difference between the groups on post treatment occlusion.

Edward Ellis III and Gaylord Throckmorton²⁶ found that there were no appreciable differences between both the treatment groups and no significant differences were noticed on bite force examination between the fractured and the non-fractured side. They also stated that the bite forces increased with increase in duration but after 6 months no increase in bite forces were seen. Reena M. Talwar et al,²⁷ however, found lower biting forces at the fractures side than the control group. In our study, there was no statistically significant difference between the groups on bite force measurement at one year post treatment.

In our study 2 (29%) patients in the ORIF group and 5 (63%) patients in the CRMMF group had the variable amount of pain on one year post-operative review. Hyde. N et al²⁵ reported 6% of patients treated with the closed reduction (CRMMF) were left with chronic pain. Gert Santler et al²⁴ had however stated that sensitivity due to weather and pain perception during the maximal opening of mouth were significantly higher in the ORIF group. Studies by Giacomo De Riu et al²⁸ found the absence of pain in both the groups. Matthias Schneider et al²⁹ states that in their closed reduction group the level of pain had decreased with increase in the level of the fracture. Yasuharu Takenoshita et al²³ states that both groups had no complaints of pain. In our study 1(13%) out of the 8 treated under CRMMF had a tolerable pain. 71% of the patients in ORIF group had no pain while 38% in CRMMF group had no pain. Although statistically it was insignificant, the pain was thought to be more pronounced in CRMMF group when individually examined.

CONCLUSION

We conclude that at the end of one year post-treatment, there was no difference in the post-treatment outcome in between the groups in terms of mouth opening, bite force, facial symmetry and contour at rest. However the patients treated by CRMMF had the high incidence of chronic pain (63%) and significant ramus height reduction at fractured site and deviation of mouth during the opening. There were no significant post treatment complications following ORIF through retromandibular-transparotid approach.

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