ORIGINAL RESEARCH

Functional Results after Conservative Treatment of Fractures of The Mandibular Condyle

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ABSTRACT

Introduction: Fractures of the mandibular condylar process are common injuries of fractures of the facial bones and represent 20% to 62% of mandibular fractures. Management of fractures is a debatable issue especially regarding surgical and non-surgical treatment. The decision about the choice of the type of treatment must always take into consideration some of the factors, such as the patient's general health status, type of fracture, diagnostic precision, and mainly the capability, experience and skill of the surgeons in treating mandibular condyle fractures.

Materials & Methods: This study included 18 patients, with condylar fracture including head, neck or sub condylar fractures with or without associated injuries, treated with intermaxillary fixation. In a follow up period of 3 months, pain in the TMJ, lateral and protrusive movements and pain in muscle of mastication were evaluated.

Results: A very highly significant improvement ($p<.001$) in all the parameters selected, were observed with marked improvement in the occlusion.

Conclusion: The conservative treatment of mandibular condyle fractures is an effective treatment modality in terms of functional outcome. However assessment of factors pertaining to individual cases must be made to determine the mode of therapy, most likely to produce a favorable outcome.

Keywords: Condyle fracture, mandible, intermaxillary fixation, mandibular fracture, surgical and non-surgical treatment.

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INTRODUCTION

On the abundance of nonscientific literature available on the TMJ, Melvin Moss has rightly said, "I know of no other single anatomical subject concerning which so much misinformation has been printed and then believed[1]" is really appropriate to the debate about treatment of condylar fractures, Management of fractures of the mandibular condyle is a debatable issue amongst oral and maxillofacial surgeons that has sparked considerable controversy, especially regarding surgical and non-surgical treatment.[1,2] This controversy is reflected in the wide variety of options and proposed treatment modalities offered in the literature. In selecting the treatment modality it is important to analyze variables such as maximum mouth opening, left and right lateral movements, protrusion, fracture localization and tendency for hypertrophic scars and the impact of the chosen treatment on daily performance. It is also important that the patient be informed of all these variables and participates in the choice of treatment. The commonly accepted agreed goal of treatment is the reestablishment of the preoperative function of the masticatory system. This restoration typically involves reestablishment of the preoperative relationship of the fracture segments, the occlusion and the maxillofacial symmetry. Unlike fracture of other bones, however the exact re approximation of the fracture condylar segment may not be absolutely essential.[3] Fractures of the mandibular condylar process are common injuries that account for 29% to 40% of fractures of the facial bones and represent 20% to 62% of mandibular fractures. Direct blow to the chin or to the lateral side of the jaw caused by traffic collisions, violence, accidental falls, and sports injuries were found to be the common causes for mandibular condyle fracture. The complications of condylar fracture include pain, restricted mandibular movement, muscle spasm and deviation of the mandible, malocclusion, and pathological changes in the TMJ, osteonecrosis, facial asymmetry, and ankylosis, irrespective of whether treatment was performed or not.[4] They also include fracture of the tympanic plate, mandibular fossa of temporal bone fracture, with or without displacement of the condylar segment into the middle cranial fossa, damage to cranial nerves, vascular injury,

bleeding, growth disturbance, arteriovenous fistula, and alter the balance in the masticatory muscles.[4,5]

Closed/Non-surgical treatment of mandibular fractures with maxilla mandibular fixation (MMF) has a long and successful history, but it is not without significant morbidity. The best results have been achieved in skeletally immature children, where condylar remodeling often can restore condylar anatomy to near normal, even in the face of little or no fracture reduction. Despite almost miraculous condylar remodeling in children, the outcomes in adults have not been uniform, and a significant percentage suffers long-term aesthetic and functional problems.[6] In recent years, open treatment of condylar fractures has gained popularity, probably because of the introduction of plate and screw fixation devices that allow stable fixation of these fractures. Many surgical treatment modalities have been advocated for the treatment of mandibular condyle fractures which includes intraosseous or transosseous wire fixation, intramedullary pins, long screw placement, miniaturized dynamic compression plates designed for zygoma fractures, free graft with wire fixation after extracorporeal avulsion, disk repair with silicone rubber implantation, axial anchor screws, rigid plates and screws, bioresorbable plates, screws and condylectomy etc.[7]

The future trend is towards the use of the endoscope to treat condylar injuries which is a natural extension of minimally invasive techniques for managing craniomaxillofacial trauma. Most surgeons accept, on an intellectual level, that fracture reduction and rigid fixation with restoration of anatomy are laudable goals if it can be achieved without undue morbidity. Endoscopic assistance allows the surgeon to produce anatomic fracture alignment, and to avoid the negative sequelae of condylar malunion. The endoscopic approach has the potential to reduce morbidity by limiting scars, reducing the risk to the facial nerve, and eliminating the need for MMF, and yet having the advantages of anatomic reduction and rigid fixation. The decrease in morbidity associated with the endoscopic approach may expand the indications for reduction and rigid fixation in the future.[6]

As a general rule any treatment should aim to reconstruct traumatized structures to provide the optimal basis for function. The restoration of the physiological function of the temporomandibular system is of primary importance in the treatment of the condylar fracture.

The decision about the choice of the type of treatment must always take into consideration some of the factors, such as the patient's general health status, type of fracture, diagnostic precision, and mainly the capability, experience and skill of the surgeons in treating mandibular condyle fractures.

MATERIALS & METHODS

This study consisted of cases of condylar fractures with or without associated fractures elsewhere in the maxillofacial region that reported to the Department of Oral And Maxillofacial Surgery. A total of 18 cases were included in this study.

Criteria for case selection:

- Unilateral or Bilateral fracture of mandibular condyle with or without associated fractures.
- Age 12 years and above
- Sufficient dentition to allow Maxillomandibular fixation and assessment of occlusal relationship.

Fifteen males and three females within the age range of 12 – 75 years with a mean of 30.88 years formed the study group. Ten patients had isolated condylar fractures, while eight had associated injuries in the maxillofacial structure. Most of the patients reported after several days following injury, seeking treatment mainly due to pain and functional deficits. For all patients a detailed case history was taken to rule out significant systemic conditions that could have a bearing on patient's treatment protocol.

Detailed clinical examination was carried out as per the protocol. The face and mandible was examined for any abnormal contours. Mandibular movements were checked for any abnormalities along with recording of maximum interincisial opening. The occlusion was checked for any discrepancies. Any Intraoral or Extraoral lacerations were thoroughly examined and debrided prior to treatment. Any evidence of buccal or sublingual ecchymosis was noted.

Radiographic examination included the ortho-pantomogram. Additional radiographic projections were obtained when needed. The radiographs were assessed for the degree of displacement of the fractured fragments.

Non-surgical or conservative therapy included elastic traction followed by maxillomandibular fixation for a variable period of 3-6 weeks. The surgical reduction and fixation of fractures elsewhere on the mandible reduced the time period of maxillomandibular fixation.

The fractures were stabilized by intermaxillary fixation, which was established using Erich's arch bar and 24 or 26 gauze smooth, stainless steel wires. The arch bars were shaped and fixed to the teeth using 0.4 mm soft stainless steel wire, placed gingivally at the prominent line of the teeth. Upper and lower arches were connected by 0.4 mm wire. The patients rinsed their mouths with 0.1% chlorhexidine twice daily throughout the whole period of immobilization. They were seen once a week for possible adjustment of the apparatus. The intermaxillary fixation was maintained for about three to six weeks depending upon the individual cases and also fractures.

Normal occlusion was the term used for occlusion corresponding to that before the accident. In older patients we were guided by abrasion facets. A soft semisolid and liquid diet was advocated during this period. Post treatment the patients were followed up at a regular interval of 1, 2 and 3 months for checking mouth opening (inter incisal distance), occlusion, condylar movements, pain in the TMJ and masticatory muscles.

Patients were only considered to have complications when the symptoms were related to the fracture or its treatment and were recognized as a problem for patient, and when

complication could be verified objectively. Malocclusion consisted of hyper occlusion posteriorly on the fractured side, contralateral open bite or cross bite. Pain located in the joints or to the masticatory muscles was verified by reaction on palpation of these structures.

STATISTICAL ANALYSIS

The statistical analysis was done using SPSS (Statistical Package for Social Sciences) Version 15.0 statistical Analysis Software. The values were represented in Number (%) and Mean±SD.

RESULT

A total of 18 cases of mandibular condylar fractures were enrolled in the study. Details related to age, gender, cause of fracture, type of fracture, treatment used, mouth opening, any associated injury, pain score in TMJ and masticatory muscle, lateral and protrusive movements were recorded.

The subjects were followed up for 3 months at monthly time intervals to assess the change in mouth opening, TMJ pain scores, Masticatory muscle pain score, lateral movement and protrusive movement. At the end of 3 months follow up change in occlusion was noted.

The results obtained have been shown as under:

Table 1 shows the mean pain score at fractured side was 3.89±1.20 while the same was recorded as 0.53±1.26 at non fractured side, thereby showing a statistically significant difference ($p<0.001$). At one month the mean pain score at fractured side was 1.74±0.73 while at non fractured side it was 0.32±0.75, once again showing a statistically significant difference ($p<0.001$). At 2 month, the mean pain score at fractured side was 1.00±0.47 while that at non fractured side was 0.21±0.54, thus once again showing a statistically significant difference ($p<0.001$). However, at 3 month interval the mean pain score at both the sides was 0.16±0.38 thus showing full recuperation at the fractured side.

Contrary to pain scores for TMJ, table 2 for masticatory muscle no significant difference in mean pain scores of fractured and non-fractured sides were seen. The trends showed a continuous decrease in pain score from baseline to 3 months for both the sides.

In post-operative assessment the mean mouth opening was 21.72±2.97 mm which increased to 24.06±6.31 mm at 1 month, 30.28±4.80 mm at 2 months and 37.11±2.11 mm at 3 months. As compared to baseline, mean mouth opening at 2 months and 3 months was found to be significantly higher ($p<0.001$).(Table 3)

Table 4 and shows a significant reduction in pain score as seen in both sides starting from 1 month post-operatively. The reduction was found to be maximum at 3 months in both the sides.

Fractures at condylar region occur when the concentration of tensile strain exceeds the limit of tolerance of the bone. The precise location of tensile strain depends on site, direction and magnitude of impact and anatomical considerations related to the architectural configuration of the mandible. The condylar neck is inherently a weak region so it fractures easily. Moreover there is a change of axis from condylar neck to head. This twisting of neck at a different axis makes it more vulnerable to fracture

Many articles pertaining to the incidence and causes of maxillofacial injuries have been published. The causes of maxillofacial fractures have changed over the past 3 decades, and they continue to do so. The main causes worldwide are traffic accidents, assaults, falls, sports-related injuries, and civilian warfare. Because of social, cultural, and environmental factors, both the incidence and etiology of maxillofacial fractures vary from one country to another.

In our study the condylar fractures were more common among men (83.3%) over half of whom were in the 20 – 40 age groups (66.6%), this finding is comparable to finding of D. A. Mitchell[8] who showed that over half of the fractures were in the 20 – 40 yrs group and 82% patients were male. The major etiological factors in our study was RTA (61%) followed by fall (22.2) which is supported by the study of Telfer MR[9] et al where the main cause was traffic accidents, and assaults followed by falls, sports-related injuries, and civilian warfare. Also in the study of P. U. Dijkstra[10], et al. the

SN	Time interval	Fractured site		Non-fractured site		Significance of difference	
		Mean	SD	Mean	SD	"t"	"p"
1.	Baseline	3.89	1.20	0.53	1.26	6.344	<0.001
2.	1 month	1.74	0.73	0.32	0.75	5.295	<0.001
3.	2 month	1.00	0.47	0.21	0.54	4.825	<0.001
4.	3 month	0.16	0.38	0.16	0.38	0	1

Table-1: Comparison of Pain in TMJ at fractured and non-fractured site at different time intervals (n=18)

SN	Time interval	Fractured site		Non-fractured site		Significance of difference	
		Mean	SD	Mean	SD	"t"	"p"
1.	Baseline	2.89	0.46	2.11	2.21	1.529	0.144
2.	1 month	1.11	0.57	1.00	1.05	0.383	0.706
3.	2 month	0.58	0.61	0.47	0.77	0.490	0.630
4.	3 month	0	0	0.16	0.38	1.837	0.083

Table-2: Comparison of Masticatory Muscle Pain at fractured and non-fractured site at different time intervals (n=18)

	Mean	SD	Change from baseline	Significance	
				"t"	"p"
Baseline	21.72	2.97	–	–	–
1 month	24.06	6.31	2.33±4.79	2.067	0.054
2 months	30.28	4.80	8.56±4.51	8.041	<0.001
3 months	37.11	2.11	15.39±3.57	18.305	<0.001

Table-3: Change in Mouth Opening at different time intervals

	Mean	SD	Change from baseline	Significance	
				"t"	"p"
Right side					
Baseline	2.22	2.13	–	–	–
1 month	0.94	1.00	-1.28±1.32	4.108	0.001
2 months	0.50	0.51	-1.72±1.74	4.194	0.001
3 months	0.06	0.24	-2.16±2.09	4.391	<0.001
Left side					
Baseline	2.11	2.22	–	–	–
1 month	1.00	1.09	-1.11±1.23	3.828	0.001
2 months	0.61	0.70	-1.50±1.65	3.848	0.001
3 months	0.17	0.38	-1.94±2.10	3.929	0.001

Table-4: Change in TMJ Pain Scores at different time intervals

most common cause of fractures was road traffic accident.

Functional therapy is adopted most frequently, since it permits early mobilization and adequate functional stimulation of condylar growth (in growing subjects) and bone remodeling (in all subjects). It is indicated in almost all condylar fractures that occur in childhood, and in intracapsular and extracapsular fractures that do not include serious condylar dislocation in adults.

The majority of surgeons seem to favor nonsurgical treatment of condylar fractures. This preference is largely the result of 3 main factors. First, nonsurgical treatment gives "satisfactory" results in the majority of cases. Second, there are no large series of patients reported in the literature who have been followed after surgical treatment because management of condylar fractures has historically been with nonsurgical means. Third, surgery of condylar fractures is difficult because of the inherent anatomical hazards (i.e., VII nerve).

In a study by Santler[11] et al. two hundred thirty-four patients with fractures of the mandibular condylar process treated by open and closed methods, 150 patients with a mean follow-up time of 2.5 years were analyzed using radiologic, objective and subjective clinical examinations. No significant difference in mobility, joint problems, occlusion, muscle pain, or nerve disorders were observed when the surgically and nonsurgically treated patients were compared. The only significant difference was in subjective discomfort. Surgically treated patients showed significantly more whether sensitivity and pain on maximum mouth opening. Because of these disadvantages, open surgery is only indicated in patients with severely dislocated condylar process fractures.

Marker[12] et al. designed a study to record the results of closed treatment of condylar fractures and to find out whether there was any variable that was predictive of complications. The ability to open the mouth, deviation and occlusion were recorded. After one year 45 of the 348 patients (13%) had minor physical complaints such as reduced ability to open the mouth, deviation, or dysfunction. Ten of them (3%) had pain in the joint or muscles or both. Eight patients (2%) had malocclusion, out of which seven could be related to dislocation of the condylar head out of the fossa. Five of the eight patients had bilateral fractures. They concluded that closed treatment of condylar fractures is non-traumatic, safe, and reliable and in only few cases may cause disturbances of function and malocclusion.

In the present study, after three months of follow up seven patients (38.8%) had minor complaints such as pain or reduced ability to open the mouth. Six (33.3%) of them had pain in the temporomandibular joint or muscles of mastication or both whereas only one patient (5.5%) had reduced ability to open the mouth. In a study by Zide[13] M F et al. at 3months follow up, both groups (surgical and non surgical) maintained a 35-mm opening, but the maximal mouth opening of surgical group was less than that of the conservative group. The patients were able to open about 40 mm 6 months postoperatively. In a follow-up study of 1 to 2 years, the maximal mouth opening movement in the conservative group was regarded as normal as the mean measurement was 41.5 mm. In our study we achieved the mean mouth opening at 3 months follow up to be 37.11mm which is quite similar to the above study.

Yasuharu Takenoshita[14] et al in his study "Comparison of Functional Recovery After Nonsurgical and Surgical Treatment of Condylar Fractures" evaluated 16 cases of condylar fracture treated surgically, comparing them with the 20 cases treated nonsurgically, with a 2-year follow up.

The patients with conservative treatment were able to open an average of 28 mm (range, 13.5 to 42.9 mm), and those with open reduction, an average of 27 mm (range, 19.9 to 33.5 mm) 1 month after release of MMF at 3 weeks After controlled exercises involving mandibular opening, the conservatively treated patients acquired wide mouth opening much earlier than the patients who had undergone open reduction, whereas in our study the mean mouth opening at one month interval was 24.06mm which progressively improved following exercises.

Palmieri et al.[15] described mandibular movement in patients with unilateral condylar fractures after open and closed reduction. Mean mouth opening at 3 years follow-up was 46.2mm in the closed group and 49.3mm in the open group. In our patient groups mean mouth opening was 37.11 mm at 3 months follow up, which can be attributed to a lesser follow up period as well as the smaller jaw size in Indian subcontinent. Similarly Yasuharu Takenoshita[14] et al. in their study on "Comparison of Functional Recovery After Nonsurgical and Surgical Treatment of Condylar Fractures" treated 16 patients surgically and compared them to the 20 patients treated non surgically and concluded that acceptable

function of the joint was acquired in all cases. No patients complained of severe pain in the affected joints in either group during the last follow-up period.

A significant improvement was seen in the pain score in TMJ region as well as muscles of mastication, which was also observed in the study of J.P.H.J. Rutges[16] who analyzed sixty patients and reexamined 28 patients. The clinical dysfunction index showed: severe symptoms in 11%, moderate symptoms in 39%, mild symptoms in 39% and 11% had no symptoms.

In a study on changes in mandibular movement and occlusal condition after conservative treatment for condylar fractures for 18 patients, Kazuhiro et al[17] reported lateral excursion towards the non-fractured side to be 6.4 mm whereas towards the fractured side it was 9.2mm at 3 months post operatively where as in our study the average movement towards the fractured side was 4.47 mm and to the non-fractured side, it was 4.16mm for the same time interval. The same study reported mandibular protrusion to be 5.2mm 3 months post operatively where as in our patients the mean protrusive movement at 3 months postoperatively was 4.72mm

There was a considerable reduction in the pain score (VAS Scale 5). The mean pain at 3 months interval in our study was .11 in the TMJ region where as in muscles of mastication it was .085, whereas the in study of P. U. Dijkstra[10] to determine functional impairment and pain after closed treatment of fractures of the mandibular condyle, the mean score was 2.3(VAS scale 100).

CONCLUSION

The conservative treatment of mandibular condyle fractures is an effective treatment now a days of functional outcome. However determining the factors of pertaining to individual cases must be made for the mode of therapy, which mostly produces a favorable outcome.

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