Retrospective analysis on the outcome of open and closed reduction of mandibular condylar fractures at tertiary centre of Gujarat

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ABSTRACT

Aim: Aim of this study is to analyse the epidemiology, treatment modalities and complications faced in management of mandibular condylar fractures by surgical and conservative treatment, over period of five years at our centre.

Material and method: Data of patients who were diagnosed with condylar fractures of mandible from 2013 to 2018 was collected, and were evaluated on the basis of Etiology, fracture pattern, age, sex, associated injuries, treatment modalities and complications.

Results: The sample size of 82 patients (total 204), 67 male (81.71%) and 15 female (18.29%) (Male: female = 4.5:1), commonly affected 21–40 years age group. RTA is the most common cause (67.07). Subcondylar fractures were significantly related to RTA under influence of alcohol (48.5%). Total 55 (67%) were treated conservatively and (30.59%) of this belonged to MacLennan I. MacLennan II and III were mostly treated surgically with retromandibular approach being the most common.

Conclusion: The principal factors which determine the treatment plan are the level of the fracture and the degree of displacement. Most of undisplaced fractures can be managed by closed non surgical treatment. Open reduction is justified mostly in adults with undisplaced or displaced fractures associated with Malocclusion and patients requiring immediate function. Even after these guidelines many other factors like Medical condition, Patient acceptance & Cost can be a deciding factor.

1. Introduction

Injuries of the maxillofacial region are in increasing frequency and severity due to heavy reliance and carelessness during road transportation and the increasing socioeconomic activities of the population^{1,2}

The Condyle can be fractured by direct or indirect trauma, and the displacement of the fracture is determined by the direction, degree, magnitude, impact of force, state of dentition and the occlusion. When adequate molar support and the teeth are in occlusion, little or no displacement is likely to happen, and when the mouth is wide open the full force will be transmitted to the condyles (Rowe and Killey, 1968).³

The treatment of condylar fractures remains controversial despite many studies published in the scientific literature.^{5–7,12–14} Many studies favor conservative management due to its safety, while some favor surgical management in order to achieve a better and faster functional restoration.^{6,7,12,13} Analytical study of the epidemiology and treatment of mandibular condylar fractures reveals the incidence, etiology,

gender, types and sites of condyle fractures, patterns of treatment and associated complications. Comparative analysis of data of different studies can enhance the understanding of the facial trauma in different regions, allowing the optimization of treatment and improvement of the patient's quality of life.

The purpose of this retrospective study was to evaluate the epidemiology, treatment modalities and complications of mandibular condyle fractures at our centre.

2. Materials and method

The approval of study was given by the Institutional Ethical Board. The patients registered with the Department of Oral and Maxillofacial Surgery between January 2013 to December 2018 who got treated for their Maxillofacial Injuries were considered for this study and patients having condylar fractures were then segregated. Investigator standardized the collected data from patient's records. Patient's data had to

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Table 1
Gender distribution.

Gender	N	%	Ratio
F	15	18.29%	M:F = 4.5:1
M	67	81.71%	
Total	82	100.00%	

M = Male; F = Female.

Table 2
Age distribution.

	N	%
< 20 Years	9	10.98%
21–30 Years	32	39.02%
31–40 Years	19	23.17%
41–50 Years	16	19.51%
51–60 Years	6	7.32%
Total	82	100.00%

be complete on all parameters to be included in the study. Cases with missing and inadequate data were excluded.

The parameters studied were etiology, the associated injuries, type of fracture and associated complications. They were classified according to Lindahl classification, according to the anatomic position of condyle into condylar head, condylar neck, and subcondylar fractures.⁸ Unilateral or bilateral condylar fractures were diagnosed and then classified depending on their severity. Fractures were further categorized based on MacLennan classification.⁴

Depending on the pattern of injury different treatment modalities were applied. Nonsurgical treatment included no treatment, closed treatment with maxillo-mandibular fixation and surgical treatment with or, without maxillo-mandibular fixation. Parameters evaluated in the study were facial nerve damage, malocclusion, maximum mouth opening (MMO) and Others Complications (salivary fistula, infection, ankylosis) in surgical and conservatively managed condyle fracture.

3. Results

Out of the total sample of 82 patients, 67 (81.71%) were males and 15 (18.29%) were females pointing out to a male preponderance (4.5:1). Majority (39.02%) were in the age group of 21–30 years followed by 31–40 years (23.17%). This shows that the young adults are mostly affected (Tables 1 and 2). Table 3 shows frequency of gender distribution in different age groups. Male preponderance was observed in all age groups. In 21–30 years of age group men were mainly affected (84.38%). Table 4 shows gender, age group and type of fractures according to different etiologies. Fractures observed in age group of 21–30 were mainly due to RTA under alcohol influence (about 40%). The distribution of age according to different etiologies observed that males were highly affected by RTA under influence of alcohol. Fractures were classified according to different etiologies, subcondyle fractures were (48.48%) mostly due to RTA under influence of alcohol. Table 5 shows the distribution of the location of condylar fractures according to different age groups. Etiology and fracture severity are the association that were shown in Table 6. More Displaced condylar fractures were noted due to RTA under influence of alcohol. Table 7 shows associated

Table 3
Frequency of gender distribution in different age group.

GENDER	10-20 y	%	21-30 y	%	31-40 y	%	41-50 y	%	51-60 y	%
M	9	100.00%	27	84.38%	14	73.68%	13	81.25%	4	66.67%
F	0	0.00%	5	15.63%	5	26.32%	3	18.75%	2	33.33%

M = Male; F = Female.

fractures with condylar fracture, Parasymphysis fractures (46.34%) were most commonly associated with condylar fractures. Table 8 shows undisplaced fractures managed by closed reduction and displaced fracture managed by open reduction. Table 9 shows different approaches for condylar exposure; majority of subcondyle fractures were managed by retromandibular approach. Table 10 shows complications occurring due to different treatment approaches. Salivary fistula (7.32%) and facial nerve injury (2.44%) noted during retromandibular and preauricular approach respectively. Table 11 shows mouth opening comparison in pre-operative and post-operative in open and closed reduction management.

4. Discussion

The retrospective study was conducted at our centre in which total 204 cases of maxilla mandibular fractures were noted between January 2013 to December 2018. 82 cases of condylar fractures were identified and reviewed. Closed reduction was the treatment of choice in undisplaced fractures and was used in 55 cases. Displaced fractures were managed with Open reduction.

In our study, male predominance was noted; percentage of male with mandibular condylar fractures were 81.71% (67 out of 82 patient) and women were 18.29% (15 out of 82 patient). Male/female ratio was 4.5:1, which was in agreement with study conducted by; Monazzi et al., 2017.⁹ In 11–20 year age group only 9 men reported with condylar fractures (100%). This can be explained on the basis that in this age group females are less active and are in more protected environment. However in 21–30 age group total 32 sample (39.02%) noted among them 5 female (15.63%) and 27 men (84.38%) noted, which was in agreement with study conducted by Monazzi et al., 2017.⁹ This value also shows that females have still not played a functioning job in the public arena and endured wounds simply like the guys at the accomplishment or beginning of puberty in India. Therefore, men invest more energy in move utilizing different transportation means and in this manner endure a greater number of wounds than women.

There is a change in trend of etiology of maxillofacial trauma because of changes in ways of life, industrialization, transportation means. In our study the most frequent causes of mandibular condyle fractures were RTA; mostly under influence of alcohol 34 (41.46%) then RTA without alcohol was 21 (25.60%), then fall down from height was 17 (20.73%) and fall down on ground after slipping 9 (10.97%) followed by assault 1 (1.24%) cases. There are notable differences among different countries as to the order of the most frequent causes of mandibular condyle fracture.^{9–12}

A few significant systems credited to the characterization of condylar fractures have been utilized in the publications. The level of fracture (Head, neck, subcondyle), dislocation of fracture, and the relationship of the condylar head to the articular fossa was defined by Lindahl in his classification system (Lindahl, 1977).⁸ MacLennan classification (MacLennan, 1952)⁴ recognized condylar fractures with deviation and displacement, dislocation, no displacement, which provided a guideline for surgical therapy (Haug and Brandt, 2007).¹⁵ The present study used the classification proposed by Lindahl & MacLennan et al. (MacLennan, 1952)⁴ because these are the standard classification systems followed at our centre.

In our study, the most common fracture reported was subcondylar

Table 4
The distribution of sex, age, and type of fracture according to different etiologies.

	total	gender		age group						Type of condyle fracture													
				M		F		10-20 y		21-30 y		31-40 y		41-50 y		51-60 y		H		N		Subcondyle	
		M	%	M	%	F	%	M	%	M	%	M	%	M	%	M	%	H	%	N	%	Subcondyle	%
RTA WITH ALCOHOL	34	34	50.75	0	0	5	55.56	13	40.63	8	42.11	7	43.75	1	16.67	7	31.82	11	42.31	16	48.48		
RTA NO ALCOHOL	21	13	19.40	8	53.33	1	11.11	10	31.25	3	15.79	5	31.25	2	33.33	8	36.36	5	19.23	8	24.24		
FALL FROM HEIGHT	17	13	19.40	4	26.67	3	33.33	3	9.38	7	36.8	3	18.75	1	16.67	6	27.27	5	19.23	6	18.18		
FALL FROM GROUND	9	6	8.96	3	20	0	0	6	18.75	1	5.26	1	6.25	1	16.67	1	4.55	5	19.23	3	9.09		
ASSAULT	1	1	1.49	0	0	0	0	0	0	0	0	0	0	1	16.67	0	0	0	0	1	3.03		

fracture which was (41.46%) of the entire sample which is agreement to the study conducted by **Monazzi et al., 2017**.⁹ Significantly, most common reported fracture in literature is the head of condyle fracture. **He et al. 2009**¹⁶ noted 65%, **Zhou et al., 2013**¹³ accounted 48.6% to condylar head fractures. In our observation subcondyle fracture was most common fracture seen predominantly in younger age group (28.13%) which may be attributed to the modes of transportation in the studied groups.

In our study we observed bilateral condylar head in 17.07% of cases caused by excessive force during RTA. Similar results were reported by **Monazzi et al. 2017**.⁹ As per **Marker et al 2000**,¹⁷ in cases where significant force is involved more bilateral fractures occur; on the other hand, moderate force causes more number of subcondylar fractures and least force is required for head fractures. As discussed we observed more cases of unilateral subcondylar and head fractures which again corroborates the fact that the fractures in Indian Subcontinent are due to Moderate to low velocity injuries. In our study only one assault case reported with fracture dislocation from fossa. **Monazzi et al. 2017**,⁹ stated that MacLennan's class IV fractures were more frequently noted in high velocity accidents. Condylar fractures of MacLennan's class I and II (63.41%) were usually caused by fall due to slipping on ground with low force intensity. The results of our study are consistent with **Marker et al. 2000**¹⁷ and **Monazzi et al. 2017**.¹¹

Alongside condylar fractures parasymphysis fractures (46.34%) were the most common site of fracture, followed by mandibular body fractures (18.29%), symphysis fracture (12.20%), which are in accordance to the findings of other reports (**Sawazaki et al., 2010**).⁶

Previously closed treatment was akin to the Conservative treatment the zest of which has been debated highly in the community whether closed is actually conservative. We too agree that in today's scenario we cannot call closed as conservative, at the most it can be called non-surgical cause it still has its aggressive component. There is an evolution in the indications for open or closed treatment of mandibular condylar fractures in the past decades. Zide and Kent's report (**Zide and Kent, 1989**)¹⁹ regarding the indications for open reduction of mandibular condylar fractures. Zide's discussion (**Zide, 2001**)¹⁸ considered there is true need for open reduction and rigid internal fixation, are for, condylar displacement and ramus height instability. However, a latest meta-analysis failed to arrive at a resolution with respect to whether open or closed treatment ought to be utilized for the management of mandibular condylar fractures; this being a result of moderately low quality of the accessible information and absence of quality data in relative examinations. (**Nussbaum et al., 2008**)²⁰

Most of the condyle fractures were treated by closed method (67.07%) in our centre. In our study, undisplaced fractures (30.59%), and some deviated fractures (26.83%) were mostly treated by closed approach while most of the displaced (35.37%), dislocated (1.22%) and almost half of deviated fractures and one undisplaced fractures were treated surgically. Total 30 sample (36.59%) are noted in undisplaced category in which almost all were treated conservatively giving IMF for 3 weeks (96.87%) or no treatment, only one who has isolated subcondyle fracture with malocclusion was treated surgically. 22 (26.83%) of sample were recorded as deviated fractures. Out of 22, 12 treated conservatively because mostly all of these were simple condylar neck fractures (54.55%) and rest of 10 (45.45%) were subcondylar fractures; all of which were treated surgically. Majority of condylar fractures were noted in category of displaced fractures 29 (35.37%), from which 16 were treated surgically (55.17%) and 13 conservatively (44.83%). Although indicated we were not able to surgically operate 13 cases because of various reasons like medical history, patient consent and other required approvals. 1 case of MacLennan 4 or dislocated fracture was treated Conservatively.

Monazzi et al., 2017⁹ showed that the surgical group had an average mouth opening of 27 mm and the conservative group had an average of 30 mm. In contrast, our study show a favorable result regarding maximal mouth opening with surgical approach with a

Table 5

Type of injury in different ages

TYPE	10-20 y	%	21-30 y	%	31-40 y	%	41-50 y	%	51-60 y	%
HEAD	0	0.00	11	34.38	6	31.58	4	25.00	1	16.67
NECK	2	22.22	12	37.50	5	26.32	5	31.25	2	33.33
SUBCONDYLE	7	77.78	9	28.13	8	42.11	7	43.75	3	50

Table 6

Severity of injury according to etiology.

	total	MAC 1	%	MAC 2	%	MAC 3	%	MAC 4	%
RTA WITH ALCOHOL	34	9	30.00%	9	40.91%	15	51.72%	1	100.00%
RTA NO ALCOHOL	21	9	30%	6	27.27%	6	20.69%	0	0.00%
FALL FROM HEIGHT	17	8	26.66%	5	22.73%	4	13.79%	0	0.00%
FALL FROM GROUND	9	4	13.33%	2	9.09%	3	10.34%	0	0.00%
ASSAULT	1	0	0.00%	0	0.00%	1	3.45%	0	0.00%

MAC = MacLennan class 1, 2, 3,4.

Table 7

Associated fracture with condyle fracture.

	N	%
Symphysis	10	12.20%
Parasymphysis	38	46.34%
Body	15	18.29%
Angle	6	7.32%
Midface	8	9.76%
Isolated	5	6.10%
Total	82	100.00%

statistically significant difference (p value < 0.05). The differences could be seen amongst the conservative (mean value = 25.76) and surgical treatment (mean value = 29.20) regarding the mouth opening in our study. We evaluated post-operative mouth opening for 1 month because we are working at tertiary centre and all patients were economically poor so they were not able to come for regular follow up. We advised physiotherapy for mouth opening at home for improve the mouth opening.²¹ Average pre-operative mouth opening 25 mm and post-operative mouth opening 29 mm observed in who was operated by preauricular and average pre-operative mouth opening 24 mm and post-operative mouth opening 27 mm observed in patients who was operated by retromandibular and average pre-operative mouth opening 27 mm and post-operative mouth opening 26 mm observed in patients who was operated by submandibular approach.

During Open surgical reduction of 27 cases we used various approaches as preauricular (25.93%), Submandibular (3.70%), retromandibular (66.67%) and existing laceration (3.70%). Facial nerve injury was noted in 2 out of 6 Preauricular incision (28.57%) both of which fully recovered in 4 months. Salivary fistula was observed in 6 (33.33%) which was conservatively managed and they fully recovered in 15 days. Only one sample (5.56%) reported with infection and

Table 8

Treatment according to severity of fracture.

	MAC-1	%	MAC-2	%	MAC-3	%	MAC-4	%
CONSERVATIVE	29	96.67%	12	54.55%	13	44.83%	1	100.00%
SURGICAL	1	3.33%	10	45.45%	16	55.17%	0	0.00%

Table 9

Different approaches for condyle.

Approaches	N	%
Existing Laceration	1	3.70%
Preauricular	7	25.93%
Retromandibular	18	66.67%
Submandibular	1	3.70%
Total	27	100.00%

salivary fistula after 15 days, in this scenario plate was removed and IMF was given for 2 weeks. One patient (1.82%) who was managed by closed reduction, observed to have condyle fused with glenoid fossa which was managed by B/L condylectomy. This result is according to the study conducted by [Garcia-Guerrero et al. 2018](#).²¹

5. Conclusion

The usefulness of epidemiological investigations in maxillofacial traumatology is generally perceived, in light of the fact that these examinations furnish principal data with suggestions for access to and quality of life after treatment. This retrospective study of condylar injuries has revealed that about.

- 1) One-fourth of the cases were patients with age group 21–30 years.
- 2) Males were more affected with a preponderance of 4.5:1.
- 3) we conclude that more cases of unilateral subcondylar and head fractures were found which again corroborates the fact that the fractures in Indian Subcontinent are due to Moderate to low velocity injuries.

Patient with an adequate mouth opening with undisplaced or

Table 10
Complication.

Complication	N	%
Salivary Fistula Present	6	7.32%
Infection	1	1.22%
Facial Nerve Injury Temporal and Zygomatic	2	2.44%
Fused with Glenoid Fossa (ANKYLOSIS)	1	1.22%

Table 11
Mouth opening comparison.

Mouth Opening	Mean	SD	p value
Pre Op	24.61	5.262	0.001
Post Op	27.69	5.076	

minimally displaced fractures can be treated conservatively although patients having undisplaced or displaced fractures in which occlusion cannot be achieved can be successfully managed by surgical intervention with minimal complications and good outcomes.

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