Evaluation of the Mandibular Function, after Nonsurgical Treatment of Unilateral Subcondylar Fracture: A 1-Year Follow-Up Study

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Craniomaxillofac Trauma Reconstruction 2016;9:229–234

Abstract

There are no clearly defined guidelines for when an open or closed treatment is indicated for treatment of mandibular condylar fractures. The aim of the study is to analyze the mandibular function after nonsurgical treatment of unilateral subcondylar fractures, in a prospective study. A prospective study was conducted on 30 patients with unilateral mandibular subcondylar fracture undergoing nonsurgical treatment. Clinical and radiographic examinations were done prior to treatment and at 12-month follow-up. Pain, perceived occlusion, mouth opening, protrusion, and horizontal movements of the mandible were evaluated by clinical examination. Radiologic evaluation was done using Panoramic and Reverse Towne's radiographs. At 12-month follow-up, there was minimal pain in the temporomandibular joint region, there was an improvement in the perceived occlusion, and mouth opening did not reduce. There was insignificant absolute difference between left and right lateral mandibular movements. The amount of increase in the protrusion of mandible was insignificant. On radiographic evaluation, the degree of coronal and sagittal displacement was insignificant at follow-up. Mean ramus height pretreatment and 12 months posttreatment were 0.98 ± 0.50 and 0.87 ± 0.47 , respectively. Based on this study, patients had adequate mandibular function and minimal pain after nonsurgical treatment. Unilateral subcondylar fractures of the mandible can be treated nonsurgically in patients with minimal occlusal discrepancies, adequate mouth opening, minimal displacement of condyle, and minimal ramus height shortening.

Keywords

- fracture
- closed treatment
- subcondylar
- mandibular
- nonsurgical

One of the most common maxillofacial fractures is that involving the mandible (57%).¹ Mandibular condylar fractures constitute 18 to 57% of all mandibular fractures.^{1–6} Treatment of fractures of the condyle depends on many factors including clinical and radiological evidence for the presence of the fracture, extent (whether unilateral or bilateral), level of the fracture, degree of displacement or dislocation, the presence of additional facial fractures, deranged occlusion and mandibular dysfunction, posterior occlusal support, clinical experience of the surgeon, and willingness of the patient to undergo surgery.^{4,6,7} Adult mandibular condylar fractures

can be treated in three ways: (1) maxillomandibular fixation (MMF) which is followed by functional therapy; (2) functional therapy without MMF; and (3) open reduction with or without internal fixation. In the first two treatments, surgical procedure on the fractured segments is not undertaken and hence are forms of closed treatment.⁸ Lately endoscopically assisted intraoral approach is showing promising results.^{9,10} In the past, closed treatment involving intermaxillary fixation, followed by active physical therapy, had been mainly used. Closed treatment is indicated many times because of problems following surgical approach.^{11–13} The purpose of

received

June 16, 2015

accepted after revision

February 20, 2016

published online

July 8, 2016

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Tel: +1(212) 584-4662.

DOI <http://dx.doi.org/10.1055/s-0036-1584399>.
ISSN 1943-3875.

this study is to evaluate the mandibular function after non-surgical treatment of unilateral mandibular subcondylar fractures presenting with minimal dental malocclusion.

Methodology

The present study was done on patients diagnosed with unilateral mandibular condyle fractures and who underwent nonsurgical treatment for the fracture from 2011 to 2014. The study patients were obtained from the OPD, Department of Oral and Maxillofacial Surgery, College of Dental Sciences, Davangere, Karnataka, India. The data from 30 patients treated for unilateral condylar fractures were available for analysis. Continuous data were presented as mean and standard deviation and categorical data as numbers and percentages. Unpaired Student *t*-test was used for quantitative analysis and Chi-square test was used to test association. The statistical analysis was performed using the SPSS package (statistical package for social sciences version 17).

Inclusion Criteria

- Subcondylar fracture of mandible less than 1 week old demonstrated on roentgenograms
- Malocclusion
- Reduced mouth opening

Exclusion Criteria

- Patients with history of any psychiatric disorders or mental retardation
- Patients who had mandibular function impairment or temporomandibular joint (TMJ) pain or pain in the muscles of mastication prior to fracturing the mandibular condyle

Treatment of the fractured mandibular condyle was performed according to the standard procedures of the department. Any other associated fractures of mandible if present were treated by open reduction and internal fixation. Arch bars were used to stabilize such fractures preoperatively and were later used for intraoperative MMF. The arch bars were also utilized for placement of guiding elastics postoperatively to treat the condylar fracture. Patients having subcondylar fractures presenting with dental malocclusion without any other associated mandibular fractures were treated with arch bars and guiding elastics. The rigid intermaxillary fixation was not used.

A prospective study was done on patients with fracture of the unilateral mandibular subcondyle treated nonsurgically. All the patients included in the study were clinically assessed for mandibular function and were radiographically evaluated for the displacement of the fractured mandibular condyle. Patients were recalled to the department 12 months post-treatment for follow-up.

At follow-up, physical examination was performed by one examiner. Maximal mouth opening, left and right lateral mandibular movements, and protrusion were measured with a measuring scale. Maximal inter-incisal distance (mouth opening) was taken as vertical range of motion.

Left lateral movement, right lateral movement, and protrusion were taken as horizontal range of movements and were measured as the movement of the mandibular central incisors relative to the maxillary central incisors in the horizontal plane. The absolute difference between left and right sides was chosen because it would not matter whether a unilateral condylar fracture patient deviates during, from, or to the affected side¹⁴ (→Fig. 1). Visual analog scale (VAS) of 100 mm was used to measure the average pain intensity experienced by the patient pretreatment and during the week prior to follow-up. The VAS is a line with “no pain” at one end and “severe pain imaginable” at the other end.¹⁵ Objective analysis of occlusion was done as part of routine intraoral examination of the department and was noted as either stable or deranged. All the patients presented with varied amounts of malocclusion but not all perceived their occlusion as deranged. Hence, perceived occlusion was assessed, by asking the patients whether they rated their occlusion good, moderate, or poor.¹⁶

Radiographic Evaluation

Two radiographs, that is, panoramic radiograph and Reverse Towne's radiograph, were done pretreatment and 12 months postoperatively. Reverse Towne's radiograph was used to measure the coronal position of the condylar process. Sagittal displacement of the fractured condyle and vertical overlap of the fractured condylar process fragment were measured using panoramic radiograph.¹⁷

Assessments of pretreatment and 12 months after non-surgical treatment were used, if data of 12-month follow-up were missing, the data from the 6-month follow-up were used (last observation carried forward).

The collected data were entered into the Microsoft excel sheet and were subjected to further statistical analysis to assess the mandibular function after nonsurgical treatment of mandibular condyle. Ethical clearance was obtained from College of Dental Sciences, Davangere.

Results

All patients had their maxillary and mandibular molar teeth intact. →Table 1 shows the mean $\pm$ SD and frequency of VAS recorded pretreatment and 12 months posttreatment. There was mild pain in the temporomandibular joint region after mandibular condyle fracture. At 12 months posttreatment, there was minimal pain in the temporomandibular joint region after closed treatment of the fracture. →Table 2 shows the occlusion perceived by the patient. There was improvement in perceived occlusion in some patients as only one patient perceived the occlusion as poor at 12 months. →Tables 3 and 4 show the physical examination of the range of motion of mandible. In this study, the decrease in mouth opening was insignificant. The mean of absolute difference between left and right lateral mandibular movements pretreatment and 12 months postoperatively was 2.03 (SD 1.56) and 1.73 (SD 0.94), respectively. The *p*-value was 0.372. This change in amount of absolute distance was insignificant. The increase in the protrusion of mandible was insignificant.

Fig. 1 Range of mandibular motion.

► **Table 5** shows the displacement of condylar process fracture assessed by panoramic view and reverse Towne's view radiographs. The decrease in the degree of coronal displacement of the fractured condyle and the degree of sagittal displacement was insignificant.

The decrease in the mean ramus height at 12 months posttreatment was insignificant as well.

Discussion

Most of the surgeons seem to favor nonsurgical treatment of condylar fractures mainly because of three factors. First,

satisfactory results are obtained in majority of cases treated by nonsurgical methods. Second, there are not many reports of long-term follow-up of patients treated surgically because historically nonsurgical means were the most common mode of management of condylar fractures. Third, anatomical hazards (i.e., VII nerve) make surgery of condylar fractures difficult. In this study, there was pain in the TMJ region after condylar fracture pretreatment as measured by the VAS scale. Santler et al¹⁸ stated that deviation of mandible can lead to muscular pain. In this study, deviation of fractured condyle could be the reason for the mild pain in the temporomandibular region.

Table 1 Mean $\pm$ SD and frequency of visual analog scale recorded at 6 and 12 month interval

Variable	Mean $\pm$ SD		Frequency	
	Pretreatment	12 mo	Pretreatment	12 mo
VAS pain	21.53 $\pm$ 11.69	12 $\pm$ 5.50	30 (100%)	30 (100%)

Table 2 Perceived occlusion

Perceived occlusion		Good	Moderate	Poor
Frequency	Pretreatment	21 (70%)	6 (20%)	3 (10%)
	12 mo	22 (73.3%)	7 (23.3%)	1 (3.3%)

Table 3 Range of mandibular movements

Variable	Mean $\pm$ SD		Unpaired <i>t</i> -test	
	Pretreatment	12 mo	<i>t</i> Value	<i>p</i> Value (significance)
Maximum mouth opening	35.73 $\pm$ 4.60	35.20 $\pm$ 4.16	0.471	0.640 (NS)
Left lateral excursion	7.33 $\pm$ 3.67	7.23 $\pm$ 3.46	0.108	0.914 (NS)
Right lateral excursion	7.13 $\pm$ 3.38	7.20 $\pm$ 3.30	0.077	0.939 (NS)
Protrusion	6.46 $\pm$ 3.11	6.53 $\pm$ 3.20	0.082	0.935 (NS)

Table 4 Absolute difference between left and right movements of mandible

Variable	Mean $\pm$ SD		Unpaired <i>t</i> -test	
	Pretreatment	12 mo	<i>t</i> Value	<i>p</i> Value (significance)
Difference between right and left lateral excursion	2.03 $\pm$ 1.56	1.73 $\pm$ 0.94	0.899	0.372 (NS)

Table 5 Displacement of fractured condyle

Displacement variable	Mean $\pm$ SD		Unpaired <i>t</i> -test	
	Pretreatment	12 mo	<i>t</i> Value	<i>p</i> Value (significance)
Coronal plane (Towne's image): condyle/ramus angle difference	9.70 $\pm$ 5.38 degrees	8.80 $\pm$ 4.95 degrees	0.674	0.503 (NS)
Sagittal plane (panoramic image): condyle/ramus angle difference	4.83 $\pm$ 2.40 degrees	4.83 $\pm$ 2.61 degrees	0.000	1.000 (NS)
Ramus height difference (panoramic image) (mm)	0.98 $\pm$ 0.50	0.87 $\pm$ 0.47	0.869	0.389 (NS)

At 12 months posttreatment, there was minimal or no pain in the TMJ region after closed treatment of condylar fracture in the present study. Following trauma, there may be a varying degree of limited mandibular movements due to muscle spasm, edema, and hemarthrosis. These factors predispose to mandibular deviation to the injured side on mouth opening.¹⁹

This can lead to pain in the temporomandibular region. In this study, there was pain present pretreatment and no pain at 12 months. The presence of pain could be because of spasm or edema following trauma, which resolved over a period with minimal pain at 12 months postoperatively after nonsurgical treatment of condylar fractures. Increased amount of degree of deviation of mandible can lead to muscular pain.¹⁸

"Good" perceived occlusion could be because of reduced differences between the ramus height on the fractured and nonfractured sides which prevents premature occlusal contacts of posterior teeth on the fractured side. Occlusion

perceived as moderate or poor might be due to the reduced ramal height on the fractured side compared with the nonfractured side which could cause posterior gagging of occlusion. It could also be because of deviation of the jaw to the fractured side leading to an open bite on the nonfractured side. Moderate or poor perceived occlusion can also occur because of any occlusal interference between opposing maxillary and mandibular teeth due to trauma. In a study conducted by Niezen et al,¹⁶ 24% of patients perceived their occlusion as "moderate" or "poor." The *p*-value was 0.523 which was insignificant. Patient's perception of occlusion was similar at 6 and 12 months postoperatively.

The most common complaint after treatment of a fracture of mandibular condyle is persistent restriction of mouth opening.²⁰ Adequate mouth opening (> 30 mm) was present pretreatment and it did not change significantly after 12 postoperative months. Inadequate physiotherapy in the recovery period can be the reason for the unchanged amount of mouth opening. Patient should be motivated highly toward physiotherapy in the

recovery period so that a mouth opening as large as possible can be achieved. Deviation of mouth opening is assumed to be a sign of compensatory movements of the contralateral joint due to shortening of the ascending ramus height on the affected side.^{6,21-23} It can also be because deviation is a sign of a reduced translator capacity of the affected joint as a result of an intra-capsular fracture.^{20,22,24,25} After closed treatment on an average, the mandible deviates toward the side of fracture and the average amount of deviation is less than 2 mm at most periods.¹⁷ Though after a trauma, one side may fracture but the non-fractured contralateral joint may suffer from the trauma, reducing translator capacity of that side as well. Sometimes, this reduced translator capacity is even more than that of the fractured side.²⁶ This can be a reason for a reduced movement of mandible during protrusion in this study.

Change in the degree of coronal displacement of the condyle at 12 months postoperatively from its position at pretreatment is insignificant. In this study, the displacement is less compared with the study by Eckelt et al²³ in which the closed treatment group had degree of angulation at 16.8 degrees (range: 0–45 degrees, SD: 14.61) which had not substantially improved when compared with the preoperative values of that study. Greater coronal displacement of the condyle due to trauma for patients treated with closed treatment is associated with greater restriction in incisor as well as condylar movement.¹⁷ The condyle makes attempts to attach itself to the abutting bone from which it fractured. During this period where the bone and soft tissues are healing, every attempt should be made to gain and maintain a wide range of jaw and circumarticular movement about a new articulation.²⁷

In a study by Palmieri et al,¹⁷ the sagittal displacement pretreatment and at 6 weeks posttreatment was less in contrast to the present study and was insignificant as well as the correlations between sagittal displacement and motion variables were few.

In this study, the decrease in the ramus height at 12 months compared with pretreatment was not significant. This could be because of the reduced displacement of the fractured condyle preventing the ramus to be pulled up by the muscles attached to the mandible as can be in case of a high condylar fracture, undisplaced fracture, or a greenstick fracture. In a prospective randomized multicenter study, shortening of the ascending ramus, and angulation of the fragments, remained basically unchanged after 6 months of closed treatment.²³

Unilateral condylar fracture can be treated nonsurgically if they meet the following criteria:

1. Good complement of teeth, especially posterior teeth must be present. Without them, there is a significant loss of posterior vertical dimension and an increase in the mandibular and occlusal plane angles.
2. Cooperative patient who wear their elastics. Functional exercises should be done regularly and should be present for periodic follow-up.
3. Surgeon should examine the patient on follow-up visits to assess treatment and alter functional therapy if necessary. Although closed techniques do not reduce subcondylar fractures, they do manage the occlusion, and most patients

achieve satisfactory results.²⁸ In this study, all these criteria were met and closed treatment without a period of intermaxillary fixation (IMF) was chosen as the treatment option.

Conclusion

It can be concluded that unilateral subcondylar fractures of the mandible with no malocclusion can be treated nonsurgically. Adequate mouth opening, minimal displacement of condyle, and minimal ramus height shortening are other factors to be considered before opting for a closed treatment. Mouth opening as large as possible should be tried to attain in the recovery period. Adequate pain management is important to prevent development of long-standing pain. Patients should be followed up for a long period to assess any worsening of mandibular function.

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