



Complications of closed reduction in treatment of unilateral condylar fractures: A decade-long survey

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ARTICLE INFO

Article Type:

Original Article

Received: 3 Jul 2015

Revised: 14 Aug 2015

Accepted: 29 Aug 2015

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ABSTRACT

Introduction: This study was conducted to investigate the side effects of closed reduction method as a treatment modality of unilateral condylar fractures of the mandible in patients referred to Shahid Beheshti University Hospital (Babol, Iran) over than one decade (2002 to 2012).

Materials and Methods: To accomplish this study, patient's data were collected referring to their files in Shahid Beheshti University Hospital. Cases with unilateral condylar fractures of the mandible aged older than 12 who treated by closed reduction technique; were selected. Finally, 24 out of 78 selected patients entered to this study. Considering the variants such as age, gender, maximum mouth opening (MMO), mandibular deviation from midline on MMO and patient's satisfaction of mastication were captured.

Result: About 24 patients, 18 males (75%) and 6 females (25%) aged from 13 to 52 and the mean age of 24.7, were included in this study. The MMO of 23 cases (95.83%) were in normal range (≥ 35 mm); 23 patients (95.83%) were satisfied with their quality of mastication. 17 cases (70.83%) out of all patients had no deviation during mouth opening.

Conclusion: According to low complication rate of closed reduction of mandibular condylar fractures deduced in this study, it may be acceptable as a conservative treatment modality.

Keywords: Closed Reduction Technique, Complications, Mandibular Condylar Fractures

Introduction

Mandibular fractures are a common type of fracture in maxillofacial trauma, and the mandibular condyle is the most frequent site of the fracture (25-35% of all cases) [1].

Condylar fractures are mainly caused by an indirect injury (e.g., trauma to the chin) and rarely occurs by direct trauma unless in combination with zygomatic fractures [1]. Thus, displacement of the fracture can be determined by the factors such as: Direction of the incoming force and position of the mandible during trauma (open or closed) and dental occlusion [2]. Condylar fractures, according to the site of the fracture, could be divided into three types including the condylar neck, sub-condylar, and head of the condyle [3]. Condylar injuries, regardless of the other parts of the mandible, need special considerations because of their

anatomical differences and restoration capacity [1].

There are two methods in approach to this kind of fracture: (1) Conservative treatment [just by physiotherapy and with no means of surgical intervention; or closed reduction with maxillomandibular fixation (MMF)], (2) open reduction and internal fixation (ORIF) [2]. Conservative treatment is generally undertaken utilizing MMF and evaluated by this fact that how much the MMF has been successful to achieve an acceptable dental occlusion and lower jaw function [4, 5].

There are lots of controversies pertaining to treatment methods of condylar fractures [1]. Some researchers suggest conservative treatment because it does not contain disadvantages of surgery such as; remaining of the scar, post-operative pain or facial nerve paralysis. Some others prefer surgery for benefits of anatomical reduction, maximum restoration of the mandibular range of motion and optimal

functional outcomes [6].

In fact, both methods may have some complications. Conservative treatment may lead to complications such as: Deviation of the chin while maximum opening of the mouth [7], facial asymmetry [2, 7], limitation in mandibular range of motion [2, 7], temporomandibular joint dysfunction [7], ankylosis of the joint [7], chronic pain [2, 7], arthritis [8] and malocclusion [7] especially anterior open bite [2]. On the other hand, ORIF increases the risk of damage to the facial nerve branches, and also when used as an external approach can remain scar [2].

The surgeon's decision for treatment may be influenced by several factors including extent of the fracture (bilateral or unilateral), surgeon's experience [9], level of the fracture and degree of its displacement, the status of dental occlusion, concurrent fractures and patient's requests [2]. Fully objective and differentiated evaluation is not possible due to current methods for clinical examinations. Because limited motions of the fractured condyle, may compensate with contralateral side [10].

Generally approved methods for the treatment of condylar fractures do not obviously prefer surgical reduction to conservative treatment [11]. Although, many studies have been searching for the best treatment method, this matter has still been left as a controversy [7].

According to this feature that closed reduction of condylar fractures is the standard method and is used most often, we decided to evaluate the complications of this technique implemented in patients referred to Shahid Beheshti University Hospital (Babol, Iran) over than a decade (2002-2012).

Material and Methods

A cross-sectional retrospective study was conducted to investigate the prevalence of complications of closed reduction in the treatment of unilateral condylar fractures in patients admitted in a university hospital during a decade (2002-2012). Referring to the patient's medical records filed on admission to the hospital; cases with unilateral condylar fractures of the mandible, aged older than 12 who had been treated by closed reduction technique were selected. The refer 24 patients possessed with this inclusion criteria entered the study. We called them and they were ensured that we were going to do a free clinical examination to check out the outcomes of this method of treatment. The required data obtained on examination were patient's age, sex, maximum mouth opening (MMO), mandibular deviation from midline on maximum opening and patient's satisfaction of mastication. To measure the MMO, a pair of calipers was used and the interincisal distance was measured on MMO. Based on the studies of Kotrashetti et al. [1], Kyzas et al. [2], and Zhao et al. (2012) [12]; the mouth opening of at least 35 mm was considered normal. Patient's satisfaction of mastication was qualitatively evaluated as "Poor, Moderate, and Good" according their proclaims. Mandibular deviation

from midline, on MMO, was measured by a pair of calipers considering the horizontal distance between upper and lower dental midlines. Collected data was analyzed by two statistical tests (binomial test and t-test) utilizing SPSS software (version 19; SPSS Inc., Chicago, IL, USA). $P < 0.05$ was considered as significant.

Results

This study comprised 24 patients whose medical records was first investigated and then they were called to refer to be examined clinically. The mean age at the time of trauma was 24.70 with a range of 13-52. Sex distribution was 18 males (75%) and 6 females (25%). Based on the results obtained from binomial test MMO was normal (35 mm or more) in 23 patients (95.83%) (Tables 1 and 2).

Table 1. Frequency of MMO

MMO	Frequency	Relative frequency
Less than 35 mm		
Male	1	4.17
Female	0	0.00
35 mm		
Male	1	4.17
Female	0	0.00
More than 35 mm		
Male	16	66.66
Female	6	25.00
Sum	24	100

MMO: Maximum mouth opening

The average of the maximum opening in patients was 43.58 ± 5.80 mm (42.00 ± 11.60 mm in males and 43.00 ± 4.19 mm in females).

23 patients (95.83%) were satisfied with their mastication. According to the patients' response 8.33% of males and 4.17% of females had a moderate level of satisfaction; also 62.5% of males and 20.83% of females had a good level of satisfaction (Tables 2 and 3).

Based on the results showed on table 2, it can be concluded that 95.83% of all patients had an acceptable level of satisfaction from their mastication and also there is a significant difference between level of satisfaction and quality of mastication from moderate levels and on, and about 95.83% of the patients were satisfied from the quality of mastication.

17 cases (70.83%) out of all patients had no deviation during mouth opening. Accordingly, 50% of males and 20.83% of females had no deviation, and 25%, also males and 4.17% of females had same deviation during mouth opening (Tables 4).

Results of the t-test also showed that there is a significant difference between levels of satisfaction in patients, according to occurrence of deviation of the mandible from midline during MMO, and 70.83% of patients have been satisfied (Table 5).

Table 2. Results of binomial test

Variables	Groups	N (%)	Significance level
MMO	Less than 35 mm	1 (4.17)	0
	35 mm or greater	23 (95.83)	
Level of satisfaction from mastication	Poor	1 (4.17)	0
	Moderate or good	23 (95.83)	

MMO: Maximum mouth opening

Table 3. Frequency of level of satisfaction from mastication

Level of satisfaction from mastication	Frequency	Relative frequency
Poor		
Male	1	4.17
Female	0	0.00
Moderate		
Male	2	8.33
Female	1	4.17
Good		
Male	15	62.50
Female	5	20.83
Sum	24	100

Table 4. Frequency of deviation during MMO

Deviation during MMO	Frequency	Relative frequency
With deviation		
Male	6	25.00
Female	1	4.17
Without deviation		
Male	12	50.00
Female	5	20.83
Sum	24	100

MMO: Maximum mouth opening

Table 5. Results of t-test

Variables	Groups	Number	Percentage	Significance level
Deviation on mouth opening	With deviation during MMO	7	0.1729	0
	Without deviation during MMO	17	83.70	

MMO: Maximum mouth opening

Discussion

Regarding to high prevalence of mandibular fractures [1] specially condylar fractures that comprise one third of them [13] many studies have focused on it and most of them have compared closed reduction and ORIF, two main treatment methods of these fracture type [1, 3, 8, 14-23]. However, the management of the condylar fractures is still remained as a controversy due to the anatomy of this joint and also post-operative complication such as mandibular deviation, ankylosis and etc. [20].

In this study, we were intended to investigate the complications of closed reduction technique.

Sex distribution in this study was 18 males and 6 females with 3:1 ratio. The matter that men had greater population than women in this study was similar to most of the other surveys [9, 22, 24-29]. Mean age of the patients was 24.70 (from 13 to 52). The range of age was so various in different studies but in the studies performed by Sforza et al. [20], Niezen et al. [9], Silvennoinen et al. [4], Villarreal et al. [27] and Singh et al. [21] reported mean age had a range of 20-30 years.

The mean of MMO (interincisal distance) in this study

was 43.58 ± 5.80 mm (42.00 ± 11.60 in males and 43.00 ± 4.19 in females). This result ($MMO \geq 35$ mm) was also reported by Nogami et al. [8], Landes et al. [30], de Riu et al. [31], Niezen et al. [9], Villarreal et al. [27], Shen et al. [32], Silvennoinen et al. [5], Throckmorton and Ellis [23], Forouzanfar et al. [7], Sforza et al. [20], Kondoh et al. [11] and Landes and Lipphardt [17], and Silvennoinen et al. [5].

Silvennoinen et al. [4], Rutges et al. [26], Schneider et al. [19], and Haug and Assael [16] in their studies had also similar results. However, Bhagol et al. [24] and Singh et al. [21] reported different results in their studies, in which that mean of MMO was < 35 mm (Table 6). In our study, restricted mouth opening was noted in 1 patient (4.17%). Yamamoto et al. [33] and Leiser et al. [25] reported greater amounts of this variable in their studies. In addition, in a meta-analysis executed by Nussbaum et al. [18], 13 studies were reviewed, and the mean of the MMO in all of them was normal. Moreover, Hlawitschka and Eckelt [10] reported that MMO was just slightly less favorable in patients after fracture than other people. Kyzas et al. [2] reviewed 20 studies in a meta-analysis and showed that MMO was normal except in 2 studies.

Table 6. MMO (mm) and mandibular deviation from midline on opening

Study*	MMO (mm)	Deviation on opening
Landes and Lipphardt [17]	46 12 months later	
Nogami et al. [8]	39.5 ± 2.4 12 months later	
Landes et al. [30]	41.0 ± 7.3	
De Riu et al. [31]	46 ± 7 (37-52)	31.5%
Niezen et al. [9]	51.9 (SD 8.4)	
Villarreal et al. [27]	40.95 ± 4.13 6 months later	20.3%
Yamamoto et al. [33]	7.31% < 35	4.87%
Silvennoinen et al. [4]	> 40 44	4.40%
Rutges et al. [26]	(86% ≥ 40)	
Shen et al. [32]	37 3 months later - 49.9 ± 9.4	
Silvennoinen et al. [4]	6 months later - 53.9 ± 9.0 12 months later - 51.8 ± 9.5	
Schneider et al. [19]	42	
Haug and Assael [16]	42.50 ± 9.92	
Bhagol et al. [24]	Class I (minimally displaced) - 34.5 ± 2.28 Class II (moderately displaced) - 33.54 ± 1.89 6 months later	
Throckmorton and Ellis [23]	Men - 47.0 ± 12.0 Women - 37.2 ± 15.4 12 months later	2-3 mm
Leiser et al. [25]	Reduced MMO 18.5%	18.5%
Singh et al. [21]	31.5	
Forouzanfar et al. [7]	49 ± 9	20%
Kondoh et al. [11]	40.00 ± 1.67 12 months later	
Sforza et al. [20]	48.7 ± 8.3	25%
Kotrashetti et al. [1]	3 months later - 58.3% < 40 6 months later - 41.7% < 40	
Hlawitschka et al. [10]		67% > 2 mm
Villarreal et al. [27]		20.3%
Stiesch-Scholz et al. [22]		38%
This study	43.58 ± 5.80	29.17%

*The references of listed studies are given in the context
MMO: Maximum mouth opening

We also examined mandibular deviation from midline during MMO after treatment. Only 7 patients (29.71%) had deviation during MMO. Results reported by de Riu et al. [31], Hlawitschka et al. [15], Sforza et al. [20] and Kyzas et al. [2] were similar to our study. Mandibular deviation during MMO has also been reported in other studies but with different degrees (Table 6) [4, 5, 7, 15, 22, 27-33]. Chrcanovic [3] showed functional problems such as limited mandibular range of motion and deviation on mouth opening in their study.

Another variable in our study, evaluated after treatment, was level of satisfaction from quality of mastication. Only 1 (4.17%) out of 24 patients was not satisfied. Rutges et al. [26] and Niezen et al. [9] showed that 85% and 76% of their patients, respectively described their occlusion as "Good."

Finally, in a meta-analysis of Brandt and Haug [14] and also in a study of Haug and Assael [16], open and closed reduction techniques, there was no significant statistical difference between ORIF and closed reduction and MMF in

term of MMO, mandibular deviation on opening and masticatory function.

Conclusion

Regarding to low complications of closed reduction technique as showed in this study, it may be considered as a conservative treatment modality.

Acknowledgement

We express eternal gratitude to the staff of Shahid Beheshti University Hospital for contribution of collecting data.

Conflict of Interest: None declared.

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Please cite this paper as:

Foroughi R, Ahmadi M, Ahmadi Z. Complications of closed reduction in treatment of unilateral condylar fractures: A decade-long survey. *J Craniomaxillofac Res* 2015; 2(3-4): 116-121.