

Original Research Article

The effect of facial fractures on mouth opening range: a case series

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Abstract

Introduction: Facial fractures can result in limitation of mouth opening range, which consequently leads to functional impairments. **Objective:** To identify the influence of facial fractures and their corrective surgery on mouth opening range. **Material and methods:** Consecutive patients submitted to maxillofacial surgery had their mouth opening range measured at four different moments: pre-operative (T0), immediate post-operative (within 24 hours after operation) (T1), one-week post-operative (T2) and one-month post-operative (T3). Eighteen subjects composed the sample, majorly represented by male gender, fractures caused by direct trauma as in traffic accidents, age among 21-30 years old and presenting mandible fracture. **Results:** Mouth opening at T0 demonstrated a mean value of 26.63 mm, T1 decreased to a mean of 22.59 mm, T2 mean value evolved to 26.42 mm and T3 displayed mean value of 34.57 mm. Statistical evaluation demonstrated overall significance for the comparison among all different periods, particularly for isolated mandible fractures, except between T0 and T2. **Conclusion:** It can be suggested that fracture itself and surgery for its correction have a negative effect on mouth opening range; however, the capacity of mouth opening presents signs of recovery since the first post-operative week, with notable progression until one month after surgery.

Introduction

Restricted mobility of the temporomandibular joint (TMJ), also known as trismus, can be caused by a systemic condition as seen in tetanus but is much more commonly observed secondary to local conditions of the maxillofacial area such as trauma, oral surgery, and infection. The expected normal mouth opening range, measured from the interincisal distance, is around 35-40 millimeters in adults and 30 millimeters in children. The main reason for the TMJ to not fully function is due to spasm of the masticatory muscles that cause partial or total inability to open the mouth, although problems intrinsic to TMJ, such as ankylose, may also occur [1-4, 6, 8].

Facial fractures, which are common causes to limit normal mouth opening regardless of their etiology, cause an inflammatory process of the masticatory muscles (i.e. masseter, temporalis, lateral pterygoid, and medial pterygoid), which are directed related to the mandible, maxilla, and zygomatic bones [1, 2, 9].

The inability to properly open the mouth might interfere in the adequate oral hygiene, social interaction, speech, nutrition, dental treatments under local anesthesia, and even treatments under general anesthesia as those for maxillofacial fractures or infections [2, 5-7].

This study aimed to quantify the preoperative mouth opening range in patients who suffered facial fractures related to the mandible, maxilla, and zygomatic bones and identify how such TMJ mobility evolves during the postoperative period.

Material and methods

For this prospective observational study, data was collected from consecutive subjects submitted to surgery for the correction of maxillofacial fractures by the department of Oral and Maxillofacial Surgery of the University General Hospital, associated to the University of Cuiaba - Brazil, between May 2014 and October 2014.

Standard mouth opening was considered 45 mm measured between the incisor edge of upper and lower incisors. Interincisal measurement was obtained with an electronic caliper. The patient was seated on a dental chair in a semi-supine position (inclined at an angle of 45° to the ground) and asked to present spontaneous maximum mouth opening (figure 1). Measurements were obtained at four different intervals for each patient: pre-operative (T0), immediate post-operative (within 24 hours

after operation) (T1), one-week post-operative (T2) and one-month post-operative (T3). Additional data (age, gender, etiology of facial fracture, fractured facial bone) was collected to be compared with the main outcome (range of mouth opening) to isolate variables that would be significant to the research.



Figure 1 - Maximum spontaneous mouth opening registered by an electronic caliper

Selection of patients was intentional and defined by consecutive sample. Inclusion criteria were subjects with fractures involving facial bones related to the masticatory muscles (mandible, maxilla, and/or zygomatic) and consent of patients after fully explained regarding the research. Exclusion criteria were defined by the absence of upper and/or lower incisors and subjects with cognitive impairment recorded on medical charts since it would impair collection of research data.

This study was performed under the principles of the Declaration of Helsinki, in compliance with the resolution 466/2012 of the Brazilian National Health Council (CNS). The Ethics Committee of the University of Cuiaba - UNIC, under the protocol number 575.112, gave ethical approval to the proposed research.

Descriptive analysis was accomplished by evaluation of mean values and standard deviation. Statistics assessment was performed by the comparison of mean values (overall and type of fracture) using paired t-test from QuickCalcs (GraphPad Software, La Jolla - CA, USA), considering statistical significance at 0.05.

Results

Of the 39 patients that underwent correction of facial fractures within the period of the study, only 18 subjects composed the sample according to the proposed methodology. Details of the sample regarding gender, age, etiology, and facial fracture under local anesthesia, and even sample are presented on table I.

Gender distribution was displayed by 16 men (88.8%) and 2 women (11.2%). Mean overall age was 38 years, varying from 21 to 58 years-old, with most of the subjects between 21 and 30 years-old. Facial fractures were most commonly related to traffic accidents (50%) followed by falls, and

assaults (22% each). The most common facial bone related to the masticatory muscle fractured was the mandible (83.33%), followed by the zygomatic (28%), and maxilla (16.67%).

Mouth opening at T0 demonstrated a reduction from expected normal range, with mean value of 26.63 mm; at T1, mouth opening decreased to a mean of 22.59 mm; one week later, at T2, mean value of mouth opening evolved to 26.42 mm; final measurement, at T3, displayed mean value of 34.57 mm (table II). Statistical analysis demonstrated overall significance for the comparison among all different periods, particularly for isolated mandible fractures, except between T0 and T2 (table III).

Table I - Subjects profile regarding gender, age, etiology, and facial fracture

Patient	Gender	Age (years)	Etiology	Fracture facial bone
1	Male	52	Fall	Mandible
2	Male	26	Traffic accident	Mandible
3	Male	28	Traffic accident	Mandible and Maxilla
4	Female	37	Traffic accident	Maxilla and Zygomatic
5	Female	21	Traffic accident	Mandible and Zygomatic
6	Male	56	Fall	Zygomatic
7	Male	42	Traffic accident	Mandible
8	Male	33	Assault	Mandible
9	Male	30	Traffic accident	Mandible
10	Male	30	Assault	Mandible e Maxilla
11	Male	39	Fall	Zygomatic
12	Male	55	Traffic accident	Mandible and Zygomatic
13	Male	43	Fall	Mandible
14	Male	46	Traffic accident	Mandible
15	Male	37	Gunshot	Mandible
16	Male	45	Assault	Mandible
17	Male	21	Traffic accident	Mandible
18	Male	58	Assault	Mandible

Table II - Mean values for mouth opening range at T0, T1, T2 and T3 (standard deviation in parenthesis)

Type of fracture	T0	T1	T2	T3
Mandible	24.53 (6.73)	20.43 (6.02)	24.08 (7.12)	33.25 (5.79)
Zygomatic	50.04 (9.04)	48.15 (8.15)	50.16 (10.17)	51.5 (13.5)
Mandible and maxilla	21.68 (3.81)	16.21 (0.50)	17.14 (5.13)	21.68 (3.60)
Mandible and zygomatic	20.44 (0.75)	15.46 (0.01)	22.61 (2.39)	25.27 (2.83)
Maxilla and zygomatic	25.17 (0.00)	22.26 (0.00)	30.8 (0.00)	59.53 (0.00)
All fractures	26.63 (10.45)	22.59 (10.73)	26.42 (11.15)	34.56 (11.78)

Table III - Statistic analysis (paired t-test) among different periods of evaluation by group and for the overall sample (bold numbers indicate statistical difference among periods)

	T0 vs. T1	T0 vs. T2	T0 vs. T3	T1 vs. T2	T1 vs. T3	T2 vs. T3
Mandible	0.0048	0.8919	0.0143	0.1407	0.0017	0.0010
Zygomatic	0.2809	0.9320	0.7990	0.5000	0.6439	0.7576
Mandible and maxilla	0.3464	0.7010	1.0000	0.8951	0.4095	0.2065
Mandible and zygomatic	0.0969	0.4120	0.2586	0.2064	0.1794	0.1034
All fractures	0.0001	0.9223	0.0070	0.0338	0.0001	0.0004

Discussion

Most of the studies demonstrate that males are more common than females, which is in accordance to facial trauma studies, but gender does not seem to be a significant variable to the incidence of trismus secondary to facial fractures. The same understanding applies to the age of the sample, which is in accordance to the most active and exposed period of life of the population [1, 6, 9].

Standard deviation was found to be similar for all measurements, indicating that restriction to normal mouth opening values were consistent to each subject biological response to trauma and this difference seemed to be consistent throughout the sample.

Trismus as a postoperative predicted complication can be prevented by several means as the use of corticosteroids, non-steroidal anti-inflammatory, cold packs over the traumatized areas or laser therapy [2-4]. Hence, even if no therapy can be predicted

prior to the occurrence of a facial fracture, these alternatives seem logical during the perioperative period to improve TMJ recovery.

As facial fractures occur, the masticatory muscles related to the zygomatic, mandibular and maxillary bones undergo spasms that will definitely have an effect to the amplitude of mouth opening. Although specific interventions are expected on postoperative cases of TMJ ankyloses, interventional study results do not have evidence to support any specific treatment other than the repair of the facial fracture is needed on trauma patients [1, 6].

Lo *et al.* [6] developed an apparatus to perform the rehabilitation of the TMJ that was affected by different conditions. Among them, seven cases of trauma (five of them resulting in facial fractures) presented a mean of 22 mm of mouth opening at presentation. After a varied period of treatment (from 10 to 28 days), mouth opening range was around 37 mm. Although the idea seemed to be relevant, the end result does not seem to be far

from those presented by this study without any kind of specific intervention to the TMJ and also questionable to its applicability considering the manufacturing cost of about 300 USD.

Chang *et al.* [1] retrospectively evaluated the effect of postoperative physiotherapy on interventional and observational groups of patients that suffered from zygomatic fractures. In spite of the confusing methodology and the results that were not able to support any postoperative therapy to mouth opening range since no significant difference was found between interventional and observational groups, the authors clearly illustrated that not only the muscular but also the skeletal structure can be affected by zygomatic fractures since extension of the fractures could be seen on the TMJ area.

The option for surgical or non-surgical treatment of the facial fracture does not seem to be correlated to the amplitude of mouth opening [1, 6, 9]. Trismus itself is generally a symptom of a greater problem and treatment, whatever the modality is chosen, would probably have better success if the primary cause of TMJ restricted mobility is the one to be treated [8]. It is important to highlight that none of the patients from the present study reported TMJ dysfunction symptoms, which can be a concern following facial fractures [9].

Decreased mouth opening range is an obstacle to general anesthesia. Alternatives to provide tracheal intubation vary from videolaryngoscopy, awake fiber optic intubation, the use of laryngeal mask or even tracheotomy [2, 7]. Therefore, preoperative anesthetic evaluation seems to be reasonable to prevent major complications and provide the best alternative when general anesthesia is necessary for the treatment of facial fractures.

Conclusion

The present study demonstrated the negative influence of the facial fracture on the capacity of normal mouth opening range, which developed partial trismus due to effect of the trauma on osseous and muscular structures. It can be suggested that fracture itself and surgery for its correction have a negative effect on mouth opening range, probably due to edema, muscle spasm, and pain. However, the capacity of mouth opening presents signs of recovery since the first post-operative week, with remarkable progression until one month after surgery.

Further clinical studies on alternatives to minimize the effects of trauma and surgery on mouth opening range are desirable, since literature is scarce on such topic.

References

1. Chang C-M, Ko EC, Kao C-C, Chang P-Y, Chen MYC. Incidence and clinical significance of zygomaticomaxillary complex fracture involving the temporomandibular joint with emphasis on trismus. *Kaohsiung J Med Sci.* 2012;28(6):336-40.
2. Dhanrajani PJ, Jonaidel O. Trismus: aetiology, differential diagnosis and treatment. *Dent Update.* 2002;29(2):88-92.
3. Kazancioglu HO, Kurklu E, Ezirganli S. Effects of ozone therapy on pain, swelling, and trismus following third molar surgery. *Int J Oral Maxillofac Surg.* 2014;43(5):644-8.
4. Kocer G, Yuce E, Tuzuner Oncul A, Dereci O, Koskan O. Effect of the route of administration of methylprednisolone on oedema and trismus in impacted lower third molar surgery. *Int J Oral Maxillofac Surg.* 2014;43(5):639-43.
5. Krishna Ch V, Mahendranadh Reddy K, Gupta N, Shastry YM, Sekhar NC, Aditya V et al. Fabrication of customized sectional impression trays in management of patients with limited mouth opening: a simple and unique approach. *Case Rep Dent.* 2013;2013:275047.
6. Lo L-J, Lin C-L, Chen Y-R. A device for temporomandibular joint exercise and trismus correction: design and clinical application. *J Plast Reconstr Aesthetic Surg.* 2008;61(3):297-301.
7. Nussbaum BL. Dental care for patients who are unable to open their mouths. *Dent Clin North Am.* 2009;53(2):323-8.
8. Sidebottom AJ. How do I manage restricted mouth opening secondary to problems with the temporomandibular joint? *Br J Oral Maxillofac Surg.* 2013;51(6):469-72.
9. Tabrizi R, Bahramnejad E, Mohaghegh M, Alipour S. Is the frequency of temporomandibular dysfunction different in various mandibular fractures? *J Oral Maxillofac Surg Off J Am Assoc Oral Maxillofac Surg.* 2014;72(4):755-61.