

Simplification on the Reduction of Comminuted Mandibular Fractures for Stable Internal Fixation

ORIGINAL

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Abstract

Background: The fractures of the comminuted type have a prevalence of 30 to 50% when related to the ones affecting the mandibular bone. They are characterized by the presence of multiple bone fragments involving several lines of fracture, resulting in small fragments within the same area. Usually resulting from high-energy trauma, they cause large displacements, tooth loss, as well as associated lesions in soft tissues.

Cases Reports: This article aimed to report two cases addressing the simplification method in the reduction of comminuted fractures treated by the method of open reduction and functionally stable fixation, which emphasized the importance of establishing a sequence of reduction maneuvers and application of osteosynthesis for a functional, occlusal and aesthetic result of the lower facial third.

Conclusion: The simplification of mandibular comminuted fractures proves to be an excellent ally when one intends to reduce difficulties of reduction of the fracture and the dental occlusion on the transoperative, as well as to facilitate the application of 2.4 reconstruction plates.

Background

In the last decades, there has been a significant increase in Cranio-maxillofacial trauma and the mandible fracture occupies the second place among the fractures of facial bones, affecting around 20% to 50% [1, 2]. This is because, due to their anatomy, topography, and projection in the lower facial third, they are often injured. [3]. They are caused mainly by motor vehicle accidents, since it is a very resistant

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Keywords

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bone that requires a relatively strong trauma to have it fractured and may also be a result of practicing sports, injury caused by firearm or a weapon, physical assault, tooth extraction, workplace accidents, metabolic diseases and tumors [4, 5, 6, 7, 8].

Regarding the gender, young men aged between 21 to 30 years old are mostly involved, since this group participates in the most dangerous exercises and sports, drives less carefully and is more prone to engage in episodes of interpersonal violence. However, there is a worldwide trend to the increase of incidence in women, who are increasingly more exposed to the risk factors of this type of trauma [9, 10, 11, 12].

The location and the pattern of mandibular fractures are determined by the mechanism of the injury and the direction of the force vector. In addition, other factors such as age of the patient, the presence or absence of teeth, the presence of pathologies and the physical properties of the etiologic agent also have a direct effect on the characteristics and results of the fracture [11]. According to the anatomical region, the distribution of the main fractured sites have been reported as 16% to 33% involving the body; 23.1% to 27.3%, the angle; 19.5 to 29.3%, the condyle; 8.4% to 22%, the symphysis; 16% to 33% parasymphysis; 1.7% to 2.4%, the ramus; 0.2% to 4.8%, the coronoid process and 1.4% to 3.1% in the alveolar process [11, 12, 13].

The comminuted fractures are characterized by the presence of multiple bone fragments involving several lines of fracture, resulting in small bone fragments within the same area [14]. Usually resulting from high-energy trauma, with prevalence of around 30% to 50% [8, 11, 12, 15, 16].

The main signs and symptoms presented by mandibular fractures include difficulty in chewing, pain, malocclusion, facial asymmetry, retroposition of the mandible, paresthesia along the inferior alveolar nerve, hyperactivity of the salivary glands and bone mobility at the fractured site [11, 12, 16].

One of the major goals of its treatment is focused on the union of fractured segments restoring the pre-injury strength and function. This requires a proper anatomical reduction and immobilization that will consolidate the fractured segments [16, 17].

The functionally stable internal fixation is the treatment of choice for the vast majority of mandibular fractures by the rapid return of the functions of the masticatory system [8, 16].

This study aims to address the simplification method in the reduction of the comminuted fractures for a stable internal fixation with two reported cases of comminuted mandible fractures, treated by the method of open reduction and rigid internal fixation, emphasizing the importance of a correct diagnosis and treatment.

Case Reports

Case Report 1

E.S.S patient, 25 years old, male was treated in the emergency department of the Hospital Regional do Cariri (HRC), in Juazeiro do Norte – CE, reporting he has been a victim of a motorcycle accident. Facial asymmetry was evident, moderate edema in the left part of the face and ipsilateral submental bruise. On intraoral examination, a sublingual hematoma was checked, bone discontinuity of the mandibular arch in body region, unstable occlusion and crepitus to palpation. The radiographic examination revealed a fracture in the right side angle region, symphysis, parasymphysis, bilateral subcondylar and comminuted fracture on the left side of the body of the mandible. **(Figure 1)**

After submandibular access, the presence of multiple bone fragments was observed in the region **(Figure 2)**. Then, an intraoral access was realized for exposure of the fracture of the mandibular angle **(Figure 3)**.

To facilitate the reduction in this approach, intermaxillary fixation was performed with 4 intermaxi-

Figure 1: AP radiography of the mandible and Towne's AP showing fractures.

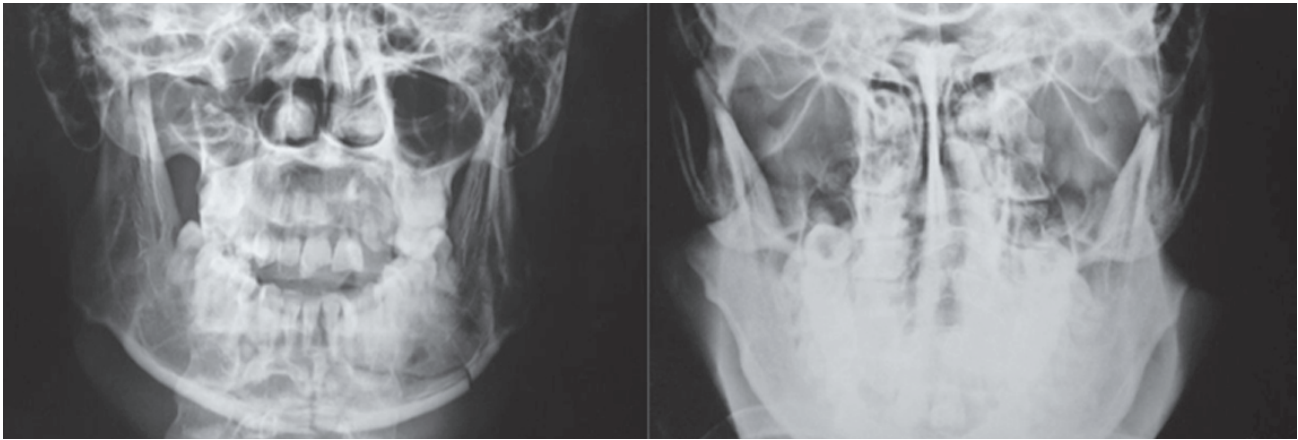


Figure 2: Surgical access with display of fractured stumps.



Figure 3: Surgical access with visualization of intraoral and contralateral fractured stumps.



illary fixation screws (IMF®) and steel wire n° 1 (Aciflex®), guided by dental occlusion. For fixation of the mandible, the simplification of the fracture was done joining the smaller fragments with 2.0 mm titanium

plates system, facilitating the definitive fixation with a “load bearing” reconstruction plate of the 2.4 system. The mandibular contour was reconstructed and occlusion was restored (**Figure 4, 5 and 6**).

Figure 4: Alignment of the fracture and fixation following the oblique jaw line with a 2.0 mm titanium plate system.



Figure 5: Simplification of fractured stumps with mini-plates.

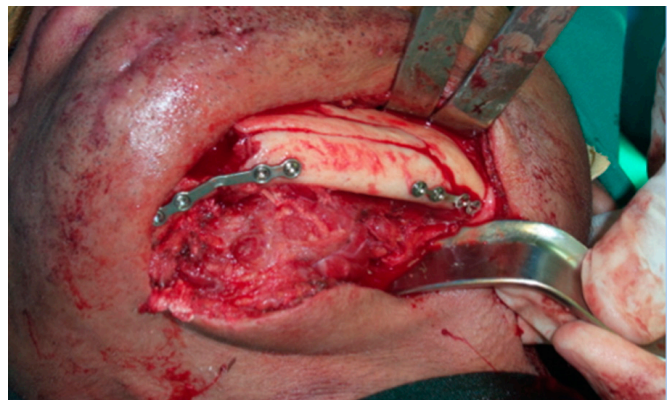
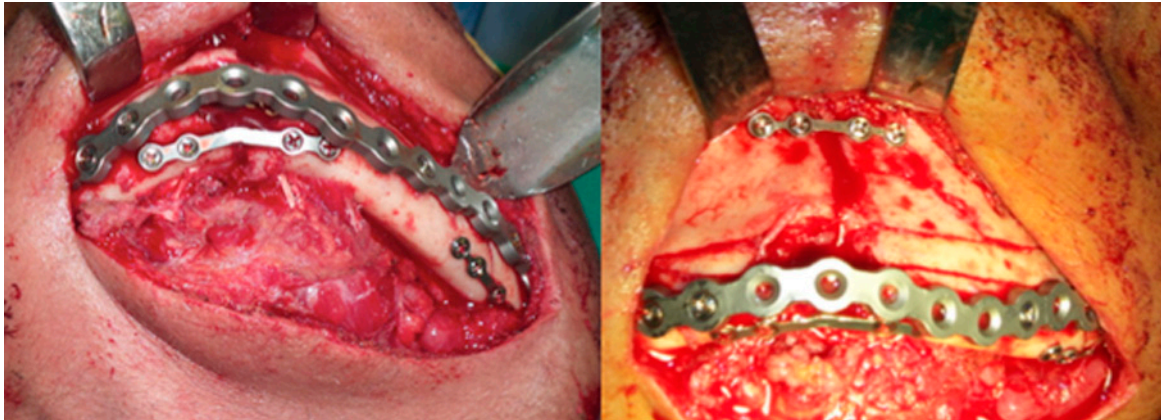


Figure 6: Stable Internal Fixation with 2.4 reconstruction plate.**Figure 7:** Postoperative Radiography.

The stability of fixed fragments and the obtained occlusion were tested with a clinically satisfactory result and the essig-type splint was removed, and the intermaxillary fixation was released with maintenance of the IMF screws.

Functional approach was adopted for the undisplaced subcondylar fractures with the use of Class II elastic bands 7 weeks in the IMF screws, and the patient was instructed to perform physiotherapy exercises 4 times a day.

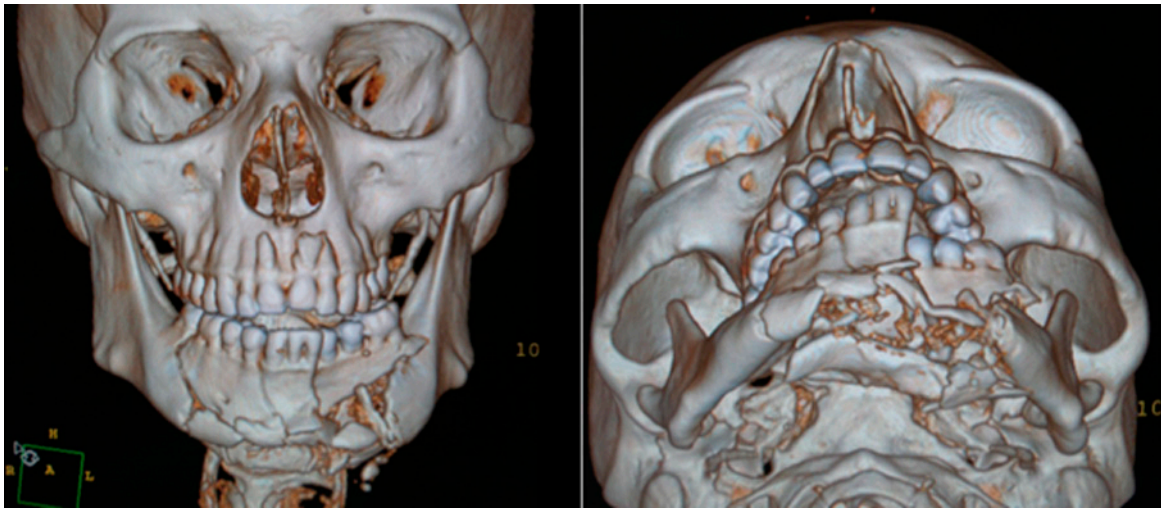
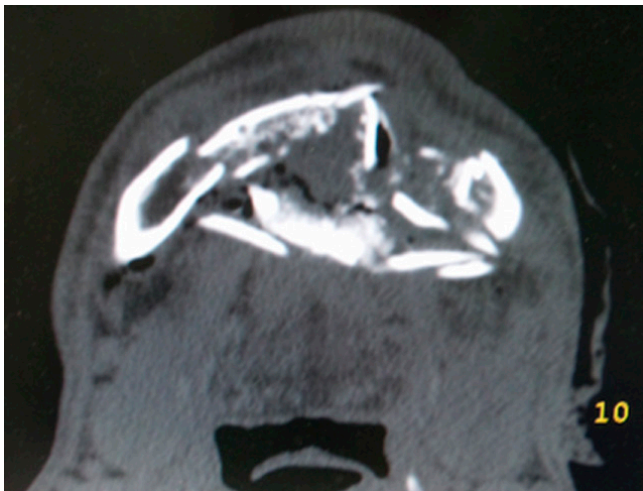
The alignment of the repositioned fragments was verified radiographically and found to be satisfactory (**Figure 7**).

Case report 2

J.S.S, Patient, 46 years old, male, victim of a fall from a height of 13 meters, was attended by the Oral and Maxillofacial Surgery Service of the Hospital Regional do Cariri –CE. The patient was

found with facial trauma with partially obstructed airways, conscious, oriented and pallor. There was evidence of open fracture of the anterior mandible region with facial swelling and loss of chin prominence. Examination revealed an open fracture of the mandible, sublingual hematoma and lingual ptosis. Computed tomography (CT), revealed a highly comminuted fracture of anterior mandibular region with multiple bone fragments (**Figure 8, 9**).

An immediate intervention for reduction and fixation of the fracture was chosen. The access was made through the lacerations. After mucoperiosteal detachment, the presence of multiple bone fragments belonging to the body portion and extension for alveolar process were observed (**Figure 10**). Intermaxillary fixation was applied using an Erich bar on the mandible and 4 intermaxillary fixation screws (IMF®) for stabilization of the occlu-

Figure 8: Computed tomography with three-dimensional reconstruction .**Figure 9:** Computed tomography in axial section, preoperative.**Figure 10:** Surgical access through traumatic wound with visualization of fractured stumps.**Figure 11:** Maxillomandibular block and reduction of dental occlusion.

sion (**Figure 11**). Then we proceeded to the union of larger fragments joined to the fixed portions, and after the smaller were fixed by means of mini-plates and screws of the 2.0mm system, wherein the fracture is simplified to provide further strength and stability with plates and screws of the 2.4mm system (Load Bearing) of high profile, in which the jaw line was reconstructed (**Figure 12 e 13**).

Figure 12: Simplification of the reduction with union of the smaller fragments.

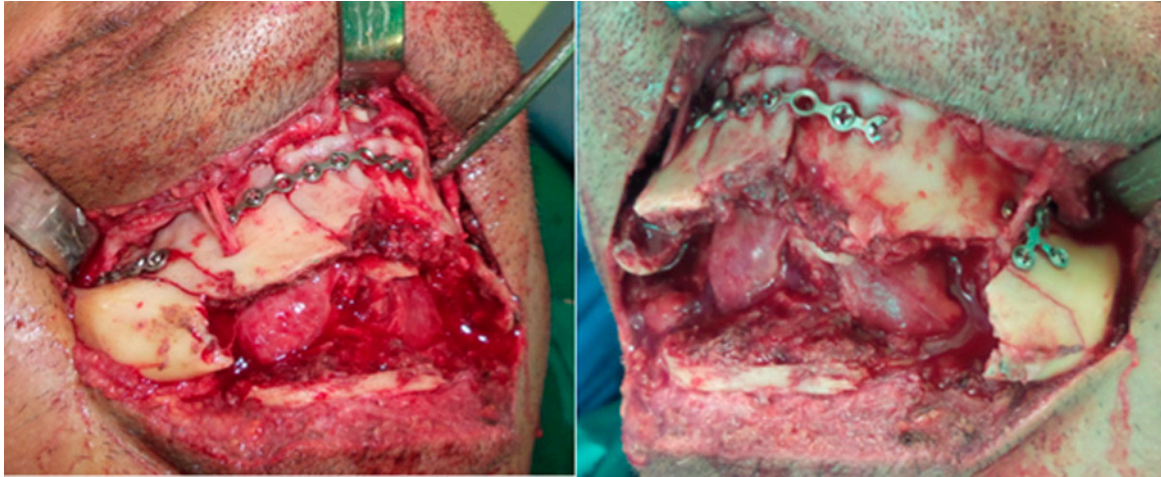


Figure 13: Stable internal fixation with mandibular reconstruction with 2.4 plates.



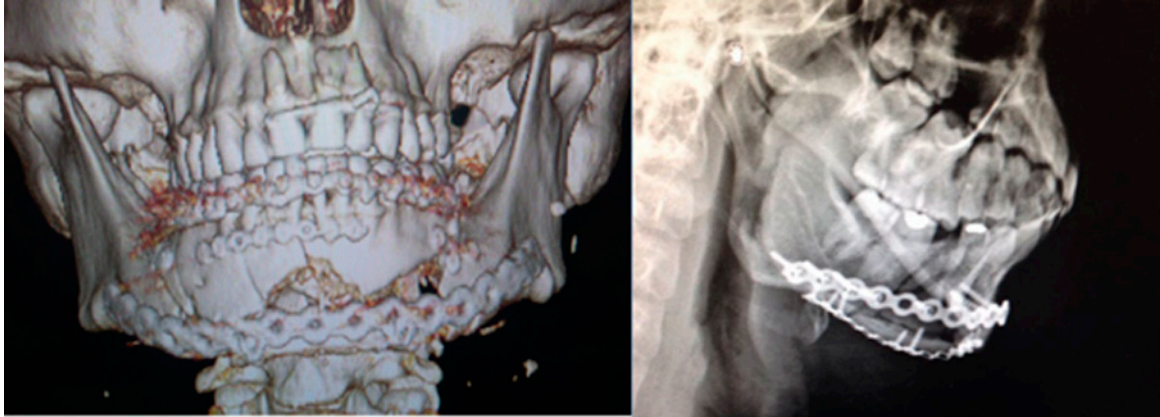
The clinical and radiographic analysis (CT) in the postoperative, found stable occlusion, satisfactory mouth opening and the alignment of properly repositioned fragments with well adapted plates (**Figure 14 and 15**)

Discussion

Cranio-maxillofacial trauma can be considered one of the most devastating aggressions found in trauma centers because of its emotional consequences, the possibility of deformity and also the economic impact caused in the public and private health system [18]. Treatment is multidisciplinary, involving mainly the specialties of traumatology, speech therapy, ophthalmology, plastic surgery, neurosurgery and physiotherapy [12, 18].

Studies have shown that the treatment of mandibular fractures primarily aim the restoration of the pre-injury occlusion, acceptable aesthetics and their anatomical form and function. For this, it is necessary to be based on the principles that govern the traumatology: reduction, fixation, immobilization and supportive therapies [11, 16, 17, 19].

The conservative treatment is a course taken when there is minimum displacement of the bone fragments by the action of the mastication muscles. In these cases, with a simple monitoring and

Figure 14: Postoperative computed tomography..**Figure 15:** Satisfactory occlusal, functional and aesthetic results.

guidance, function is restored; other times, the surgeon performs an intermaxillary fixation [20, 21].

In general, the authors recommend that the treatment of mandibular fractures without displacement or with minimum displacement should be closed or conservative treatment, obeying the principles of immobilization through the fixation of Erich bars, by essig-type splint and intermaxillary fixation with elastic bands for 45 to 90 days [10, 11, 16, 19, 21, 22].

In the case number 1 reported here, we opted for a closed treatment with elastic bands, for the consolidation of subcondylar fractures, given the presence of minimum displacement of the fractured segments.

On the other hand, in the presence of displacement of the bone fragments, the treatment must be surgical or open, with stable rigid internal fixation in order to get better results [10, 22, 23].

The simplification of the comminuted fragments with mini-plates and screws are used as an aid in

reducing fractures, for subsequent fixation with reconstruction plates [19].

In the reported cases, because they are comminuted fractures of the mandible, the fractures when simplified, provide strength and stability to the use of reconstruction plates. The main advantages of this technique are: to provide reductions with greater precision and stability, to eliminate the need for post operative prolonged intermaxillary fixation, rapidly rehabilitate and restore the function in the immediate postoperative period, contributing greatly to the overall health status of the patient [12, 24, 25].

The use of simplification and stable internal fixation in the reduction of comminuted fractures of the mandible is an effective treatment, provided that the oral and maxillofacial surgeons have knowledge of mandibular anatomy and physiology as well as knowledge of the fixation principles and surgical techniques of applying the system of osteosynthesis. The most important fact is that they should possess "common sense" when they are using this system [12, 21].

Conclusion

The simplification of mandibular comminuted fractures proves to be an excellent ally when one intends to reduce difficulties of reduction of the fracture and the dental occlusion on the transoperative, as well as to facilitate the application of 2.4 reconstruction plates.

Consent

Written informed consent was obtained from the patients for publication of this Cases report and any accompanying images, although they preserved their identities

Ethics questions

The ethical committee of the Regional Hospital of Cariri, for case presentation, approved the current study.

Competing interests

The authors declare no conflicts of interest. All research was conducted with their own resources.

Financial resources

The authors state that they used their own resources and did not receive financial aid from any institution. The authors state that they did not receive financial aid from any institution (political, personal, religious, ideological, academic, intellectual, commercial, or any other).

References

1. Patrocínio, GP. et al. Mandibular fracture: analysis of 293 patients treated in the Hospital of Clinics, Federal University of Uberlândia. *Rev Bras Otorrinolaringol* 2005, V.71, n.5, 560-65, sep./oct.
2. Wulkan, M.; Parreira, JR.; Botter, DA. Epidemiologia do trauma facial. *Rev. Assoc. Med. Bras* 2005 v. 51, n. 5, p. 290-5.
3. Sassi, LM.; Dissenha., JL. et al. Fratura da mandibular: revisão de 82 casos. *Rev. Bras. Cir. Cabeça Pescoço* 2010, v.39, no 3, p. 190-192.
4. Busuito, MJ.; Smith, JRDJ.; Robson, MC. Mandibular fractures in the urban trauma center. *J Trauma* 1986, v. 26(9), p. 826-0.
5. Gassner, R.; Tuli, Tarkan.; Hachl, O.; Rudisch, A.; Ulmer, H. Cranio-maxillofacial trauma: a 10 year review of 9543 cases with 21067 injuries. *Journal of Cranio-Maxillofacial Surgery* 2003, v. 31, p. 51-61.
6. Motamedi, MH. An assessment of maxillofacial fractures: a 5-year study of 237 patients. *J. oral Maxillofac. Surg* 2003, v. 61, n. 1, p. 61-4.
7. Andrade Filho, EF.; Fadul, JRR.; Azevedo, RA.; Rocha, MAD.; Santos, RA.; Toledo SR., et al. Fraturas de mandíbula: análise de 166 casos. *Rev Assoc Med Bras* 2000, v.46(3), p. 272-6.
8. Zhi, LI.; Zu-bing, LI. Clinical Characteristics and treatment of multiple site comminuted mandible fractures. *Journal of Cranio-Maxillo-Facial Surgery* 2011, v. 39, p. 296-299.
9. Ellis, E.; Moos, KE.; El-attar, A. Ten years of mandibular fractures: An analysis of 2,137 cases. *Oral Surg* 1985, v. 59, p. 120-9.

10. Fonseca, RJ. Oral and Maxillofacial Trauma, 3 ed. Philadelphia: W.B. Saunders Company, v. 3, 500p, 2000.
11. Miloro, M. Peterson's Principals of Oral and Maxillofacial Surgery. 2 ed. Philadelphia: BC Decker. 2004.
12. Camargo, IB.; Oliveira, DM.; Fernandes, AV.; farias, EM. Fratura parassinfisária em Mulher Vítima de Violência Doméstica: Relato de Caso. *Rev. Cir. Traumatol. Buco-Maxilo-Fac* 2012, Camaragibe v.12, n.1, p. 9-16, jan./março.
13. Hupp, JR.; III, EE.; tucker, MR. Cirurgia oral e maxilofacial contemporânea. São Paulo, 5ed., Elsevier, 2009. 704p.
14. Finn, RA. Treatment of comminuted mandibular fractures by closed reduction. *J Oral Maxillofac Surg* 1996, v54, p. 320-327.
15. Dingman, RO.; natvig, P. Cirurgia das fraturas faciais. São Paulo: Ed. Santos, 3a Reimpressão, 2004.
16. Futran ND. Management of comminuted mandible fractures. *Operative Techniques in Otolaryngology* 2008, Vol 19, No 2.
17. Vasconcellos, RJH.; Oliveira, DM.; Santos KPC.; Calado, MV. Métodos de tratamento as fraturas mandibulares. *Rev. Cir. Traumat. Buco-Maxilo-Facial* 2001, v.1, n2, p.21-27.
18. Wulkan, M.; Parreira Jr, J.G.; Botter, D.A. Epidemiologia do Trauma Facial. *Rev Assoc Med Bras* 2005 v.51, n.5, p.290-5.
19. Bagheri, SC.; Bell, RB.; Khan, HA.; Terapias atuais em Cirurgia Bucomaxilofacial. 1. ed., Rio de Janeiro: Elsevier. 2013.
20. Toledo Filho, JL. et al. Utilização De Miniplacas No Tratamento De Fraturas Da Mandíbula. *Revista da APCD* 1998, v. 52, n. 1.
21. Caubi, AF. et al. Fratura de mandíbula em pacientes geriátricos: Relato de caso clínico. *Revista de Cirurgia e Traumatologia Buco-Maxilo-Facial* 2004, v.4, n.2, p. 115-120.
22. Gomes, ACA. et al. Tratamento Das Fraturas Mandibulares: Relato de Caso Clínico. *Rev. Cir. Traum. Buco-Maxilo-Facial* 2001, v. 1, n. 2, p. 31-38.
23. Souza, LCM.; Lucca, MES. Fratura de mandíbula: análise de 282 pacientes. *Revista Paulista de Odontologia* 1992, n.1, p. 2-4.
24. Schmidt, BL.; Kearns, G.; Gordon, N.; Kaban, LB. A financial analysis of maxillomandibular fixation versus rigid internal fixation for treatment of mandibular fractures. *J Oral Maxillofac Surg* 2000, v. 58, n. 1206-10.
25. Zronba, H.; Lutz, JC.; Zinhk, S.; Wilk, A. Epidemiology and treatment outcome of surgically treated mandibular condyle fractures. A five years retrospective study. *Jornal of Cranio-Maxillo-Facial Surgery* 2014, v. 42, p. 879-884.

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