

Comparison of bite force recovery following treatment of isolated mandibular angle fracture using miniplates

¹Dr. Bheemappa. F.B, Reader Department of Oral and Maxillofacial Surgery, PMNM Dental College and Hospital, Bagalkot.

²Dr. Rajat Kumar Jain, Senior resident Department of Oral and Maxillofacial Surgery PMNM Dental College and Hospital, Bagalkot.

³Dr. Santosh. S. Gudi, Professor and Head, Department of Oral and Maxillofacial Surgery, PMNM Dental College and Hospital, Bagalkot.

⁴Dr. Tejaswini, Senior lecturer Department of oral and Maxillofacial Surgery, PMNM Dental College and Hospital, Bagalkot.

⁵Dr. Soumya Allurkar, Reader Department of Oral and Maxillofacial Surgery, PMNM Dental College and Hospital, Bagalkot.

⁶Dr. Soumya Sulibhavi, Senior lecturer Department of Oral and Maxillofacial Surgery, PMNM Dental College and Hospital, Bagalkot.

Corresponding Author: Dr. Tejaswini, Senior lecturer Department of oral and Maxillofacial Surgery, PMNM Dental College and Hospital, Bagalkot.

Citation of this Article: Dr. Bheemappa. F.B, Dr. Rajat Kumar Jain, Dr. Santosh. S. Gudi, Dr. Tejaswini, Dr. Soumya Allurkar, Dr. Soumya Sulibhavi, “Comparison of bite force recovery following treatment of isolated mandibular angle fracture using miniplates”, IJDSIR- June - 2022, Vol. – 5, Issue - 3, P. No. 169 – 174.

Copyright: © 2022, Dr. Tejaswini, et al. This is an open access journal and article distributed under the terms of the creative commons attribution non-commercial License. Which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Background: The fracture is defined as “breach in the continuity of bone”. Facial area is one of the most frequently injured area of the body, accounting for 23–97% of all facial fractures. Mandible is the only mobile bone of facial skeleton and their has been a significant increase in number of cases in recent years. The energy required to fracture it being of the order of 44.6–74.4 kg/m, which is about the same as the zygoma and about

half that for the frontal bone. It is four times as much force is required to fracture maxilla

Angle fractures are often unfavourable because of the actions of the masseter, temporalis, and medial pterygoid muscles, which distract the proximal segment superomedial Ly.

Involvement of the mandibular angle in 23% of jaw fractures can be attributed to its relatively thin cross-sectional area and its location near the third molar tooth socket. Unerupted or impacted third molar create

weakness in the angle region of the mandible. Complications arising from these fractures include fracture non-union, malunion, dental malocclusion, and osteomyelitis.

Miniplate osteosynthesis, first introduced by Michelet in 1973, and further developed by Champy et al in 1975, is the current standard for the treatment of mandibular fracture.

The normal bite force of the individual varies from 120 N to 800 N depending on age, sex, site and method of measurement.

Maximum voluntary bite force is an indicator of the functional state of the stomatognathic system, and its magnitude is the result of the combined action of the jaw elevator muscles modified by jaw biomechanics, their muscle cross sections, muscle sarcomere length and reflex mechanisms. In this way, the measurement of bite force can provide useful data for the evaluation of jaw function and activity.

Keywords: fracture, Bite force, Mini plates, Angle fracture

Introduction

Facial area is one of the most frequently injured area of the body, accounting for 23–97% of all facial fractures.

Mandible is the only mobile bone of facial skeleton and their has been a significant increase in number of cases in recent years. It is the second most commonly occurring fractures next to nasal bone fractures when considering facial fractures. It is the tenth most commonly occurring fracture when considering the frequency of bone fractures of the whole body.¹

Involvement of the mandibular angle in 23% of jaw fractures can be attributed to its relatively thin cross-sectional area and its location near the third molar tooth socket. Unerupted or impacted third molar create weakness in the angle region of the mandible.[2] Angle

fractures are often unfavourable because of the actions of the masseter, temporalis, and medial pterygoid muscles, which distract the proximal segment superomedial Ly.[3]

The therapeutic goal of any fracture management is to restore the original anatomic form and function as soon as possible without any morbidity. The normal bite force of the individual varies from 120 (Newton) N to 800 N depending on age, sex, site and method of measurement. [4,5] Maximum voluntary bite force is an indicator of the functional state of the stomatognathic system, and its magnitude is the result of the combined action of the jaw elevator muscles modified by jaw biomechanics, their muscle cross sections, muscle sarcomere length and reflex mechanisms. In this way, the measurement of bite force can provide useful data for the evaluation of jaw function and activity. [4,5]

The purpose of this study is to determine the clinical and functional stability and efficacy in the management of mandibular angle fractures treated with miniplates using bite force measurements, post-operatively.

Methodology

Twenty (20) individuals were selected for the study and were divided into two groups namely Group a, group b.

Group a (control group) included 10 individuals who were not medically compromised, with full complement of teeth and no history of previous trauma with an age group of 20 to 50 years.

Group B (study group) included 10 individuals who reported to the Department of Oral and Maxillofacial surgery, P M N M Dental college, Bagalkot, and were diagnosed to have mandibular angle fracture of age group between 20 to 50 years.

After proper clinical and radiographical examination, the 10 patients with mandibular angle fracture underwent

open reduction and internal fixation (ORIF), through an intra-oral approach using mini plates and screws under general anesthesia (GA). The bite force was measured post-operatively at a follow up intervals of 1st week, 1st month, 3rd month and 6th month using bite force device.

Inclusion criteria

1. Patients diagnosed with Mandibular angle fracture, requiring open reduction and internal fixation for treatment.

2. Subject medically fit and willing to participate in this study.

Exclusion criteria

1. Medically compromised patients for surgical procedure.
2. Patients with infection.
3. Patients with associated bone pathology.
4. Patients with compromised immunity.
5. Patients with midface, dentoalveolar and any other fractures of the jaw.



Figure 2

Follow up

The patients were followed up on 1st week, 1st Month, 3rd Month and 6th month post-operatively. The parameters which were recorded are shown in case history and examination record as shown in early post-operative follow up sheet.

Patient was evaluated Clinically and Radiographically for occlusion, infection and plate stability. The bite force was recorded postoperatively on 1st week, 1st Month, 3rd Month and 6th month.

Results

Table 1: Comparison of study group and control group with bite force

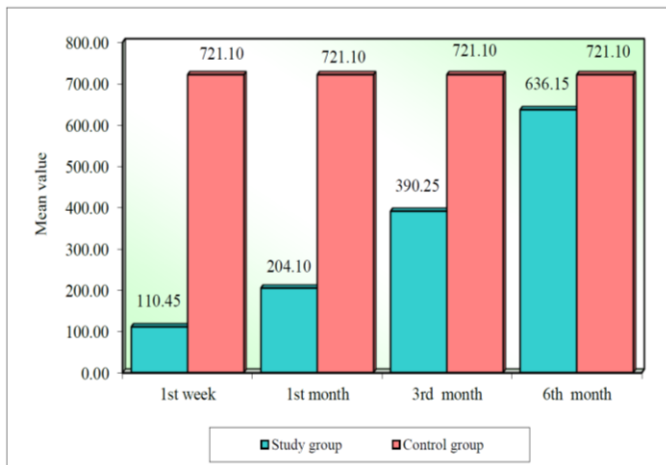
| Time points | Study group | | Control group | | t-value | p-value |
|-----------------------|-------------|----------|---------------|----------|----------|---------|
| | Mean | Std.Dev. | Mean | Std.Dev. | | |
| 1 st week | 105.80 | 16.81 | 720.80 | 60.94 | -30.7623 | 0.0001* |
| 1 st month | 202.40 | 34.31 | 720.80 | 60.94 | -23.4402 | 0.0001* |
| 3 rd month | 394.60 | 71.07 | 720.80 | 60.94 | -11.0181 | 0.0001* |
| 6 th month | 633.60 | 96.87 | 720.80 | 60.94 | -2.4095 | 0.0269* |

*p<0.05



Figure 1

In this study, the mean bite force of the patient at 1st week follow up was 110.45, 204.10 at 1st month, 390.25 at 3rd month & 636.15 at 6th month follow up respectively. The mean bite force of control group in the study was 721.10



Graph 1: Comparison of study group and control group with bite force scores at different treatment time points in total samples.

Discussion

Bite force is considered as one of the indicators for the functional restoration of the masticatory system that results from the action of jaw elevator muscles modified by the craniomandibular biomechanics. [6] It is the cumulative effect of number of factors such as number of residual teeth, tactile impulses, pressure and pain perception in periodontal ligament. There is a reduction in bite force with age due to age dependent deterioration of dentition.

mandibular angle is a region particularly prone to fracture from falls or attack, comprising 25% to 33% of all mandibular fractures. In fact, according to Moore, a change in the direction of the bone tends to weaken the angle region of the mandible and increases its susceptibility to fracture. This is observed in the area where the horizontal body and vertical ascending ramus meet. Presence of incompletely erupted third molars is associated with an increased risk of angle fracture.[7]

Masseter muscle and medial pterygoid muscle are attached to the angle and these can cause displacement of bone fragments after fracture. Reduction as a treatment for fracture should be considered especially for patients with a mandibular third molar.[8]

So, with this study we have tried to determine the clinical and functional stability and efficacy in the management of mandibular angle fractures treated with miniplates using bite force measurements, post-operatively.

The age distribution of the patients in our study was between 20-50 years with a mean age of 30.8 years. Majority of the individuals in this age group have complete permanent dentition, which is a necessity for the measurement of bite force and that their bite force remains relatively constant during this period. A review by Koc et.al. states that normal aging process causes change in masticatory muscle force, and it stays fairly constant from about 20 years to 50 years of age and then declines.[9]

The gender wise distribution of the patients in this study were, 7 (70%) males and 3(30%) females. The majority of the patients in this study were males which was similar to the study conducted by Wook-Jae Yoon et al in 2014. In their study 56 males (90.3%) and 6 females (9.7%) were present.[10]

Preoperative assessment of fracture fragments in the study groups showed unstable fracture whereas postoperative assessment from 1st week to 6th months showed stability of fracture fragments.

In the present study, bite force was measured at an intervals of post-operative 1st week, 1st month, 3rd month and 6th month post-op. and was compared with control group. The mean bite force of the patient at 1st week follow up was 110.45, 204.10 at 1st month, 390.25 at 3rd month & 636.15 at 6th month follow up

respectively & was statistically significant with the p value being 0.0001 respectively.

In the study conducted by Gerlach and Schwarz which evaluated maximal bite force in 22 mandibular angle fracture patients treated with mini plate osteosynthesis as advocated by Champy. The authors found postoperatively (after 1 week) only 31% of the maximal vertical loading as compared to controls was registered. These values increased to 58% at the 6th week postoperatively.[11] In a comparable study Tate et al also evaluated vertical bite forces after treatment of angle fractures using two miniplates. They found at 6 weeks postoperatively 52% of molar forces obtained within a control group and Sonnenberg & Voelker reported 50% after use of compression osteosynthesis. [12]

Furthermore, the patient's willingness to bite hard is also a major factor. This is related both to mental attitude and to the comfort of the teeth, so some patients especially within the first postoperative weeks are afraid to use their jaws vigorously. This explains the reason for the low values of bite forces recorded in this study at the end of first postoperative week which were also found in the study done by Varga S et al in 2010.[13]

The mean bite force of the patient on the right-side 1st week post operatively was 115.10 which significantly increased to 638.70 in th 6th month post op. Similarly on the left side, 1st week post operatively mean bite force was 105.80 which significantly increased to 633.60 in th 6th month post op. Ellis and Walker in 1996, have found that bite forces in the acute postoperative period are much lower than bite forces recorded later in the postoperative period or in the non- operated population. These results were in agreement to our results in this study. Mastication forces have been shown to decrease

dramatically after a fracture, with the values gradually returning to normal as healing progresses.[14]

Conclusion

The results obtained suggested that the miniplates fulfilled the treatment goals of adequate immobilization, fixation and stabilization of mandibular fractures. This system is easy to adapt and reduces operating time. The biteforces of patients treated using miniplates showed better improvement at the end of 6th month postoperative week. Though a more extensive study with more number of patients and longer period of follow up, is required to come to a definitive conclusion.

References

1. Fonseca and Walker: Textbook of Oral and Maxillofacial Trauma, Third edition, Volume I; Elsevier Saunders
2. Fedok et al.: Repair of Mandibular Angle Fractures. Laryngoscope, 1998; 108:1218-1224.
3. Mustafa et al. "Comparison of bite force recovery following treatment of mandibular angle fracture using one and two miniplates." Alexandria Dental Journal. (2017) Vol.42 Pages:147-154.
4. Varga S, Spalj S, Milesovic S, Mestrovic S, Slaj M. Maximum voluntary molar bite force in subjects with normal occlusion. European Journal of Orthodontics 2011; 33:427-433.
5. Hagberg C. Assessments of bite force: A Review. Journal of Craniomandibular Disorders: Facial & Oral pain 1987; 1(3).
6. Koc D, Dogan A, Bek B. Bite force and influential factors on bite force measurements: a literature review. European journal of dentistry. 2010 Apr;4(2):223.
7. Singh S, Fry R, Joshi A, Sharma G, Singh S. Fractures of angle of mandible- A Retrospective study. Journal of Oral Biology and Craniofacial Research 2012;2(3):154-158.

8. Pal, Dr. Kuldeep & R, Dr. Susmitha & Mitra, Dr. G.V. & Moti vale, Dr. Tejas & Tiwari, Dr. Swati. (2017). evaluation of post-operative bite force in mandible fractures treated with open and closed reduction. *International Journal of Advanced Research*. 5. 1002-1008. 10.21474/IJAR01/3245.
9. Bakke M. Bite force and occlusion. In *Seminars in orthodontics* 2006 Jun 30 (Vol.12, No. 2, pp. 120-126). WB Saunders.
10. Wook-Jae Yoon etal: A Clinical Study of Mandibular Angle Fracture. *Maxillofac Plast Reconstr Surg* 2014;36(5):201-206.
11. Jain GC, Jain R, Dwivedi H. A comparative evaluation of bite force as a parameter for the stability in conventional and three-dimensional mini plates. *Indian J Dent Sci* 2018; 10:133-8.
12. Gerlach and Schwarz. Bite forces in patients after treatment of mandibular angle fractures with miniplate osteosynthesis according to Champy. *Int. J. Oral Maxillofac. Surg.* 2002; 31: 345–348.
13. Varga S, Spalj, S., Lapter Varga, M., Anic Milosevic, S., Mestrovic, S., &Slaj, M. (2010). Maximum voluntary molar bite force in subjects with normal occlusion. *The European Journal of Orthodontics*, 33(4), 427–433.
14. Bakke M. Bite force and occlusion. In *Seminars in orthodontics* 2006 Jun 30 (Vol.12, No. 2, pp. 120-126). WB Saunders.