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PROSPECTIVE STUDY TO MEASURE AND COMPARE BITE FORCE IN PATIENTS WITH MANDIBULAR FRACTURE TREATED WITH 2.4MM LOCKING PLATE VS 2.7MM NONLOCKING PLATE.

Dental Science

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ABSTRACT

Aims : To compare bite force in patients with mandibular fractures treated with 2.4mm locking vs 2.7mm nonlocking plates.

Material and Methods: A prospective randomized clinical study was conducted at Taj Hospital and Dental Clinic, Agra, to treat consecutive mandible fractures. The patients were randomly divided into two groups.

Group 1: Treated with 2.4mm locking titanium plates.

Group 2: Treated with 2.7mm nonlocking titanium plates.

The cause of trauma, the number of days from injury to surgery, average age, gender and site of distribution were all reviewed. The assessment was done at 1st, 3rd, 6th week and 3rd month using bite force as a clinical parameter. Bite force was recorded using gnathodynamometer consisting of a strain gauge.

Results: A total of 24 patients with mandibular fractures selected met the inclusion criteria. In our study, a statistically significant difference was found between the two groups. However bite force gradually increased at a similar rate in both the groups on subsequent follow up.

Conclusion: Locking plates are more effeicient in bearing masticatory force during oeteosynthesis of fracture.

KEYWORDS

Mandible Fracture, Locking, Nonlocking, Biteforce.

INTRODUCTION

Mandibular fractures are common facial injuries accounting for 40 to 65% of all maxillofacial fractures. The most common causes of mandibular fractures were motor vehicle accidents and assaults.[1,2] The best time to do osteosynthesis is soon after injury.[3,4] Champy et al recommended fixation within 12 hours of injury. With the development of osteosynthesis in maxillofacial surgery, different systems have been designed. They have become smaller, easy to handle and extraoral incision can be avoided.

The four main goals of treating mandibular fractures are:-

1) Anatomical reconstitution
2) Immobilization
3) Prevention of infection
4) Rehabilitation of function

Different techniques for treatment of mandibular fractures evolved in past few decades ranging from intermaxillary fixation, wire osteosynthesis, miniplate osteosynthesis and rigid fixation. The basic concept of rigid fixation is absolute stability. Two fundamental principles are required to obtain adequate rigid internal fixation for comminuted fractures. First, the fixation needs to support the full functional loads (Load-Bearing Osteosynthesis). Second, absolute stability of fracture construct must be achieved,[8,12] this is a prerequisite for sound bone healing and early rehabilitation of function.

Bite force is considered as one of the best indicator of functional rehabilitation of masticatory function,[26] in addition bite force has been considered important in the diagnosis of disturbances of stomatognathic system.[27]

MATERIALS AND METHODS

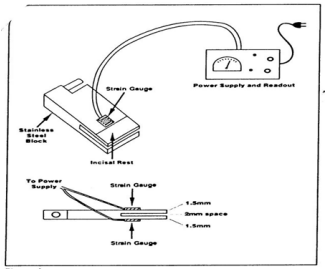
The study comprised of 24 patients having mandibular fractures. They were randomly selected irrespective of cast, creed, age and sex. Inclusion criteria included patients having mandibular fractures with comminuting, infection, pathological fracture, continuity defect and trauma. Informed consent was taken to participate in the study. The patients were divided into two groups consisting of 12 patients in each group.

Group 1: Treated with 2.4mm locking titanium plates.
Group 2: Treated with 2.7mm nonlocking titanium plates

Surgery was performed under general anesthesia . Standard instruments were used for maxillofacial surgery. Basic operative technique for operating in both the groups was same.

Bite force measuring instrument (Gnathodynamometer) consist of following parts[fig 1].

Figure 1- Circuit diagram of Gnathodynamometer



1) Biting member:- Stainless steel alloy (316 molybedenum bearing austenitic stainless steel) more resistant to general corrosion.
2) Strain gauge:- A device whose electrical resistance varies in proportion to amount of strain in the device.
3) Three core shielded wire cable:- Three core shielded wire of one meter length used to connect the two strain gauges into the bridge circuit.
4) Signal conditioning circuit:- It consists of strain gauge and instrumentation amplifer.
5) Digital panel meter (DPM):- To display bite force. When force is applied on biting member the resistance of the strain gauge increases, producing some unbalanced bridge output on the amplifier. A digital panel meter display the number and thus precision weights are co-related [28][fig 2]

Fig. 2 Bite Force Measuring Device with Digital Panel Meter

To measure bite force the patient was seated on dental chair with head unsupported and positioned so that the Frankfurt Horizontal Plane would be parallel to the floor. The patients were explained about the procedure and instructed to bite maximally when asked [fig 3]. The fork was placed parallel to the dental arch so that biting member was positioned in the right maxillary first molar region. In the beginning of the test, each subject was asked to bite on the fork as trial in order to make him familiar with the equipment and no measurement was made. Consecutively, a series of three recordings were taken and noted. The rest period of one minute was given between each recording to prevent muscle fatigue. Mean of three recordings was taken as maximum bite force (MBF) in molar region.

Fig. 3 Measurement of Bite Force in Patient

RESULTS

The postoperative assessment of patients was done on the basis of bite force measurement at 1st week, 3rd week, 6th week and 3rd month postoperatively [table 1,2]. In both locking and nonlocking groups, MBF increased gradually at subsequent follow ups. Both groups have shown significant increase in bite force at 3rd week [table 1,2]. In locking group there was significant increase in bite force at all follow up as compared to nonlocking group [table 3].

Table 1 - Bite force measurement (Newton) in group A at subsequent follow up.

Patient S.No	1st week	3rd week	6th week	3rd month
1.	350	370	390	410
2.	352	371	400	430
3.	341	367	380	410
4.	320	379	410	425
5.	310	368	400	415
6.	305	350	390	423
7.	341	410	412	435
8.	340	396	410	435
9.	349	410	430	446
10.	336	390	405	425
11.	321	380	410	416
12.	326	379	415	418

Table 2 - Bite force measurement (Newton) in group B at subsequent follow up.

Patient S.No	1st week	3rd week	6th week	3rd month
1.	350	370	390	410
2.	352	371	400	430
3.	341	367	380	410
4.	320	379	410	425
5.	310	368	400	415
6.	305	350	390	423
7.	341	410	412	435
8.	340	396	410	435
9.	349	410	430	446
10.	336	390	405	425
11.	321	380	410	416
12.	326	379	415	418

Table 3- Comparison of Mean bite force (MBF) in each group at subsequent follow up.

Mean bite force (MBF)	1st week	3rd week	6th week	3rd month
Group A (locking)	372	428	435	440
Group B (non locking	333	380	404	424

DISCUSSION

According to Arbeitsgemeinschaft fur Osteosynthesefragen (AO)/ Association for the study of Internal Fixation (ASIF) principles, the main aim of open reduction and rigid internal fixation in management of mandibular fractures is to achieve undisturbed healing and immediate restoration of form and function without the adjunctive use of intermaxillary fixation. This approach has become increasingly popular during the past 20 years for all types of mandibular fractures and diverse plating systems have been developed to meet this fundamental requirement.[13-16] The locking plating system has been developed and popularized by AO/ASIF to obviate the main disadvantage of conventional plate system, which requires the plate to be perfectly adapted to the underlying bone to avoid gaping of the fracture and associated instability. The locking bone plate system acts as an internal-external fixator, which results in better distribution of the load and prevents load concentration on a single screw, thus decreasing the risk of screw's loosening and stripping. Moreover, because anatomic adaptation of the plate to the underlying bone contour is not crucial, there are theoretically a fewer interferences with the adjacent vascular supply.[17,18]

Cordey et al. stated that the friction between screw head and plate is the main weak point of the entire fixation.[21] In locking system the thread on screw head locks into the congruent thread of the plate, transforming the screws and plate into a unit, creating a rigid splint with higher mechanical stability. The absence of major complication and gradual significant increase in bite force corroborates the two main biological and mechanical advantages reported by experimental studies on locking plates, which allow for more rapid and undisturbed bone healing.[23-25]

In our study, in both groups bite force increases significantly at 3rd week. Locking group however show significant increase in bite force at all follow up as compared to nonlocking group.

CONCLUSION

Present study has demonstrated that treating mandibular fractures with 2.4mm locking reconstruction plate allows fast recovery and minimal complication as compared to non locking counterpart. Measurement of bite force has been a reliable method of assessing the bio-mechanical properties of masticatory system and functional rehabilitation.

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