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Management of mandibular angle fracture by 3-dimensional rectangular grid plate: A prospective clinical study

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Abstract

Mandibular angle fractures pose a significant therapeutic challenge since they have one of the highest postsurgical complication rates of all mandibular fractures, making treatment difficult. Their treatment is debatable because of the unique anatomic area, biomechanical relationships, and existence of the third molar. The angle region has seen intense debate over a number of internal fixation techniques.[1, 2]

Keywords: Jaw, Parasymphysis, Mandible

Introduction

Mandibular angle fractures pose a significant therapeutic challenge since they have one of the highest postsurgical complication rates of all mandibular fractures, making treatment difficult. Their treatment is debatable because of the unique anatomic area, biomechanical relationships, and existence of the third molar. The angle region has seen intense debate over a number of internal fixation techniques.[1, 2]

Miniplate osteosynthesis is the conventional therapy for mandibular angle fractures. As fracture line stability believed to be a key factor in determining the clinical outcome and the stability provided by miniplate fixation of mandibular angle fractures has come under examination since the amount of interfragmentary motion has a major impact on the morphological patterns of osseous repair.[3, 4]

Lower jaw`s fracture is the commonly occurring fractures in the facial skeleton which in turn causes functional and esthetic disfigurement which needs early intervention for better post treatment results. Mandible fractures may be simple, compound or complex fractures. Any type of fracture requires anatomical reduction and re-occlusion of the dentate fragment.[5]

Aim

- To evaluate the clinical outcomes for the treatment of mandibular angle fractures using 3-Dimensional rectangular grid plate.

Objective

- To evaluate the anatomic reduction of fracture clinically and radiographically.
- To evaluate the Bite force preoperatively, immediate postoperative and after 1week, 1 month & 3 months.
- To evaluate the preoperative and post-operative occlusion.
- To evaluate the pain preoperatively, immediate postoperative and after 1week, 1 month & 3 months.

Material and Methods

Study: Oral and Maxillofacial

Type of Study: Prospective Clinical Study.

Study Duration: 1 Years

Subjects: Patients reported to our department with angle fracture with or without associated facial fractures.

Sample Size: 20 patients

Inclusion Criteria

- All the adult patients between 20-50 years of age.
- All the patients reported to our department with angle fracture with or without associated facial fractures.
- Patients under ASA grade I and II.

Exclusion Criteria

- Patients with gross comminuted mandibular angle fracture, high condylar fracture, bilateral angle fracture in which intermaxillary fixation was required.
- Medically compromised patients were excluded.

Procedure/Intervention

A skin crease in the submandibular region served as the location for the skin incision, which was approximately 2 cm below and parallel to the inferior edge of the mandible and 2-3 cm long. The incision initially extends through the skin, subcutaneous tissue, superfacial fascia and platysma. Important anatomical structures such as facial artery, facial vein, marginal mandibular nerve, submandibular gland and submandibular group of lymph nodes were preserved.

Dissection was carried to the masseter muscle. Then the inferior border of mandible was identified and periosteal stripping was done to expose the fracture segments. After receiving sufficient exposure, the broken pieces were handled and reduced satisfactorily using a 3-dimensional rectangular grid plate with 6 holes and a gap that was 2 mm thick. One plate was fixed on the lateral aspect of mandible with 2 x 8 mm screws. Haemostasis achieved and the incised wound was closed in layers with 3-0 vicryl and skin closed with 4-0 prolene sutures and pressure dressing was given.[1]

Data Processing and Statistical analysis

The data obtained was compiled using an excel spread sheet Statistical analysis was done using SPSS 23 for Windows. The data were summarized using percentages and frequency and other appropriate statistical test like Student Paired t-test was employed and the difference was accepted significant at p value < 0.05.

Figure 1: 3D Rectangular Grid Plate

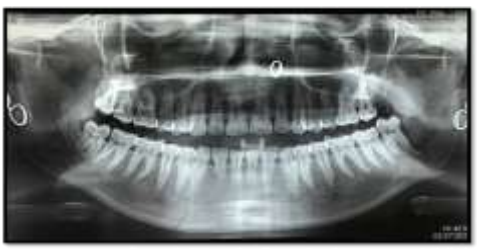

Figure 2: Pre-Operative: Opg Appreciating Right Parasymphysis # and Left Angle #

Figure 3: Fixation done with 3-Dimensional grid plate.

Figure 4: Mouth Opening Achieved Post-Operative

Figure 5: Bite Force

Observation and Results

Out of 20 patients 15 (77.3%) were male patients and 5 (22.7%) were female. In this study, all the patients were in age group of 20 to 50 years. In our study the most common cause of injury was road traffic accident in 13(59.1%) patients, followed by interpersonal violence in 7(31.8%), fall from the height 2(9.1%). According to my study, the most common associated fracture was contralateral parasymphysis fractures occurred in 12 patients. Fracture evaluation and reduction both were evaluated firstly by orthopantogram and from non-contrast computerised tomography. Post-operative occlusion was satisfactory in all the patients when compared with pre-operatively and after one month again occlusion was seen and class 1 occlusion was achieved except 2 patients in which class 2 occlusion exists naturally. Post-operatively segmental mobility was not found in any of the patients.

In this study mean bite force in patients when they reported to our department and compared from pre-operatively to immediate post-operatively, pre-operatively to 1 week, preopeartively to 1 month, preopeartively to 3 month were 0.87, 2.87, 7.03, 9.88 respectively which was statiscally highly significant, then compared from immediate post-operatively to 1 week, post-operatively to 1 month and post-operatively to 3 month were 2.0, 6.16, 9.01 respectively, then mean was compared from 1 week to 1 month, 1 week to 3 month were 4.16 and 7.01 respectively, P-value is less than 0.001 which prooved to be highly significant(Bite force measured by Bite Force Meter.

In this study, plate was infected in 2 patient at 7th post-operative day, due to improper care of sutured site and not following the post-operative instructions which was irrigated copiously by Metronidazole and normal saline and then sutured after 1 week with 3-0 vicryl. After a month, satisfactory healing was observed.

Discussion

Out of 20 patients 15(77.3%) male patients and 5(22.7%) were female. All of the patients in this study were between the age of 18 and 70 years with mean age (29.04), which is comparable to a study conducted in 2019 by Ramisetti Sudheer et al., in which the mean age of the study's participants was 34.7 years. Barry et al in 2007 presented mean age of 22.4 years which ranges from 16 to 42 years. Another study conducted by Kumar et al in 2011 in which mean age was 26.6 years (range 16-62 years). Edward Ellis III conducted a study in 2010 in which the age was in 20- 30 year old range.[1]

In our study the most common cause of injury was road traffic accident in 13(59.1%) patients, followed by interpersonal violence in 7(31.8%), fall from the height 2(9.1%). According to this study, the most common associated fracture was contralateral parasymphysis fractures, occurred in 12 patients which is similar to study done by Levy et al in 1991 who found that the most common location of the associated fracture was the contralateral parasymphyseal fracture (57%).[13]

In the first postoperative period, the increased mean mouth opening achieved from pre-operative to immediate is 4.1, from pre-operative to 1 week is 7.78, from pre-operative to 1 month is 11.74, pre-operative to 3 month is 14.17. Then again we compared mean interincisal opening from immediate to 1 week, immediate to 1 month, immediate to 3 month and were found to be 3.67, 7.63 and 10.06 respectively. We also compared mean interincisal opening from 1 week to 1month and 1 week to 3 months and value came were 3.96 and 6.39 respectively and at last we compared mean value from 1 month to 3 month and found to be 2.43, which is similar to study done by Nancy Mathew et al in which the righteous mouth opening was achieved, which showed that all the comparision value are highly significant. There was a good amount of mouth opening achieved in all patients at the end of 3-month postoperative period.[1, 2]

Mean pain score in patients in this study when compared from pre-operative to immediate, preoperative to 1 week, preoperative to 1 month, preoperative to 3 month were 1.45, 3.59, 5.95 and 5.95 respectively thereafter mean pain score was again compared with immediate to 1 week, immediate to 1 month and immediate to 3 month and were 2.14, 4.5, 4.5 respectively . In this study, plate was infected in 2 patient at 7th post-operative day, the two plates which were infected was due to not following proper instructions i.e not cleaning the suture line properly, and further it was irrigated copiously by Metronidazole and normal saline then after 7 days it was sutured with 3-0 vicryl. After a month, satisfactory healing was observed.[14, 15]

Conclusion

It was concluded that the use of titanium 3-dimensional rectangular grid plates was an effective method of treatment for mandibular fracture especially following Champy's principle. The goal of the current study was to compare and clinically evaluate the effectiveness of a 3-dimensional rectangular titanium grid plate in the management of mandibular angle fractures. The findings of this study are consistent with those of studies completed by other authors.[11,18]

The study's findings imply that a 3D rectangular grid plate is a workable substitute for conventional miniplate systems, offering a satisfactory clinical result and less risk of issues such as hardware failure, bite force, pain, occlusion, and interincisal mouth opening. Larger sample size and long-term follow-up may be necessary to draw a more precise conclusion.[14,1]

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