TREATMENT OF NON COMMUNTED MANDIBULAR ANGLE FRACTURES USING ONE NON COMPRESSION MINIPLATE

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ABSTRACT

Aim: To study the efficacy of single 4 hole with gap stainless steel miniplate osteosynthesis in the non comminuted fracture of angle of mandible along champy’s line of osteosynthesis.

Materials and Methods: Study included 24 patients with unilateral non comminuted fractures of the mandibular angle treated with single 4 hole miniplate osteosynthesis at upper border along champy’s line of osteosynthesis.

Results: After application of the miniplate, all fractures appeared clinically well reduced and stable. In eight out of the twenty four 2nd day post operative radiographs (33.3%), a 2 to 3 millimeter (mm) gap was observed at the lower border but all these cases clinically showed good dental occlusion and stability across the fracture site and none of them required any post operative guiding/training elastics of maxillomandibular fixation. The postoperative course of all the patients was mainly uneventful with only 1 patient needing nasogastric feeding.

Conclusion: Our study shows that in non comminuted mandibular angle fractures with no or minimal displacement, a single 2mm, 4 hole non compression miniplate using 8.0mm monocortical screws, provided adequate strength and stability as suggested by clinical and radiological union with minimal complications, minimal morbidity and quick return to function.

Keywords: fracture, maxillomandibular fixation, osteosynthesis.

I. INTRODUCTION:

The mandibular angle is one of the most common site for fracture. [1] This can be attributed to the presence of impacted wisdom teeth which diminishes bone quantity, high gonial angle and biomechanical reasons like shape change muscle pull that can contribute to the increased incidence of fractures in this region. According to (Ellis 1999) [2], fractures of the angle carry the highest rate of complications of all fractures of the lower jaw. Certain structural and functional peculiarities like thinner compact plate, shape changes during life and frequent impacted or partially erupted teeth, bilateral muscle cover and endosseous and extra osseous blood circulation- condition the peculiarities of the treatment of fracture.[3] Apart from conservative measures great variety of osteosynthesis methods in use indicates that so far no general agreement has been reached on treatment of mandibular fractures (Ellis and Ghali, 1991; Ellis, 1999)[4] In particular, the philosophy of compression plating and the method of miniplate osteosynthesis compete with each other. In Miniplate osteosynthesis technique, a miniplate is applied to the external oblique ridge [5] This according to Michelet et al. [6] allows early exercise, are easy to adapt and only requires an intraoral approach. However, Questions about the degree of stability provided by these miniplates have become a point of contention among
surgeons. Some authors like the AO/ ASIF advocates (Frost and Koutnik [7,3] do not think that the plates offer adequate stabilization of the fracture to eliminate the need of MMF. Mommaerts and Engelke [8] reported that 76% of their patients treated with miniplates were placed into MMF for some period post surgery.

With the miniplate system, facial scarring is minimized, operation time is shortened because of ease of adaptation, and the likelihood of damage to the facial and inferior alveolar nerves is decreased. However, questions concerning the degree of stability provided by the miniplate have become a point of controversy among surgeons. Kroon (1991), [9] in the miniplate system described that, a loading force close to the fracture line at the mandibular angle causes gaping at the lower mandibular margin. Therefore, many surgeons who use this miniplate use immobilization for a short period to ensure stability. [8]

Although the controversy has not been resolved, this method of bone plating to stabilize fractures has become more popular in recent years owing to the ease with which the plates can be placed transorally. A consecutive series of studies has indicated that, contrary to popular beliefs, the incidence of complications after fractures of the mandibular angle are inversely proportional to the rigidity of the fixation applied. Whenever two points of fixation were used for angle fractures, the complication rate was much higher than when one point of fixation was applied. This finding seemingly defies logic, because conventional wisdom would indicate that more stable fixation should provide fewer complications. However, experience has shown the opposite [10,11,12]. Therefore, the question that must be asked is how much fixation is enough for structures of the mandibular angle.

The purpose of this investigation was to analyze the efficacy of a single 4 hole non compression stainless steel miniplate with gap (2.0mm diameter) using 8.0mm length stainless steel screws, in fixation of non comminuted fractures of mandibular angle by a prospective study.

II. METHODOLOGY

Aims of this study was to analyze the efficacy of a single 4 hole non compression stainless steel miniplate with gap (2.0mm diameter) using 8.0mm length stainless steel screws, in fixation of non comminuted fractures of mandibular angle by a prospective study. Complications were defined as being minor implying any post operative abnormal sequelae that could be managed by non surgical treatment or major implying any post operative sequelae needing a second surgery for correction. 12 patients with unilateral fractures of the mandibular angle were considered for the study.

Patients with non comminuted, undisplaced fractures or if displaced fractures, then reducible without specialized instruments, simple fractures if passing through M3 without gross gingival/sulcular laceration were included in the study and those with comminuted, compound fractures, associated condylar or fractures of maxillofacial skeleton affecting occlusion or mouth opening were excluded. Patients with edentulous mandibles, pathological or malunited fractures were also not included. Follow up was done upto 6 months.

Hardware:

- Single 4 hole non compression stainless steel miniplate with gap of 2.0 mm diameter.
- 8.0 mm length self tapping steel screws of 2.0 mm diameter

Surgical technique:

Maxillomandibular fixation (MMF) was given immediately pre operatively using either arch bars or Gilmor’s direct wires. Using standard intraoral Champy’s technique single mini plate was placed along the ideal line of osteosynthesis over the external oblique ridge (EOR) as it passes onto the buccal cortex in the second or first molar region under local anesthesia or general anesthesia. Treatment of associated fractures of the mandible, if any, with ORIF was then done in the same sitting. Third molars (M3) in line of fracture were only removed in case of mobility, crown and root fracture or pathology. Removal of MMF with active jaw mobilization was done immediate post operatively.

III. RESULTS:

Out of the 24 patients, 12 had associated fractures of the mandible out of which 10 were contralateral and 2 were ipsilateral. From the 10 contralateral fractures, 8 were of the mandibular parasymphysis and 2 were of the
mandibular body. A total of 16 associated third molars out of 24 cases of angle fracture cases had to be extracted. (table 1)

The time from initial injury to surgical treatment ranged from 1 to 12 days with a mean of 4.0 days (SD=2.9 days). 10 out of 24 patients had their surgery within 1 to 2 days of trauma (41.6%), 12 within 3 to 5 days (50.0%) while only 2 patient received treatment after 10 days, due to delay in referral from the primary health care facility. No complications were however recorded in this patient. The time taken for completing the surgical procedure was in the range of 40 to 150 minutes with a mean value of 70.0 minutes (SD=35.6 minutes). The high values corresponded to the cases that were done under general anesthesia due to various reasons. The case done under local anesthesia ranged between 40 to 60 minutes with a mean of 47.5 minutes. There was no difference in the complications between the groups.

The maximum mouth opening (MMO) before surgery ranged from 15 to 35 millimeters with a mean of 25.4mm (SD=7.1mm). The MMO 2 days post operatively (1st follow up) ranged from 12 to 35mm with a mean of 23.1mm (SD=6.9mm) (Table 2) The fall in the mean was mainly attributed to the immediate postoperative inflammation and pain. On the 14th post operative day (2nd follow up), there was a marked improvement in the MMO, the mean being 29.7mm (a difference of 6.6mm; SD= 7.1mm) and the range being 20 to 42mm. Similar results were noticed at the 6th week post operatively (3rd follow up), the mean in this instance being 34.8mm (an improvement of 11.7mm; SD = 6.8mm), the range being 25 to 44mm.

After application of the miniplate, all fractures appeared clinically well reduced and stable. Postoperative radiographs were taken at each successive follow up and evaluated. In 8 out of the 24, 2nd day radiographs (33.3%), a 2 to 3mm gap was observed at the lower border but all these cases clinically showed a good dental occlusion and stability across the fracture site and none of them required any post operative guiding/training elastics of maxillomandibular fixation.

The postoperative course of all the patients was mainly uneventful with only 1 patient needing nasogastric feeding. All the operated patients had various degrees of postoperative pain and swelling at the surgical site that were managed by adequate oral or parental non steroidal analgesics. All patients received antibiotic surgical prophylaxis parentally and oral antibiotics were continued only according to the patient’s oral hygiene maintenance.

Apart from the immediate post operative swelling in all the cases, our study population showed no minor or major complications except for 1 case which experienced as asymptomatic 0.5x0.3mm exposure of the lingual cortex of the proximal fragment. No surgical treatment was given for the same and only supportive therapy in the form of warm saline gargles and strict oral hygiene maintenance was instructed. The small exposure remained non-tender throughout the subsequent recovery and was covered with normal healthy mucosa after granulating, within a period of three weeks.

![Fig 1: Fate of Associated 3rd Molars](image-url)
IV. DISCUSSION:

To permit precise fracture reduction, alignment, and stabilization, a variety of internal fixation systems have been introduced into clinical practice. Intrinsic to each of these systems is the presumption of functional stability through the healing period. Relative motion during the healing period of the bone is recognized to interfere with the normal morphologic patterns of osseous repair and predispose to complications, including postoperative osteitis, osteomyelitis, and nonunion.[13]

Although based on disparate biomechanical rationale, each fixation system seeks to restore structural and functional integrity to the fracture site until the new bone is capable of withstanding the stresses of masticatory function[14]. As an initial approximation, internal fixation systems used to stabilize mandibular angle fractures can be categorized into those that effect inter-fragmental compression and stabilization primarily through the implant (compressive systems), and systems that achieve a passive coaptation of the fragments and use antagonistic muscle forces to accomplish inter-fragmental compression and stabilization (adaptive systems). Compression fixation systems used in angle fractures include: The Swiss Association for internal fixation (ASIF) eccentric dynamic compression plate (EDCp); solitary lag screws; Luhr plate, and the Wurzburg Plate. The Champy miniplate and the Mennen plate are representative of the adaptive osteosynthesis systems.

In 1973 Michelet et al [6] introduced into the English language literature the concept of miniplate placement along the external oblique ridge for the treatment of mandibular angle fractures. The combination of the forces of the elevator muscles and occlusal forces results in the natural band of tension along the superior border in the angle region of the mandible. Stabilization of the fracture with a miniplate positioned along this tension band will negate the muscular forces that naturally act to distract the fragments.[15]

Ellis et al [2, 11] examined various treatment modalities for angle fracture. They showed a significantly higher complication rate using compression plates on both mandibular borders intraorally in comparison to the Champy technique. The Champy technique possessed the lowest complication rates in 2 separate studies (2.5% and 0% respectively). Intraoral application of larger plates appears to increase complication rates. The reasons for this unclear, but may be partly because of the extensive degloving required for plate placement. Large plates are also more difficult to contour to the mandible, and subsequent compression can generate telescoping and fracture misalignment. In 1996, Ellis and Walker, for the first time, challenged the role of biomechanics as the only one factor to be considered when treating fractures suggesting many other factors that may be more important as the improved blood supply to the bone because of limited dissection. They in turn questioned the need for absolute rigidity for treatment of angle fractures owing to the fact that bite forces are subnormal for many weeks after fracture of the mandible. [16]

R.K Singh et all [3] conducted a study designed to study feasibility of single miniplate osteosynthesis in the fracture of angle of mandible at upper border along champy’s line of osteosynthesis in 110 patients. The results showed that All the cases were treated successfully but common complications which were observed in the study were cosmetic disfigurement, delayed union, infection, wound dehiscence and paresthesia. They concluded that Single miniplate
fixation in unfavorable fracture is questionable and hence these fracture require some alternative method (locking plate, etc.) for fixation.

Barry CP et al.[17] presented 50 patients of isolated angle fractures treated with superior border plating and reported 12% experienced complications requiring plate removal, 8% patients experienced superficial soft tissue infections associated with bone plate, treated with oral antibiotics, 2% experienced plated exposure and a further patient 2% presented with a fractured bone plate. Permanent inferior alveolar nerve sensory deficit (<12 months) was present in 8%. Nineteen percent patients with normal post injury/preoperative sensory function had a postoperative sensory deficit.

All the fractures in the present study were associated with fully or partially erupted third molars (M3s) and the extracted 33% of M3s were either coming in the way of reduction or had associated root fractures or pathologies. Hence we cannot categorically state whether the retention or extraction of M3 played a role in the postoperative outcome.

The data collected in our study, when compared to the historical cohort (literature concerning the use of compression plating systems used for mandibular angle fractures specifically and other mandible fractures as a whole), suggests that the commonly encountered complications of using those systems; like bulkiness of the hardware leading on to a difficult intraoral access, thereby predisposing to the use of an extraoral incision leaving behind a permanent unsightly scar, the risk of damage to the marginal mandibular branch of the facial nerve; the relatively greater amount of periosteal stripping needed which predisposes to the risk of avascular necrosis leading on to further complications like delayed, fibrous or non union and in extreme cases even osteomyelitis, the unpredictable direction of the compressive forces transmitted by the fixation appliance on the fractured fragments thereby leading to undesired telescoping at the fracture site leading to direct oculusal or temporomandibular joint disturbances were not associated while using the miniplate osteosynthesis. The parabola shaped body of the mandible consists of the outer and inner cortical layers with a central spongiosa. The outer cortex is particularly strong and is reinforced laterally by the oblique line which runs caudally from the coronoid process to the region of the molar teeth and forms a strong projection. This provides osteosynthesis screws with good anchorage by virtue of its compact bony structure.

The other major drawback of using the compression plating systems, which is specifically relevant to the mandibular angle region, is the unpredictable direction of the compressive forces transmitted by the fixation appliance on the fractured fragments thereby leading to undesired telescoping at the fracture site leading to direct oculusal or temporomandibular joint disturbances. In fact in a recent survey conducted by Gear et al (2006), on the international AO/ASIF faculty, have reported that even if the surgeons regularly employed compression plates for the angle fractures, they preferred to keep the screws in neutral position. In the same survey they highlighted that according to the number of cases being treated per year, most of the AO/ASIF faculty (treating greater number of cases) preferred to employ the Champy’s technique themselves as compared to compression plating systems even though being proponents of rigid internal fixation.[18] This goes on to prove that the miniplate osteosynthesis technique is easy to master and perform, while giving acceptable and predictable results without putting the patient any greater risk for a second whatsoever.

V. CONCLUSION:

Our study shows that in non comminuted mandibular angle fractures with no or minimal displacement, a single 4 hole non compression miniplate using 8.0mm monocortical screws, provided adequate strength and stability as suggested by clinical and radiological union with minimal complications, minimal morbidity and quick return to function. Because these plates were small and monocortical screws placement was possible without damaging the tooth roots.

Only one complication managed non surgically suggests the effectiveness of the technique as a good internal fixation system considering the complex anatomical and biomechanical factors which are peculiar to the region of the mandibular angle. However, because of the low sample size, we are unable to resolute firm recommendations to surgeons over the use of this technique of fixation. Future research with large sample size and more control may be able to provide surgeons with clearer conclusions than those listed above.

REFERENCES: