

ORIGINAL RESEARCH

An Evaluation for the Need of Supplemental Maxillo-Mandibular Fixation in mandibular fractures after Miniplate Osteosynthesis

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ABSTRACT:

Aim: To evaluate the necessity of supplemental maxillo-mandibular fixation after miniplate osteosynthesis for the treatment of mandibular fractures using 2.0 mm titanium miniplate. **Methods:** 30 adult patients reporting with mandibular fractures were randomly divided into two groups: GROUP A (included fifteen patients in whom supplemental maxillo-mandibular fixation was released immediately after surgery) & GROUP B (included fifteen patients in whom supplemental postoperative maxillo-mandibular fixation was kept for a period of 7 days). Patients were kept on a follow up for 3 months. **Results:** Post-operative occlusal disturbances were found in one patient each in both group A and group B. Difference in post-operative pain and improvements in post-operative pain on subsequent follow-ups, was found to be statistically not significant. Post-operative mouth opening was found to be more on 7th post-operative day in group A patients (29.20±6.57 mm) as compared to in group B (21.60±4.40 mm), with a p-value of 0.01. Wound dehiscence was found in only one patient in group A, while no cases of wound dehiscence were seen in group B. In group A, 1 patient had wound infection and in group B, 2 patients had wound infection. No cases of post-operative non-union or post-operative malunion were seen in either of the groups. **Conclusion:** The current prospective study shows no significant differences in treating mandibular fracture by open reduction and internal fixation with or without supplemental maxillo-mandibular fixation.

Keywords: Mandibular fractures; Maxillo-mandibular Fixation; Miniplate Osteosynthesis; Occlusal Disturbances; Postoperative mouth opening.

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INTRODUCTION

Mandibular fractures are common facial injuries, occurring twice as frequently as fractures of the bones of the midface¹ and constitute the bulk of the trauma treated by an oral and maxillofacial surgeon. The management of fractures to the maxillofacial complex remains a challenge for oral and maxillofacial surgeons, demanding both a high level of skill and expertise to adequately treat fractures of the mandible. The goal in reduction is to restore pre-morbid occlusion, allowing patients to resume masticatory functions.

The treatment of jaw fractures has a long history, from ancient Egypt to the present. The first reports describing the treatment of mandibular and maxillary fractures comes from Egypt and dates back to the 17th century BC². The fractures were fixed by simple wooden splints

and linen splints soaked with glue. In the eighteenth and nineteenth centuries, fractures were treated quite successfully in outpatients. During that period, the potential for sepsis was ever present and access to anesthesia was limited, so the treatment was conservative. The teeth were simply repositioned (without anesthetic) using bandages and dental splints to hold them in alignment to allow comfort as well as bony union.

Maxillo-mandibular fixation (MMF) became the workhorse for surgeons treating these fractures during the early parts of the twentieth century. Maxillo-mandibular fixation, along with Gunning splints and circum-mandibular wires provided improved, although still incomplete, immobilization at the fracture site. Interosseous wire fixation improved stability, but the continued mobility of the bony segments led to

unacceptable rates of infection while still requiring at least 4-6 weeks of maxillo-mandibular fixation³. Prolonged MMF has been criticized for pain, poor oral hygiene, phonetic disturbance, loss of effective work time, weight loss, reduced masticatory efficiency, and reduced mouth opening⁴. As a result, there has been a search for ways to reduce the period of maxillo-mandibular fixation⁵.

Modern traumatology started with the development of osteosynthesis, which was a major step forward in craniomaxillofacial surgery. Today, many different systems are available, ranging from the heavy compression plates for mandibular reconstruction to low profile plates for midfacial fixation.

The purpose of this study was to evaluate relationship between outcomes of mandibular fractures treated by monocortical miniplate fixation and the use of supplemental maxillo-mandibular fixation.

MATERIALS AND METHODS

A prospective study was carried out in thirty adult patients, who reported our department with mandibular fractures and were treated by open reduction and internal fixation. The patients were randomly divided into 2 groups: GROUP A- this included fifteen patients in whom supplemental maxillo-mandibular fixation was released immediately after surgery and GROUP B- this included fifteen patients in whom supplemental postoperative maxillo-mandibular fixation was kept for a period of 7 days. The clinical results were evaluated in terms of occlusal disturbance, pain, trismus, wound dehiscence, infection, non union and malunion on 3rd day, 7th day, 1 month and 3 months after surgery in both the groups. The data obtained from the above set of variables was tabulated in tables from 1 to 12, and subjected to statistical analysis by unpaired student T-test. Variables like etiology, preoperative occlusion, wound dehiscence, postoperative infection, postoperative non union and postoperative malunion were analyzed statistically using Chi square test. P value < 0.05 was taken as statistically significant and any P value > 0.05 was taken as statistically insignificant.

RESULTS

TABLE 1: FEATURES

	Group A	Group B
Gender		
Male	14	15
Female	1	0
Age (Mean)	30.13 years	25.46 years
Etiology		
Road side accident	8	10
Interpersonal Violence	5	1
Fall	1	4
Sports related	1	0
Fracture Site		
Symphysis	1	2
Parasymphysis	10	7
Body	1	2
Angle	6	12

There were total 30 patients with 15 each in both the groups. Mean age of patients in group A was 30.13 with standard deviation of 10.21 and mean age of patients in group B was 25.46 with standard deviation of 8.37. In group A, most common cause of fracture was road side accident in 8 patients followed by interpersonal violence in 5 patients and in group B, most common cause of fracture was road side accident in 10 patients followed by fall in 4 patients (Table 1).

TABLE 2: POSTOPERATIVE PAIN

Time	Group A	Group B	t-value	p-value
3 rd day	6.53±1.87	6.53±1.25	0.00	1.00 ^{NS}
7 th day	5.13±1.06	4.73±1.38	0.887	0.382 ^{NS}
1 month	2.73±1.09	2.93±1.09	0.498	0.622 ^{NS}
3 months	1.67±0.81	2.20±0.77	1.835	0.07 ^{NS}

NS; p > 0.05; Not Significant; *p < 0.05; Significant; **p < 0.001; Highly significant

TABLE 3: POSTOPERATIVE MOUTH OPENING

Time	Group A	Group B	t-value	p-value
3 rd day	22.00±5.83	-	-	-
7 th day	29.20±6.57	21.60±4.40	3.721	0.01 [*]
1 month	37.53±6.57	36.36±5.76	0.481	0.635 ^{NS}
3 months	42.20±4.97	40.86±5.18	0.719	0.478 ^{NS}

NS; p > 0.05; Not Significant; *p < 0.05; Significant; **p < 0.001; Highly significant

TABLE 4: COMPLICATIONS

	Group A	Group B
Occlusal Disturbance	1	1
Wound Dehiscence	1	0
Wound Infection	1	2
Non Union	0	0
Malunion	0	0
Total	3 (20%)	3 (20%)

Post-operative occlusal disturbances were found in one patient each in both group A and group B, which was managed by using 24 hour elastics for a period of one week. Difference in post-operative pain and improvements in post-operative pain on subsequent follow-ups, was found to be statistically not significant (p-value was greater than 0.05 on all the 4 follow-ups) (Table 2). Post-operative mouth opening was found to be more on 7th post-operative day in group A patients (29.20±6.57 mm) as compared to in group B (21.60±4.40 mm), with a p-value of 0.01. On subsequent follow-ups, no statistically significant difference was found between the two groups on the basis of post-operative mouth opening (Table 3).

Wound dehiscence was found in only one patient in group A, while no cases of wound dehiscence were seen in group B. In group A, 1 patient had wound infection and in group B, 2 patients had wound infection. No cases of post-operative non-union or post-operative malunion were seen in either of the groups (Table 4).

DISCUSSION

Modern methods of mandibular fixation have undergone a revolution during the past several decades. The development of the different systems for internal fixation of facial trauma and their application in the treatment of mandibular fractures has meant a change in the criteria for postsurgical immobilization. It has also made possible a more rapid return of function, resulting in the patient being able to resume his or her normal life earlier⁶.

The ideal treatment paradigm for mandibular fractures would encompass the latest breakthroughs in advanced biomaterials, maintain stability at the fracture site, demonstrate ease of application, and permit immediate function with release from intraoperative maxillo-mandibular fixation. In an effort to move closer to that goal, clinicians have been attempting to shorten the period of maxillo-mandibular fixation while not adversely affecting the treatment outcomes and the related complications.

Hence this study was conducted to evaluate the necessity of supplemental maxillo-mandibular fixation after miniplate osteosynthesis for the treatment of mandibular fractures using 2.0 mm titanium miniplate.

In this study, there was predominance of males i.e. 29 out of the total 30 cases. **Motamedi (2003)**⁷ observed in a retrospective study on 237 patients of maxillofacial fractures, percentage of male patients was 89% and that of female patients was 11%. This was justified by the fact that males are generally more prone to situation in which there is higher risk of trauma. The mean age of the patients in group A was 30.13 years and in group B was 25.46 years. Since direct trauma is the most common cause of mandibular fractures, it is not surprising that most of the patients were relatively young. In a study by **Berggren and Lehr (1967)**⁸, more than half the patients with mandibular fractures were between 20 and 40 years of age. **Bernstein and McClurg (1977)**⁹ reported that the greatest incidence of mandibular fracture was in the 21-30 year age group. The age distribution of the patients in the present study corresponds to the findings of the aforementioned authors.

The major etiological factor in our study was road-side accidents (60%), followed by inter-personal violence (20%), fall (16.67%) and sports-related injuries (3.33%). This is in accordance with the study of **Olson et al. (1982)**¹⁰, who found motor vehicle accidents to be the cause of nearly half the mandibular fractures and altercations to be the cause of more than one third of the fractures. The relative importance of road-side accidents versus inter-personal violence as a cause of mandibular fractures appears to be related to the social characteristics of the locality under study. In our study preponderance of cases because of road-side accidents appears to be due to lack of comprehensive rules for traffic safety in our country as compared to the western world. Hence, the traffic rules which have been formulated, needs to be strictly enforced.

The overall complication rate was found to be 20%, although all the complications were minor with no major complication seen in any patient. **Chritah, Lazow and**

Berger (2005)¹¹ treated 50 mandibular fractures in 34 patients with a mean of 6.97 days of maxillo-mandibular fixation, and the complication rate was 6%. The complication rate of 20% in our study was deceptively high because virtually all patients had a favorable outcome with successful bony union and return to pre-morbid occlusion.

Post-operative occlusion was assessed in this study and was one of the criterias to compare the outcomes of the two groups. The presence of postsurgical malocclusion depends on the number of fractures and degree of displacement, the reduction that can be achieved, the kind of immobilization, and the time of immobilization. We found postoperative occlusal disturbances in only 2 cases (6.67%), out of which one was in group A and one in group B. In both the patients there was posterior open bite on the side of angle fracture noted on the 7th post-operative day. Both the patients had an associated parasymphysis fracture in addition to angle fracture. The malocclusion was treated by using 24-hour elastic traction for a period of one week.

Postoperative pain was measured in both the groups on all the follow-ups. 0–10 Numeric Pain Rating (**McCaffery, Beebe and Latham 1994**)¹² was used to measure the pain, which rated pain on a scale from 0 (no pain) to 10 (worst pain imaginable). No statistically significant difference was found in terms of post-operative pain when both the groups were compared as difference in mean numeric pain score of all four follow-ups was statistically non-significant (p-value greater than 0.05). Although, patients reported to have a higher incidence of discomfort in the first post-operative week in group B patients as compared to group A patients due to the presence supplemental maxillo-mandibular fixation in group B patients.

A reduction in the maximal mouth opening following jaw immobilization has been reported in several previous studies in the literature (**Glineburg, Laskin and Blaustein 1982**)¹³. Methods of treatment that do not immobilize the mandible seem to cause less restriction in jaw mobility. In our study we measured the maximal mouth opening in both the groups on all follow-ups to determine whether the period of immobilization has any effect on the maximal mouth opening. We found a statistically significant difference in the post-operative mouth opening on the 7th day postoperatively (p-value=0.01). The post-operative mouth opening was more on the 7th post-operative day in group A patients as compared to group B patients but the trend towards improvement over time within each group, as well as comparisons between the two groups, was not statistically significant on the subsequent follow-ups.

Wound dehiscence is a surgical complication in which a wound ruptures along a surgical incision. Many factors like single layer closure (especially in the angle region), poor oral hygiene, smoking, existing mucosal tears, etc. contribute to increase the incidence of wound dehiscence. **Cawood (1985)**⁴ stated that dehiscence of the incision is a known complication of bone plate osteosynthesis and it has been reported in approximately 3% to 7% of cases. In

our study, there has been only one case of wound dehiscence in group A (which was managed by wound irrigation and local wound care measures), and none in group B.

In our study, wound infection was judged on the basis of Cutting's criteria for the signs of infection of acute/surgical wounds (Cutting and White 2004)¹⁴. An overall wound infection rate of 10% was found in our study, with no statistically significant difference in the wound infection rates in both the groups (p-value=0.543). All the reported cases of wound infection had discoloration, i.e. erythema, with no other sign of wound infection seen in any of the cases. In our study, we found none of the patients had post-operative malunion or post-operative nonunion. Hence, it could be concluded that the intuitive assumption that a transient period of maxillo-mandibular fixation leads to worsening trismus, less post-operative pain, and improved soft tissue and bony healing did not hold true statistically in this study. Several explanations for these observations are obvious. Even when patients are not placed in maxillo-mandibular fixation, the degree of pain and swelling, both from the original trauma as well as from surgery, serves to keep them in a physiological maxillo-mandibular fixation. So, maintaining the patients in maxillo-mandibular fixation after open reduction and internal fixation of symphyseal, parasymphyseal, body or angle fractures does not confer an advantage and may not be necessary in the repair of these minimally to moderately displaced mandibular fractures. Furthermore, immediate release of maxillo-mandibular fixation may also lead to improved patient comfort.

CONCLUSION

The current prospective study shows no significant differences in treating mandibular fracture by ORIF with or without supplemental MMF. Hence, it could be concluded that minimally or moderately displaced mandibular fractures can be treated by ORIF followed by immediate release of MMF. Though, the small sample size and limited follow up could be considered a limitation of this study. However, a large number of cases should be studied over a longer period of time for better post-operative analysis. Hence, it is recommended to have a multicenter study with a large number of patients to authenticate our claims.

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