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A COMPARATIVE STUDY OF 2MM LOCKING PLATE SYSTEM V/S NON LOCKING PLATE IN MANDIBULAR FRACTURE

Dental Science

Dr Syeed Wakeel Department of Oral and Maxillofacial Surgery, Govt. Dental College & Hospital, Srinagar.

Dr Abrar Bhat Department of Oral and Maxillofacial Surgery, Govt. Dental College & Hospital, Srinagar.

Dr Ajaz A. Shah Department of Oral and Maxillofacial Surgery, Govt. Dental College & Hospital, Srinagar.

Dr Mohammed Israr Ul Khaliq* Department of Oral and Maxillofacial Surgery, Govt. Dental College & Hospital, Srinagar. *Corresponding Author

ABSTRACT

Background: This study evaluated the efficacy of a 2.0-mm locking plate/screw system compared with a 2.0-mm non-locking plate/screw system in mandibular fractures.

Method: Patients were randomly assigned to receive 2.0-mm locking plates (group A) or 2.0-mm nonlocking plates (group B). Complications were analysed according to the type of plate used and the site of fracture. Fifteen fracture sites were treated with 2.0-mm locking plates and 15 with 2.0-mm nonlocking plates.

Results: The number of patients requiring postoperative maxillomandibular fixation was higher in group B because of occlusal deformities. None of patient of locking group have screw loosening as compared to 6.7% of screw loosening in nonlocking group. Complications occurred in the locking group with complication rates of 6% and in the nonlocking group 13% respectively.

Conclusion: Although Locking plate/screw system offers some advantages over the conventional plating system in terms of that a precise adaptation is not required when using Locking miniplates, less operative time required,provides better initial stability than the conventional plate/screw system,less loosening of screws,low infection rate, less pain and swelling,less occlusal/osseous discrepancies with better postoperative radiographic reduction and lastly less wound dehiscence. But these results proved to be statistically non-significant.

KEYWORDS

mandibular fracture; locking; nonlocking miniplates.

Introduction

Maxillofacial fractures are commonly caused by motor vehicle accidents, assaults, sports, industrial accidents and warfare.[1] Techniques for treatment of mandibular fractures have evolved significantly from past few decades. These techniques have ranged from closed reduction with maxillomandibular fixation, to open reduction with wire osteosynthesis and open reduction with either rigid internal fixation or adaptive miniplate fixation.[2]Miniplate fixation of mandible fractures along the "ideal lines of osteosynthesis" has become most widely used technique, which has been validated by several studies by champy et al.[3]Two types of miniplates are available: Non-locking (conventional) and locking miniplates (LMP). Introduction of locking miniplates for treatment of mandibular fractures have advantages over conventional non-locking miniplates. [4-6] The problem of loosening of one or more screws has been overcome by the development of the locking plate/screw system, which offers advantages over other plating systems.[7]

Material and methods

The present prospective study comprised of 30 adult patients. All the patients underwent open reduction with internal fixation of the fractured segments using Locking or Non-Locking miniplates with 2.0 mm diameter holes and 1 mm thickness. Patients were randomly divided into two equal groups of 15 patients each. Group A patients underwent osteosynthesis using2.0 mm locking miniplates while group B patients underwent osteosynthesis using 2.0 mm non-locking miniplates.

All patients were placed in MMF. Once proper occlusion was achieved, fractures were fixed with 2.0-mm titanium locking/ nonlocking miniplates along Champy's line of ideal osteosynthesis using 8-mm _ 2-mm locking/nonlocking monocortical screws . The technique for application of the 2.0- locking plates(fig 1) is no different from the application of any other type of miniplate.(fig4) The only exception is that a drill guide is required to 'centre' the drill hole with the centre of the bone plate to facilitate the screw locking with the plate.Postoperatively MMF was done for 24 hour. Patients were followed upto 24 weeks . Postoperative clinical evaluation was done on the 1st week, 6th week, 12th week and the 24th week postoperatively.

Postoperative panoramic radiographs were obtained in all cases at regular intervals (Fig 2&3 for locking plate and fig 5&6 for non locking plates,immediately postoperatively, after 1week, 9 and 24th week).

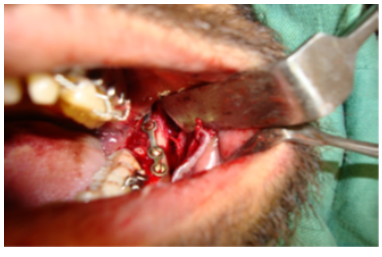

Fig.1. Angle fracture fixed with locking plate

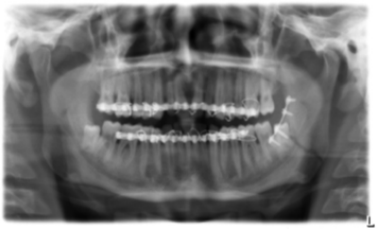

Fig.2. Immediate Post op OPG

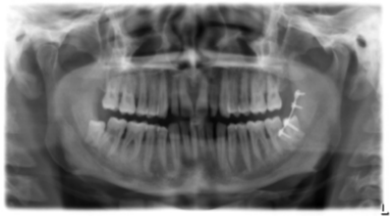

Fig .3.20th WEEK OPG

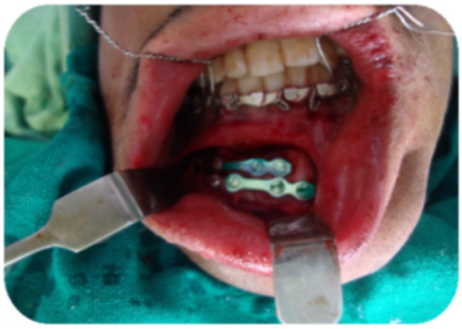

Fig 4.Parasymphysis fracture treated with non-locking plate

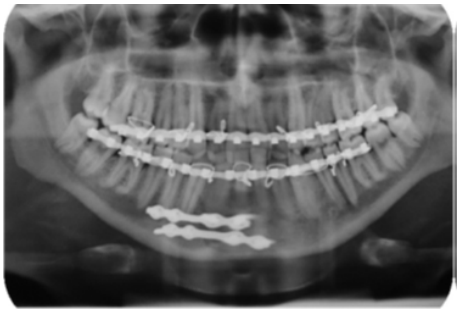

Fig .5. Post op OPG

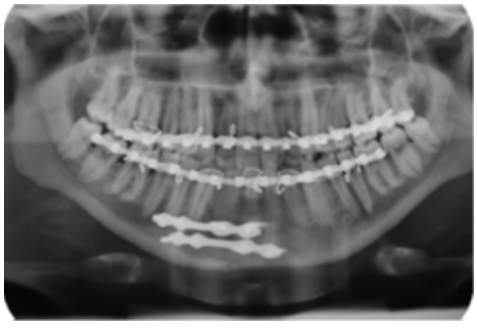

Fig .6. 20th WEEK OPG

Results

In our study mean age of presentation in group A (Locking miniplate group) was 29.13 ± 9.11 years where as in group B (Non-Locking miniplate group) mean age of presentation was 27.73± 8.32 years with p value of (p=0.664)which is statistically insignificant. The mean age of presentation corroborate well with the Western world[8] and Asian[9]studies.In Locking miniplate group (GROUP A) 80.0% were males and 20.0% were females while in Non-Locking miniplate group (GROUP B) 86.6% were males and 13.3% were females and p value=1.000 the difference between two groups is statistically insignificant.Incidence of fractures was seen more in males which also correlates with the most of the studies done.[1,8]In both the groups RTA was the most common cause of injury (66.7%) followed by assault (13.3%), fall (13.3%) and sports injury (6.7%).In our 30 cases, parasymphysis was the most common site of fracture (43.3%) followed by Angle (30.0%) as depicted in table 1.

Mean pain score (VAS) in preoperative period in Locking miniplate group was 2.20±SD (0.94), while in Non-Locking miniplate group it was 2.42± SD (0.52) with P value of 0.582 which is statistically insignificant. In the first follow-up Only 1 (6.7%) patients had mobility of fragments. When these results were compared with the patients treated using conventional plates / screw system, it showed that 05 (33.3%) patients had mobility of fragments as depicted in table 2.
Postoperative paresthesia in locking plate group was found in 2(13.3%) cases while in Non-Locking miniplate group 3(20.0%) cases had paresthesia.

The number of cases of infection in Non-Locking miniplate group exceeded the cases of infection in Locking miniplate group in every postoperative follow up which can be implied to the fact that Locking head screws have a reduced tendency to loosen .The mean duration of adaptation and fixation in Locking plates group in our study was 14.93 ± 5.59 minutes while as in Non-locking plates group it was 18.93 ± 4.20 minutes with p value 0.035 which is statistically significant.

In this study both the groups had preoperative step deformity. At the first week follow up time only 1 patient (6.7%) had a step deformity in Locking miniplate group while in Non-Locking miniplate group 3 patients (20.0%) had a step deformity with a P value of 0.598 which is statistically insignificant as depicted in table 4.

The likelihood of loosening of screws and infection have been reason for plate removal and the plate removed in our study was from the angle region in non-locking group.Locking miniplates again show a slight superiority in 1st and 9th week of radiographic follow up times with statistical non-significant results, but at the end of the study i.e. in 20th week none of the patients had any non-union.

Table 1. Site Of Fracture.

Site of fracture	Group		Total
	Locking	Non-locking	
Parasymphysis	5 (33.3%)	8 (53.3%)	13 (43.3%)
Angle	6 (40.0%)	3 (20.0%)	9 (30.0%)
Angle & Parasymphysis	1 (6.7%)	3 (20.0%)	4 (13.3%)
Body	2 (13.3%)	0 (0.0%)	2 (6.7%)
Parasymphysis & Ramus	0 (0.0%)	1 (6.7%)	1 (3.3%)
Symphysis	1 (6.7%)	0 (0.0%)	1 (3.3%)
Total	15 (100.0%)	15 (100.0%)	30 (100.0%)

Table 2. Mobility Of Fragments

	Locking (n=15)	Non-locking (n=15)	P value*
Pre-operative	15 (100%)	15 (100%)	-
1st week	1 (6.7%)	5(33.3%)	0.169
6 weeks	0 (0.0%)	0 (0.0%)	-
12 weeks	0 (0.0%)	0 (0.0%)	-
6 months	0 (0.0%)	0 (0.0%)	-

*Fisher's Exact test
Table shows the number of patients with mobile fragments; Numbers in parenthesis indicate percentage of patients with mobile fragments.

Table 3.Status Of Occlusion At Multiple Follow Ups.

	Locking (n=15)	Non-locking (n=15)	P value*
Pre-operative	15 (100%)	15 (100%)	-
1st week	2 (13.3%)	4 (26.7%)	0.651
6 weeks	0 (0.0%)	1 (6.7%)	1.000
12 weeks	0 (0.0%)	1 (6.7%)	1.000
6 months	0 (0.0%)	1 (6.7%)	1.000

*Fisher's Exact test
Table shows the number of patients with disturbed occlusion; Numbers in parenthesis indicate percentage of patients with disturbed occlusion.

Table 4. Step Deformity

	Locking (n=15)	Non-locking (n=15)	P value*
Pre-operative	15 (100%)	15 (100%)	-
1st week	1 (6.7%)	3(20.0%)	0.598
6 weeks	0 (0.0%)	2 (13.3%)	0.483
12 weeks	0 (0.0%)	1 (6.7%)	1.000
6 months	0 (0.0%)	1 (6.7%)	1.000

*Fisher's Exact test
Table shows the number of patients with step deformity; Numbers in parenthesis indicate percentage of patients with step deformity.

Discussion

Over the last 15 years, the use of internal rigid fixation in oral and maxillofacial surgery has been widely utilized. In order to improve Miniplate osteosynthesis a new internal Mini-Locking-System has been developed[7,10]Over the past 10 years, there has been an introduction of locking plate/screw systems into maxillofacial surgery.

The locking mechanism is such that the hole in the bone plate is engineered to accept screws that locks to it by the thread under the head of the screw [5,11] i.e., one thread will engage the bone another will engage a threaded area of the bone plate[12] There is slightly increased incidence of malocclusion in patients with mandibular fractures treated with Miniplate osteosynthesis[13]. This malocclusion was resolved with elastics for 2 weeks[2]. Nakamura et al reported 3.6% malocclusion rate in miniplate osteosynthesis.[14] Marsia aparecida Cabrini Gabrielli et al reported a malocclusion rate of 1.78%[15]

In our study at first follow up (02)13.3% cases in Locking miniplate group and (04)26.7% cases in Non-Locking miniplate group had developed occlusal discrepancies .In rest of follow up times all the occlusal discrepancies settled down except for (01) 6.7% case in Non-Locking group where occlusion remained disturbed throughout.In our study locking plate group showed more initial stability i.e. during first follow-up time which is in accordance to the study done by Gutwald et al[10]

The post operative infection occurred in 3.6% of the patients treated with miniplates[15].Alan S. Herford, Edward EllisIII[11]in their study showed a 7% infection rate. None of the patients at 6th week had infection in Locking miniplate group while2 patients (13.3%) in Non-Locking miniplate group had some signs of infection with P value of 0.483 which is again statistically insignificant. In the last two follow-up times infection persisted in 1(6.7%) Non-Locking miniplate group. So in last follow up overall infection was 3.7%.Thus the number of cases of infection in Non-Locking miniplate group exceeded the cases of infection in Locking miniplate group in every postoperative follow up which can be implied to the fact that Locking head screws have a reduced tendency to loosen which decrease the rate of post operative infection and failure[17]. Infection at fracture site can have serious sequalae as it can initiate delayed union, non-union, mal-union, bone and tooth loss[18]. Rigid fixation and the use of antimicrobial agents have reduced the incidence of infection[19].

In our study both the groups had preoperative step deformity. At the first week follow up time only 1 patient (6.7%) had a step deformity in Locking miniplate group while in Non-Locking miniplate group 3 patients (20.0%) had a step deformity with a P value of 0.598 which is statistically insignificant. From 6week follow up time no step deformity was found in Locking miniplate group while in Non-Locking plate group 2 cases (13.3%) had step deformity in 6th week follow up time which reduced to 1 case (6.7%) in rest of the follow up times. None of the patients out of 15 in Locking miniplate group showed any wound dehiscence, while in Non-Locking miniplate group only 1 patient (6.7%) showed wound dehiscence in 6th month follow up only, P value of which was 1.000 i.e., statistically insignificant. Total wound dehiscence shown by Veikko Tuovinen et al was 5%.[21] Wound dehiscence reported by Nakamura[14]was 3.6%.One documented advantage to the use of locking bone plate / screw systems is that the screws are unlikely to loosen from the bone plate.[6]

Radiographic evaluation for anatomical reduction, in case of Locking miniplate group has slightly better results which is in confirmatory to the theoretical advantage which highlights the fact that Locking plates produce less alteration in reduction when compared to Non-Locking plates,[5] but the results were statistically non-significant.

The overall complication rate in the present study was 6% for the 2.0-mm locking group and 13% for the 2.0-mm non-locking group. The lower complication rate than in the COLLINS et al.[20] study may be a result of longer postoperative MMF as intermaxillary fixation after fracture reduction.

Conclusion

The authors concluded that locking miniplates give the advantage of greater earlier stability and almost similar results as seen in non-locking miniplate osteosynthesis after long term follow –up.

Conflict Of Intrest; None

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