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A COMPARATIVE STUDY OF THREE DIMENSIONAL STAINLESS STEEL PLATE VERSUS STAINLESS STEEL MINIPLATE IN THE MANAGEMENT OF MANDIBULAR PARASYMPHYSIS FRACTURE

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ABSTRACT

The aim of this study is to compare the efficacy of three dimensional (3D) stainless steel miniplates in anterior mandibular fractures and to compare the use of three dimensional (3D) miniplates with Champy's miniplates and assess the bone healing post-operatively in both and to evaluate the complications associated with the use of 3D miniplates.Total 20 Patients were selected for this prospective study who suffered with mandibular symphysis and parasymphysis fracture and divided into two Groups I & II on randomized basis. All the patients were kept under antibiotics and analgesics coverage and advised for OPG and CT-Scan in cases with other associated fracture of mandible if suspected. Preoperatively all patients underwent oral prophylaxis and placement of the arch bars. Patients were operated through the standard transoral approach and either Champy's mini plates or 3D mini plates were placed to fix the fracture.

Keywords: Three dimensional (3D) plates, Champy's mini plates, Mandibular parasymphysis fracture, Open Reduction Internal Fixation (ORIF).

Number of Tables : 3 **Number of References:** 17

INTRODUCTION

The present era of fast moving, result oriented life has made a definite impact on the common man. Traffic accidents - road, or rail, violence- communal or otherwise, sport accidents etc, have had an alarming increase in the past few decades and is a cause of grave concern. Maxillofacial trauma is very common in all these unforeseen events and the unique position of the mandible on the face makes it vulnerable. It is therefore, one of the most commonly fractured facial bones.

The treatment of symphyseal and parasymphyseal mandibular fractures has evolved significantly over the past few years. Historically, mandibular fractures were treated with closed reduction and a course of prolonged maxillomandibular fixation. The next phase of mandibular fracture management involved open reduction and wire osteosynthesis. Wire osteosynthesis was subsequently supplanted as the preferred treatment of fractures by open reduction and internal fixation with titanium hardware including lag screws and plates. The approach to rigid plate fixation has likewise been modified with progressively smaller plates and less reliance on compression in the treatment of these fractures. The work of Champy and others has allowed for reliable fixation along lines of osteosynthesis through transoral approaches.[1] The Champy's method of semi rigid fixation uses easily bendable mono cortical mini plate along an 'ideal osteosynthesis line'. The developing forces are neutralized by masticatory force that produces a natural strain of compression along the lower border of the mandible. Both the techniques are associated with disadvantages, of which semi- rigid fixation is a doubt whether this fixation is sufficiently stable for fractures that cannot be adequately reduced

The shortcomings of rigid and semi-rigid fixation led to the development of 3 dimensional (3D) miniplates, consisting of two 2-hole miniplates with gap which are interconnected by vertical cross struts. Three-dimensional titanium plates and screws were developed and were reported first by Farmand and Dupoirieux.[2-4] Unlike compression and reconstruction plates, their stability is not derived from the thickness of the plate. In the combination with the screws monocortically fixed to outer cortical plate, the rectangular plates form a cuboid, which possess 3D stability. The 3D plating system is based upon the principle of obtaining support through geometrically stable configuration. The quadrangle geometry of plates assures a good stability in three dimensions of the fracture site since it offers good resistance against torque forces.

Patients and Methods:

After obtaining ethics and research committee approval, a prospective randomized clinical study was carried out for a period of 1 year 7 months (January 2010 and August 2011) in the Department of Oral and Maxillofacial Surgery, Kamineni Institute of Dental Sciences, Narketpally, Nalgonda-Dist, Andhra Pradesh, India. Informed consent was obtained, and patients within the age group of 19 to 63 years with

mandibular fracture involving symphysis, parasymphysis, with or without other associated fracture of the mandible. Preoperative infected or medically compromised patients and those not willing to return for follow-up were excluded from the study. Patients were divided into 2 groups, group I in which 3D plates were placed and group II in which Champy's miniplates were placed. A thorough history was taken that included the time and date of accident, mechanism of injury, and time of reporting to our unit. This was followed by a detailed clinical examination. The oral cavity was cleaned of blood clots, fractured tooth fragments and other debris. A temporary stabilization was provided when deemed necessary. The face and the oral cavity were examined for signs of soft tissue injuries and any neurological deficit. All wounds were debride and lacerated wounds were sutured with 3-0 silk. Inj. tetanus toxoid (TT) 0.5 ml IM was administered as a prophylaxis and patient were kept on antibiotics and analgesics. All patients were given preoperatively antibiotics, 1gm cefotaxime 1 hour before surgery and 1gm cefotaxime twice daily for 5 days after surgery. Erich arch bars were placed preoperatively in all the patients. Procedures were carried out either under general anesthesia or local anesthesia with sedation (Diazepam 5mg/ml) and local infiltration of lignocaine 2% with adrenaline 1:80000 for hemostasis. A standard transoral surgical technique was followed in both the groups to expose and reduce the fractures. Fixation was done using either 3D 2-mm stainless steel, four holes plates (group I) or standard miniplate 2-mm stainless steel, four holes with gap plates (group II) using Champy's principle of osteosynthesis. 3-D plates were adapted across the fracture line in such a way that, the horizontal crossbars were perpendicular to the fracture line and vertical struts were parallel to fracture line. In cases with oblique fracture, the plates were placed parallel to the lower border of mandible. In symphyseal/ parasymphyseal fractures, the upper crossbar was placed in sub apical position. Champy plates in symphyseal/ parasymphyseal fractures two plates were placed to overcome the torsional forces. In the parasymphysis fracture site two plates were placed below the mental foramina. The lower plate was placed first, followed by the plate above, to prevent development of diathesis at the lower border due to action of masticatory muscles. In both the type of platting 2x8mm stainless steel screws were used to stabilize the plates. A watertight wound closure was done. Total time taken for surgical procedure, i.e from the time of infiltration of xylocaine to last suture placed and time taken from plate adaptation to last screw placed were recorded. Soft diet was recommended for 1-4 weeks postoperatively depend upon the type of fracture and other associated fracture of the mandible. Patients were followed for a period of 3 months at the interval of 1 week, 2 weeks, 4 weeks, 8 weeks, and 3 months for wound dehiscence, infection, segmental mobility, postoperative occlusion, significant postoperative complications, and radiological evaluation of reduction, and fixation. Student's *t* test was used to compare 3D and Champy's miniplate fixation. A value of *P* less than .05 was considered statistically significant.

Table 1: Distribution of Mandibular Fracture According To Site.

Site	Total no. Of patients
Symphysis	2(10%)
Parasymphysis	18(90%)
Body	2(10%)
Angle fracture	4(20%)
Condylar fracture	8(40%)

Table 2: Comparison of Operating Time.

Group	N	Mean	Std. Deviation	p Value	Result
3 D Plate	10	6.3	1.33	0.0000	Sig P<0.05

Table 3: Comparison of Parameters Between Group I And Group II

Parameters	Group I (n - 20) No. of Patients (Parameter present %)	Group II (n - 20) No. of Patients (Parameter present %)	*P* Value (*t* test)
Improper occlusion	0	0	-
Infection			
At 2weeks	10	20	0.27
At 4weeks	10	10	1.00
At 2months	0	0	-
At 3months	0	0	-
Segmental mobility			
At 2weeks	20	20	0.28
At 4weeks	0	0	-
Wound dehiscence	10	10	0.14
Neurological Deficit	10	10	1.00

RESULTS

The study consisted of a sample size of 20 patients with mandibular fracture. 10 of these patients were treated by 3D miniplate (Group I) while 10 patients were treated by Champy's miniplates (Group II). Road traffic accident was the cause of fractures in 17 patients out of total 20 patients, 1 from fall and 2 of assault cases. The age group of all 20 patients ranged from youngest 19 years and oldest 63years of age, mean age of the patient being 33.9 years. Though the mean age was 33.9 yrs but the maximum trauma was noted in 20-50yrs, as injuries in road traffic accidents usually affect men 20 to 30 yrs old, the fractures incurred in these accidents are due to rapid deceleration and direct impact of the head, usually with handle of the two wheeler and in cases of assault the direct impact force directed to the mandible. Total of 20 patients were included in the study out of which all 20 were male patients.

Parasymphysis was the most frequent site of fracture. 18 out of 20 patients had parasymphysis fractures, out of which 6 patients had isolated parasymphysis fracture and rest 12 patients had other associated fracture (2 body, 4 angle, and 6 condyle) of the mandible. Symphysis fractures were present in 2 patients; both of them had associated condylar fracture of the mandible (Table-1). Out of 20patients two patients had soft tissue loss due to laceration of lingual and buccal vestibular mucosa and comminuted fracture of parasymphysis of the mandible. In both the patient wound was not infected hence included into the study. Eight parameter was evaluated with the help of a scoring system such as Operating time, Occlusion, Infection, Mobility of fracture segment, Pain, Wound dehiscence, **Neurological deficit and Oral hygiene**

Average operating time for the adaptation & placement of each type of plate at parasymphysis and symphysis region was noted in minutes. Mean duration of procedure for group I was 6.3 minutes and for group II was 10.2 minutes (Table-2). In Group I, six patients out of 10 patients had minor and four patients had severe occlusal discrepancy at premolar region where as in Group II only one out of 10 patients had minor and other 9 patient had severe occlusal discrepancy at premolar region. Molar occlusal discrepancy was severe in all the patients of both the Groups. Postoperative in Group I, 8 patients of 10 patients had normal premolar and molar occlusion. The other two patients had immediate postoperative occlusal discrepancy which was treated successfully by giving guiding elastics (blue color) for a period of 7 days. On the other hand in Group II patients, 8 of 10 patients had normal postoperative occlusion. The remaining two patients with occlusal discrepancy was corrected in one patient by placing guiding elastics for 7 days followed by selective coronoplasty and in other one patient which was just corrected by coronoplasty. Postoperatively signs of infection were checked after 2 weeks, 4 weeks, 2months and 3months. After 2 week infection was seen in one patient of Group I and two patients of Group II. Signs of infection were found in one patient of Group I, and one patient of Group II had infection even after 4 weeks. Both the patients have preoperative

tissue loss at the fracture site. All the patients of Group I & Group II showed pre operatively mobility of fracture site at parasymphysis and symphysis region, either in one plane or two planes. Postoperatively two patients of both groups had mobility of the fracture fragments at 2 weeks and none had mobility after 6 weeks. Pain was recorded based on the visual analogue scale for patients preoperatively and post operatively on 1 day, at 2 weeks, 1 month, 2 months, 3 months, at parasymphysis and symphysis region of the mandible. The preoperative pain score in Group I was moderate in four patients and severe in six patients. In Group II, two patients had moderate pain and 8 patients had severe pain. At the end of 2 weeks pain was mild in all the patients except in 3 patients (1 patient of Group I and 2 patients of group II) in which pain was moderate in two patients and severe in one patient. At the end of 3 weeks pain was decreased in one patient of group II. At the end of 1 month pain was absent in 18 patients and 2 patients from both the groups had moderate pain. However there was no pain in any patients after 2 months. In both Group I & II, out of 20 patients, two patients showed wound dehiscence respectively. Both the patients have preoperative soft tissue loss due to laceration or lingual and buccal vestibular mucosa and comminuted fracture at parasymphysis region of the mandible. Neurological deficit was reported in one of 10 patients in Group I and Group II respectively. In group I patient the nerve was exposed which was sutured using 5-0 prolene and post operatively showed complete nerve function recovery in 1year. In group I two patients out of 10 had good oral hygiene, seven had fair oral hygiene, and one had poor oral hygiene. In group II three patients had good oral hygiene, five had fair oral hygiene and two patients had poor oral hygiene. Comparison of parameters between group I and group II and their P values are summarized in (Table 3).

DISCUSSION

Over the years the methods to treat mandibular fractures have undergone many refinements. Newer methods have been tried and older ones have had improvements. The importance of treating such a fracture in the best possible way cannot be overstressed. The strategic position of the mandible on the facial skeleton and its unique role in mastication, deglutition, phonation and esthetics compels the clinician to give immediate attention whenever it is fractured. Even in open osteosynthesis technique, there has been a metamorphosis and a change in trends from rigid fixation in 1968 to semi-rigid fixation in 1973. Michelet et al (1973) began experimenting with monocortical non- compression miniplates. Using a simple cantilever beam model, Champy et al showed that the superior mandibular border was subjected to tension and splaying, and the inferior border was subjected to compression. The transition zone between the areas of tension and compression has been referred to as a “line of zero force” running along the inferior alveolar nerve. Champy’s experiment with miniplates further delineated the “ideal line of osteosynthesis” within the mandible. Farmand developed the concept of 3D

miniplates. Their shape is based on the principle of the quadrangle as a geometrically stable configuration for support. Since the stability achieved by the geometric shape of these plates surpasses the standard miniplates, the thickness can be reduced to 1 mm. The basic form is quadrangular with 2 ×2 hole square plate and 3×2 or 4×2 hole rectangular plate.

This study was designed with an aim of evaluating the efficacy of 3D miniplate in mandibular fracture and to compare it with Champy's miniplate and to report the complications encountered during its use. The study consisted of 20 male and no female patients. This male dominance was also reported by Haug et al who did a 5 years retrospective review of facial fractures. This may be justified by the fact that the males are generally more prone to situations in which there are higher risk of trauma.

Road traffic accident was the cause of mandibular fractures in 17(85%) cases, fall in 1 case and in 2(15%) cases it was interpersonal violence. This distribution compared favourably with the results obtained by Schuchardt et al who found road traffic accidents to be the cause in 35.6% cases, fist fights in 31.8% and work related accidents and sports accidents in 11.6% and 3.3% cases respectively. The traffic rules need to be formulated and strictly reinforced to reduce the percentage of road traffic accidents.

In this study parasymphysis was the most common site of fracture in 18(90%) cases, followed by symphysis in 2(10%) cases. This result was contradictory to the findings of Huag et al who found body of mandible to be the most common site (29.5%) and Schuchardt et al who found condylar fractures (25%) having the highest frequency.

The two groups (group I & II) were compared for the 8 parameters. The patients were evaluated pre-surgically, the day after surgery, 2 weeks, 1month, 2months, and 3months postoperatively. Each parameter was evaluated with the help of a scoring system on every visit of the patient. The parameters were – 1.Operating time, 2.Occlusion, 3.Infection, 4.Mobility of fracture segment, 5.Pain, 6.Wound dehiscence, 7.Neurological deficit, 8.Oral hygiene.

Operating time

The time required for the adaptation and fixation of the plate at the fracture site (Parasymphysis & symphysis region) was recorded for both the groups. The total time was not taken into consideration because of the other associate fractures of the mandible (condyle, angle & body) with the fracture in the study groups. The operating time required for the adaptation and fixation of 3D plate was ranged from 5 to 8 minutes with a mean time of 6.3 minutes and for the Champy's miniplate was ranged from 8 to 14 minutes with a mean of 10.2 minutes. Student t-test was applied to compare both the group and the results were statistically significant for Group I.

According to the study by Feledy et al and Zix et al on 3D plate who reported reduced average operating time 55 minutes. But their time is not similar to our study operative time, because they included only single fracture hence, the total time for the

procedure was recorded, which was not applicable in our study due to other associated fracture of the mandible was treated along with the fracture of parasymphysis or symphysis fracture of the mandible and total operative time would give the wrong interpretation.

Champy's mini plates (Group II) required higher time because these are linear plates and two plates are required for fixation at parasymphysis or symphysis region. On the other hand 3D (Group I) plate is geometric configured plate which consists of two horizontal bars interconnected with two vertical bars. So single 3D plate stabilized the fracture both at superior and inferior border at a time, hence time is saved in plate fixation. In cases of oblique fracture or the fracture running through the mental foramina required more time in placement of 3D plate. In such cases the plate was placed either inferior or superior to the foramina, and care was taking while placing the plate superior to the foramina is that the screws are placed between the roots of the teeth. Because of its 3D configuration and bulky shape it was difficult to place the plate at the fracture passing the mental foramina and hence Champy's plates have advantage over the 3D plates.

Occlusion:

Restoration of pre-morbid occlusion is one of the most important goals of the management of fractures of dentofacial region. The effect of not restoring the occlusion to its original condition is disabling and can cause severe effects especially on the temporo -mandibular joint.

In our study, occlusion of the patients was checked preoperatively and during the follow up stages after surgery. In Group I, six patients out of ten patients had minor and four patients had severe occlusal discrepancy at premolar region where as in Group II only one out of ten patients had minor and other nine patient had severe occlusal discrepancy at premolar region. And molar occlusal discrepancy was severe in all the patients of both the Groups. Comparison showed statistically significant difference between both the Groups.

Postoperative in Group I, eight patients out of ten patients had normal premolar and molar occlusion. The other two patients had immediate postoperative occlusal discrepancy which was treated successfully by giving guiding elastics (blue color) for a period of 7 days. Both the patients had occlusal discrepancy because of associated fractures of the mandible. One patient had condylar & other patient had angle fracture along with the parasymphysis fracture of the mandible respectively.

On the other hand in Group II patients, 8 of 10 patients had normal postoperative occlusion. Of the remaining two patients with occlusal discrepancy, one patient had condylar fracture and other patient had bilateral condylar fracture along with parasymphysis fracture of the mandible. Occlusal discrepancy was corrected in one patient by placing guiding elastics for 7 days followed by selective coronoplasty and in other one patient which was just corrected by coronoplasty.

All patients with post-operative occlusal discrepancy had oblique fracture at parasymphysis region, and had some other

associated fracture of the mandible. The occlusal discrepancy was seen because of the imbalance between the muscular activities of the muscles of mastication after the trauma and due to the edema at the TMJ region post operative. By giving guiding elastics (blue color) this problem is solved. But in cases where the tooth is involved in the line of the fracture lead to minor displacement of the tooth, which was corrected by selective coronoplasty.

This incidence of occlusal discrepancy was compared between the two groups and the results showed no statistically significant association with both groups. 3D plates and Miniplates (semi rigid type of fixation) reported less occlusal disturbances. Whatever post operative occlusal discrepancy encountered in the patients of both the groups, were the fracture associated with other part of the mandible such as condyle and the angle. As these plates are self adaptable and non-compressive, they do not fix the fragments rigidly, hence self correction due to action of oro- facial musculature can take place.

Infection:

Mandibular fractures are often contaminated by oral bacteria,13 the propensity of infection is increased in the cases where the lingual mucosa is lacerated and is reluctance of patient to swallow or move his tongue freely so that stasis develops with consequent accumulation of debris in the region of fracture. This encourages multiplication of bacteria and the greater delay in obtaining reduction and immobilization; the more likely it is that infections will result.14 Post operative infection at the fractured site is not only the result of contamination, but is also related to reduced stability of fracture i.e. mobility of fractured segments.13 Stability is considered as the best protection against infection, as movement in the presence of foreign bodies (i.e. loose screws) usually leads to infection and malunion. Infection rate is also shown to be less with intra-oral approach14. Avascularity is shown to be one of the primary risk factor and presence of teeth in fracture line.

with the use of open reduction and internal fixation, the reported incidence of infection ranged from 3% to 32%.15 guimond et al16 reported an infection rate of 5.4% (2 out of 37 patients) with the use of 3d plates, Feledy et al17 reported 9% infection rate (2 out of 22 patients) and zix et al18 reported 0% (0 out of 20) infection rate in their study. in our study infection rate reported was 10% (1 out of 10 patients) in 3d plate and 20% (2 out of 10 patients) in champy's miniplates. It has been claimed that mobility of fractured segments is a causative factor in post-operative infections. But in our study source of the infection was because of tooth in line of fracture and poor oral hygiene. Infection is the most common complication in mandibular fractures, the improvement of plate stability might be a way to minimize this problem. Guimond et al also experienced the low incidence of wound dehiscence and plate exposure with 3d plate in comparison to champy's miniplate.

Mobility Of Fractured Segments:

Mobility at the fractured site was examined in Group I and Group II patients preoperatively and during various follow up

stages. Preoperatively all patients of Group I and Group II had mobility of fracture fragment. In our study, it was observed that one case (10%) out of 10 cases of group I had mobility after 3D plate osteosynthesis and later decreased over a period of 5 weeks, and by the 3rd month postoperatively none of the patients showed any mobility in fractured segments. In Group II, two of ten patients had 2weeks postoperative mobility present at the fracture site and as similar to Group I none of the patient in Group II showed mobility in fracture segment by 5th week. One patient of group II showed mobility of fracture at parasymphysis region in one direction in which plates was removed at 6 weeks post operative and the interdental wiring was done across the teeth involved at the fracture site, this was done to reduce the mobility of fracture. Wiring was removed at 2 months when the infection was subsided and fracture mobility was also absent. Chi square test was applied to study the association between the mode of treatment and postoperative mobility. The results however showed no statistically significant difference among the two groups. All the patients who had mobility of the fracture segment postoperatively are the patients with infection at the parasymphysis fracture site. Decrease in the mobility was seen as the infection subsided.

Rigidity of fractured segments produces a stable foundation for soft tissue growth and provides improved vascularity to the area and allows better healing of wound. It also prevents bacteria from being continually pumped through the fracture site thereby decreasing the chance of osteitis. It is seen that more the mobility presents at the fracture site, greater the chances of infection. This is why the semi-rigid monocortical fixation was questioned for its use in infected fracture and contraindicated.

According to andrew et al, as 3d plates are composed of linear, square or rectangular units, they provide increased torsional stability. The symphyseal and parasymphysial fractures are under a greater degree of torsional strain than any other areas of the mandible, hence 3d plates provide higher stability in this region.

Initially, a multidisciplinary experiment was carried out by a group of engineers to check out the rigidity of monocortical plate fixation. It has been proved that though this system is semi-rigid, this amount of rigidity is sufficient for effective osteosynthesis of fractures and to resist masticatory forces during the period of healing. Recently Alper Alkan et al19carried out an in-vitro study to evaluate the biomechanical behavior of four different types of rigid fixation systems with semi-rigid fixation system that are used currently. The study demonstrated that 3d struts plates had greater resistance to compression loads than the champy's technique.

Pain

Pain associated with the procedure was recorded for Group I and Group II patients preoperatively and during various follow up stages based on a visual analogue scale. The preoperative pain score in Group I was moderate in four patients in whom fracture involved the symphysis or parasymphysis site only and in six patients the pain was severe in who fracture involved parasymphysis or symphysis and other

associated fracture of the mandible. In Group II, two patients had moderate pain and eight patients had severe pain. The overall average preoperative pain score was 2.50 in Group I and 2.80 in Group II. On the 1st post operative day pain was higher in Group II patients due to more swelling at the operated side with an average score of 1.60 and 2.40 in Group I and Group II patients respectively. At the end of 2 weeks pain was mild in all the patients except in three patients (one patient of Group I and two patients of group II) in which pain was moderate in two patients and severe in one patient, with an average pain score of 1.10 and 1.30 in Group I & II respectively. This was because of infection at the parasymphysis region of the mandible in all the three patients. But at the end of 3 weeks pain was decreased in one patient of group II. At the end of 1 month pain was absent in 18 patients and two patients from both the groups had moderate pain. In one patient of Group I in which pain was subsided at 5th week after performing incision and drainage intra orally at parasymphysis region and in Group II patient pain was subsided at 6th week after removal of Champy's plates. Mann-Whitney U test was applied to compare the average pain scores between the two groups on 1st postoperative day, at 2 weeks, 4weeks, 2 months and 3 months interval. Group II procedure was associated with significantly slightly higher pain scores on 1st day postoperative, 2 week and 4 weeks postoperatively. However there was no significant difference between the pain scores of the two groups after 4weeks postoperatively.

The higher pain scores on day 1 for Group II patients were perhaps due to the wide surgical exposure required for adaptation and manipulation of the Champy's miniplate and more working time required for the surgical procedure. The higher pain scores on 2 weeks for Group II as compared to Group I was due to higher incidence of infection and mobility at the fractured segments. None of the patients from both groups had pain after 2 months.

Wound Dehiscence

In our study comparison of 3-D miniplates with Champy's miniplates, the patients were also checked for wound dehiscence pre-operatively at the site of fracture, on the immediate post-operative day, after 2 weeks, 1month, 2months, and 3 months. One patient in Group-I and one in Group-II had preoperative soft tissue loss at the fracture site, this because of laceration of the buccal and lingual vestibular mucosa and comminuted fracture at parasymphysis region. But both the patient showed no signs of infection hence were included in the study. Post operatively two patients, one in each Group showed the wound dehiscence, both of which had preoperative existing laceration at the fracture site. Inadequate tissue available during suturing which resulted in tension at the wound closure site and post operative infection leads to wound breakdown. Both the patients were kept on antibiotics and continuous follow up in the OPD for normal saline and betadine irrigations, which led to satisfactory secondary healing. Secondary healing caused more scar tissue formation, which decreases the vestibular depth. The

comparative statistical analysis showed no significant difference between the two groups.

Neurological Deficit

Neurological deficit was reported in 1(10%) of 10 patients in group I and in 1(10%) of 10 patients of group II respectively. Both the cases had sacrificed the mental nerve at the time of trauma and gave the symptoms of nerve paraesthesia preoperatively. In group I patient in which nerve was entrapped in the fracture fragment which was retrieved during the operation and was sutured using 5-0 prolene. Postoperatively patient showed complete nerve recovery in 1year. Though the study period was only three months post operative, patients were reviewed as long as possible. In the patient of group II in which nerve was crushed in between the fracture fragment, could not be able to approximate hence that patient had complete loss of sensation all due to permanent damage of the nerve. The statistical analysis showed no difference in the two groups in reference to the nerve injury.

Oral Hygiene

Oral hygiene was also one of the most important parameters of this comparative study and played a very important role in the post-operative healing of the patients of both the groups. Pre-operatively the oral hygiene of the patients was assessed on the scoring system mentioned above i.e. 1-good oral hygiene, 2- fair, 3-poor oral hygiene. All the patients underwent oral prophylaxis preoperatively before placing the arch bars and on discharge the patients were advised to continue with chlorhexidine mouth rinses for regular use. Oral hygiene was assessed at every visit of the follow up, and the comparison done in both the groups showed no significant differences. Oral hygiene was difficult to maintain by the patients post operatively period because of presence of arch bars and presence of pain. In Group I, two patients had good, six patients had fair and two patients had poor oral hygiene during 1 week post operative period. In Group II patient oral hygiene was good in three, fair in five and poor in two patients. In one patient of group II who did not maintained the oral hygiene had infection at 2weeks at the parasymphysis region, which was subsided at 3 weeks. Oral hygiene was maintained by all the patients after removal of the arch bars. All the patient of both the groups had good oral hygiene after 1 month post operative period.

CONCLUSION

The results of this study suggest that fixation of mandibular fracture with 3D plates provides three dimensional stability and carries low morbidity and infection rates. The only probable limitation of these plates may be excessive implant material due to the extra vertical bars incorporated for countering the torque forces and in cases where the fracture line passing through the mental foramina region.

REFERENCES

Alkan A: Biomechanical comparision of different plating techniques in repair of mandibular angle fractures. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. **104**: 752-756,2007.

Bochlogyros P: A retrospective study of 1521 mandibular fractures. Journal of Oral and Maxillofac. Surg. 43: 597-599,1985.

Champy M, Lodde JP, & Jaeger JH: Mandibular osteosynthesis according to the Michelet technique. I. Biomechanical bases [in French]. *Rev Stomatol Chir Maxillofac* **77**:569-576,1976.

Champy M, Pape HD: The Strasbourg Miniplate Osteosynthesis, Cited from Kruger E. and Schilli W. *Oral and Maxillofacial Traumotology Vol*. II: Quintessence: 19-43,1986.

Champy M: Mandibular osteosynthesis by miniaturized plates via a buccal approach, *Journal of Oral. Surg*. **6**: 14-21,1978

Dal Pont G: A new method of intermaxillary bone fixation. Cited from Roccia F, Tavolaccini A, Dell'Acqua A and Fasolis M. An audit of mandibular fractures treated by intermaxillary fixation using intraoral cortical bone screws. *J Cranio-Maxillofac. Surg*. **33**: 251-254,2005

Ewers R, Harle F: Experimental and clinical results of advances in the treatment of facial trauma. *Plastic Reconstructive Surgery* **75**:25-31,1985

Farmand M, Dupoirieux L : The value of 3-dimensional plates in maxillofacial surgery. *Maxillofac Surg* **93**:353,1992.

Farmand M: The 3-D plating system in maxillofacial surgery. *J Oral Maxillofac Surg* **51**:166,1993.

Farmand M: The 3-dimensional plate fixation of fractures and osteotomies. *Facial Plast Surg* **3**:39,1995

Feledy J: Treatment of mandibular angle fractures with a matrix miniplate: A preliminary report. *Plastic and Reconstructive Surgery*. **114**: 1711-1718,2004

Guimond C: Fixation of mandibular angle fractures with a 2.0-mm 3-dimensional curved angle strut plate. *Journal of Oral Maxillofac. Surg*. **63**:209-214,2005

Haug RH, Prather J, Indrasano AT: An epidemiologic survey of facial fractures and concomitant injuries. *Journal of Oral Maxillofac. Surg*. **48**: 926,1990

lizuka T, Lindquist C: Rigid Internal Fixation of mandibular fractures, *Journal of Oral & Maxillofac. Surg*. **21**:65-69,1992

Michelet FX, Deymes: J. Osteosynthesis with miniaturized screwed plates in Maxillofacial surgery. *Journal of Oral Surg*. **1**:79-84,1973.

Schuchardt K, Schwenzer N, Rottke B and Lentrodt J. Ursachen, Haufigkeit und Lokalisation der Frakturen des Gesichtsschadels: Cited from Kruger E and Schilli W. *Oral and Maxillofacial Traumatology*. Vol I; Quintessence; 49,1982.

Zix J: Use of straight and curved 3 dimensional titanium miniplates for fracture fixation of the mandibular angle. *Journal of Oral & Maxillofac. Surg*. **65**: 1758-1763,2007