

FREQUENCY AND REASONS FOR THE REMOVAL OF STAINLESS STEEL PLATES IN MAXILLOFACIAL TRAUMA

¹ATTA-UR-REHMAN, BDS, FCPS (Oral Surgery)

²MUSLIM KHAN, BDS, FCPS (Oral Surgery)

³QIAM UD DIN, BDS (Gold Medalist), MSc (UK) (Oral Surgery)

⁴BILAL ZAMAN BABAR, BDS (Pesh)

ABSTRACT

This study was a retrospective chart review of the cases operated for maxillofacial trauma with plate osteosynthesis in Oral and Maxillofacial Surgery Unit of Khyber College of Dentistry Peshawar, Pakistan, and was designed to evaluate the frequency and various reasons for the removal of the stainless steel plates in maxillofacial trauma patients.

It was conducted on patients who were treated with internal fixation using 2.0-mm stainless steel plates and screws. All data were obtained from the operation theater computer and operative ward charts. The variables evaluated were Age, Gender, and Site from where the plate has been removed and the cause of its removal. A total of 998 patients with maxillofacial trauma reported during the years 2006 and 2007 in this Unit.

A total of 254 plates were used in the two year study period to fix various maxillofacial fractures. Types of fixations used were 2.0-mm stainless steel plates and screws. Majority of the patients were young i.e., below 40 years. Male to female ratio of the patients was 3.5:1. Out of the 254, 27 plates (10.63%) had to be removed. Mandibular body was the most common site followed by frontozygomatic suture from where the plates were removed. Infection was the most common cause of plate removal. Other reasons for the plate removal were infections and discharging sinus, plate fracture, parasthesia, pain, planned removal in children patients younger than 10 years and for psychological reasons. A few of the patients developed complications of plate osteosynthesis.

Key words: *Miniplate Osteosynthesis, Causes of removal of miniplates, Stainless Steel miniplates, Khyber College of Dentistry.*

INTRODUCTION

Injuries to the cranio-maxillofacial area affect a significant number of trauma patients, and consequences of trauma to this region can include any combination of dental, bone, and soft tissue injury. Verification of the etiology of crani-omaxillofacial fractures provides insight into the behavioral patterns of

people from different countries and also can help identify ways to prevent such injuries^{1,2}.

Internal fixation using bone plates (BPs) and screws has been used in the facial region since late 19th century¹. In the maxillofacial region, modern internal fixation devices have gained more popularity since 1978 when Champy adapted techniques from Michelet

¹ Demonstrator Oral and Maxillofacial Surgery Department, Khyber College of Dentistry, Peshawar, dratta80@yahoo.com

² Senior Registrar Oral and Maxillofacial Surgery Department, Khyber College of Dentistry, Peshawar, muslim177@hotmail.com

³ Head Department of Oral and Maxillofacial Surgery, Dean/Principal Khyber College of Dentistry, Peshawar, Prof.qiam@gmail.com

⁴ House Surgeon, Khyber College of Dentistry, Peshawar

et al., and nowadays these devices form an important part in the management of facial bone trauma, orthognathic and maxillofacial reconstructive Surgery.^{3,4,5,6} Today, open reduction and rigid internal fixation can be achieved with a variety of different plating systems, some using an intraoral approach and some an extraoral approach.^{7,8}

The application of internal fixation in maxillofacial trauma is among the great advances that have been made in the field. The use of this technique has resulted in many advantages for the patients, however complications can arise³. The most common complications are malunion, infection/osteitis, paresthesia and iatrogenic piercing of tooth roots or the mandibular canal.⁹

The rationale of the present study was to evaluate the causes of plate removal in maxillofacial trauma patients. Other purpose of the study was to compare the frequency of the plate removal to the international studies undertaken on the subject in various trauma and maxillofacial surgery units. This study was the first of its kind in the region on the subject and will be a good addition to the literature.

METHODOLOGY

All operations were conducted in Oral and Maxillofacial surgery unit of Khyber College of Dentistry, Peshawar Pakistan. Surgery was performed in a standardized manner and patients were systematically followed up postoperatively according to a prospective protocol. On admission age, gender, type of trauma, and duration from trauma to admission were recorded. Preoperative radiological examination was performed using either panoramic radiographs (OPG), occipitomental view (OM view), Jug handle view, Lateral oblique view of mandible, posteroanterior View mandible or computed tomography scans, depending on the patient's medical condition. The radiological findings preoperatively recorded were: status of dentition (dentate, partially dentate, or edentulous), presence of tooth in the line of fracture, fracture site, presence of additional mandibular fractures, The operation was performed under general anesthesia with nasotracheal intubation. Prior to open reduction, eye-let wiring was done in all dentate patients for intraoperative maxillomandibular fixation, which was followed by intermaxillary fixation ranging from one to

six weeks depending upon age group. All plates were placed using an intraoral or extraoral approach and fixated with 4 monocortical screws (2 mm diameter, 6 mm or 8 mm length) was used. Both Plates and screws were made of stainless steel.

Indications for tooth extraction were fracture of the root itself, peri-apical and peri-coronal pathologies, tooth with gross mobility, grossly carious teeth, extensive periodontal damage, impacted teeth and fracture attended for more than a week. Concomitant fractures of the mandibular symphysis, parasymphysis, or body were fixated with two, 4-hole 2 mm miniplates at the superior and inferior borders. Concurrent condylar or subcondylar fractures were treated closed by postoperative intermaxillary fixation for 21 days. Drains were not used in any of the patients. For antibiotic prophylaxis, amoxicillin/clavulanic acid 1.2 g was administered three times per day intravenously from admission up to 24 hours postoperatively, and 1 g two times per day orally for an additional 4 days. The patients were advised to rinse their mouth three times daily with a 0.1% chlorhexidine solution until removal of the dental wirings. Soft diet was strongly recommended for 6 weeks postoperatively. Panoramic radiographs for evaluation of adequacy of surgical reduction and plate localization were taken before discharge. Planned follow-up interval were 1, 2, 6, and 12 weeks postoperatively. Post surgical complications, defined as a need for further intervention, were recorded prospectively over time span of at least 6 months post operatively.

RESULTS

A total of 254 stainless steel plates (2mm) were placed to treat/fix various maxillofacial fractures during the two years study period. Out of these 254 plates, 27 (10.63%) plates were removed. Twenty one (21) patients were males and six (6) females with a male to female ratio of 3.5: 1 (Fig 1). The age range of the patient was from 4 to 60 years with a mean age of 23.8years $SD \pm 14.6$ years (Table 1). Mandibular body had been the most common site from where the plate had been removed (33.33%) followed by frontozygomatic suture (18.5%). Four plates (14.81%) were removed from the mandibular angle, while mandibular subcondylar region, mandibular para-symphysis, and zygomaticomaxillary buttress were the least common sites from where the plates were removed i.e., 7.4%

each (Table 2). Infection/discharging sinus has been the most common cause of plate removal i.e., 37.04% (n=10) (fig 2 and 3). Planned removal of plates due to age factor constituted 22.22% (n=6) out of a total of 27 plates. The least common cause of plate removal was paraesthesia 3.7%. Four plates (14.81%) were removed due to psychological reasons on patient's request. Pain and plate fractures were the other causes of plate removal i.e., 11.11% (n=3) each (Table 3).

TABLE 1: AGE DISTRIBUTION FOR PLATE REMOVAL

Age group	Number of patients	Percentage
1-10	6	22.22%
11-20	6	22.22%
21-30	8	29.62%
31-40	4	14.81%
41-50	2	7.4%
51-60	1	3.7%
Total	27	100%

TABLE 2: SITES OF THE PLATE REMOVAL

S No	Site of Plate Removal	No of cases	Percentage
1	Mandibular body	9	33.33%
2	Frontozygomatic suture	5	18.5%
3	Mandibular angle	4	14.81%
4	Mandibular Parasymphysis	3	11.11%
5	Mandibular symphysis	2	7.4%
6	Mandibular subcondylar region	2	7.4%
7	Zygomaticomaxillary buttress	2	7.4%
	Total	27	100%

TABLE 3: REASONS FOR PLATE REMOVAL

S No	Causes of Plate Removal	Number of patients	Percentage
1	Infection/discharging sinus	10	37.04%
2	Planned Removal Age factor	6	22.22%
3	Psychological	4	14.81%
4	Pain	3	11.11%
5	Plate fracture	3	11.11%
6	Paraesthesia	1	3.7%
	Total	27	100%

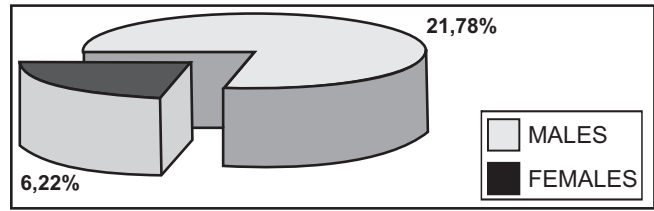


Fig 1: Gender distribution for plate removal



Fig 2: Infected plate with exposed screw in Frontozygomatic region



Fig 3: Discharging sinus due to infection in the body of the mandible

DISCUSSION

The basic orthopedic principles of bone healing and fixation biomechanics are applicable to cranio-maxillo-facial reconstructive surgery. In general, however, the emphasis is less on providing mechanical stability to resist high levels of applied physiological forces than on establishing rigid immobilization both to obtain proper, stable anatomic configuration and to promote rapid healing.¹⁰ For each particular surgical application, there exists a variety of fixation techniques to achieve these goals.

Monocortical miniplate fixation is an accepted and reliable method of fixation for patients with maxillofacial trauma undergoing orthognathic surgery.¹¹ Spiessel¹² Michelete et al¹³ and Champy et al¹⁴ developed internal fixation systems that were designed to replace or supplement maxillo- mandibular fixation in the treatment of maxillofacial injuries and deformities.

In the present study 254 plates were inserted during the two years study period. Out of these, 27 (10.63%) plates were removed.

Various international studies showed the following rate for plate removal.

Rallis and Mourouzi ¹⁵ (2006)	6.1%
Mosbah et al ¹⁶ (2003)	14%
Bhatt and Langford ⁵ (2003)	10%
Islamaoglu et al ¹⁷ (2002)	7%
Mathew and Frame ¹⁸ (1999)	5-40%
Tuovinen et al ¹⁹ (1994)	9%
Nakamura et al ²⁰ (1994)	8%

According to the present study the plate removal was predominantly done from male patients as compared to female with a male to female ration of 3.5: 1 In this regard the study is consistent with that of Rallis and Mourouzi¹⁵ showing a male to female ratio of 2.86:1.

According to the present study the age range of the patient was 4 to 60 years with the mean age of 23.8years SD± 14.6 years. While accordeing to Mosbah, and Oloyede¹⁶, the mean age of the trauma patients

who underwent plate removal was 36 years (age range 18 to 85 years). This is interesting observation because none of the child patients underwent plate removal in their series of patients. And our plate removal patients were considerably of young age comparing with their mean age.

In the maxillofacial skeleton most of the plates were removed from the mandible 74.05%. Mandibular body 33.33% had been the most common site from where the plate had been removed in the present study, followed by frontoztgomatic suture area i.e., 18.5%. Reason being because of the higher incidence of infection in the mandibular fractures. Mandiblar angle 14.81% mandibular parasymphysis and symphysis 11.11% and 7.4% respectively. Only in 7.4% the cases the plates were removed from the subcondylar region and the zygomaticomaxillary buttress area. While for the frontozygomatic suture area heating of the stainless steel plate resulted in pain. Because of pov-erty in the area most of the patients are outdoor workers and sometimes the temperature rises as high as 50 C⁰

The present study is consistant in this regard with Mosbah and Oloyede¹⁶ where of the 49 trauma cases where plate removal was performed, 38 (77.5%) were mandibular, 7 (14.3%) were from zygomatic complex fracture sites and 4 (8.2%) were maxillary. In the 38 mandibular cases, 21 (55.5%) were from the body (between first premolar and third molar), 15 (30.5%) from the angle and 2 (5.7%) from the symphyseal and parasymphyseal region.

As far as the cause of removal of the plate is concerned infection/discharging sinus had been the most common cause of the plate removal i.e., 37.04%. In 11.11% of cases the plate fracture was the reason for removal of the plate. Paraesthesia had been the least common cause of plate removal 3.7%. In children patients all the plates were removed due to age factors i.e, 22.22%. Psychological factors on patient's request constituted 14.81% of the plate removals. While in Rallis and Mourouzi¹⁵ series of plate removal, infection had been the most common cause of plate removal i.e, 24.3%. Infection rate in our patients is a bit on higher side. While 21.7% of the plates in Rallis and Mourouzi¹⁵ series were removed on patient's request showing that most of the patients do

not like palpable plates in maxillofacial region in the west.

Miniplate removal from the maxillofacial skeleton has been a controversial issue in the past decades and there has been uncertainty in the past about the need to remove miniplates and screws routinely following satisfactory healing of jaw fractures.¹⁸ Cawood²¹ recommended routine removal of stainless steel miniplates after 3 months to avoid the plate interfering with jaw function. In a retrospective study of 279 Champy miniplates used routinely as permanent implants, Brown *et al.*²² challenged the practice of routine removal of stainless steel miniplates 3 or 4 months after insertion. Iizuka and Lindqvist⁷ routinely removed stainless steel plates about a year postoperatively because there were no grounds for leaving a foreign metal object in situ after the bone had healed. Moberg *et al.*²³ advised removal of nickel-chromium and cobalt-chromium alloy implants after satisfactory healing, because metal elements released from the surface could induce allergic sensitization. It has, however, been suggested that titanium and titanium alloys are suitable for use as permanent maxillofacial implants because their biocompatibility is superior to that of stainless steel.^{16,24} Rosenberg *et al.*²⁵ removed titanium miniplates only if the patient had symptoms, or if they became infected or the wound broke down.

CONCLUSIONS

From this study and its comparison with international studies it was concluded that routine removal of stainless steel miniplates is not required for oral and maxillofacial trauma patients treated with plates.

As titanium plates are very costly, using stainless steel miniplates for management of maxillofacial trauma patients is still good option for fixation in developing and underdeveloped countries.

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