

Original Article

The Incidence and Indications for removal of Osteosynthesis Devices in Adult Trauma Patients: A Retrospective Study

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Objective: The aim of this retrospective study was to assess the incidence and indications for the removal of bone plates.

Study design: Retrospective Study

Place and Duration: This study was carried out at the department of Oral and Maxillofacial Surgery, Pakistan Institute of Medical Sciences (PIMS) between January 2007 and December 2011.

Materials and Methods: The medical records of all patients who underwent removal of bone plates after facial bone trauma were reviewed over a 5-year period. Data concerning age and gender distribution, cause of trauma, time between insertion and removal, indications and site of removal were evaluated for each patient.

Results: During the study period, 861 cases underwent open reduction and internal fixation using bone plates and screws. In 51 cases bone plates were removed (46 males and 5 females) with an overall removal rate of 5.9%. The most common indication for removal was infection (51%) followed by pain (23.5%). The mandible was the most common site of removal (60.8%). Most of the plates (90%) were removed within the first year after insertion.

Conclusions: Infection was seen to be the most prevalent etiological factor indicating removal. The majority of the cases warranting plate removal were the elderly having co-morbid conditions. Removal of plates are more likely to occur within the first year of insertion, effect that should be taken into consideration during the process of obtaining informed consent.

Keywords: Plate removal, maxillofacial implants, screws removal, PIMS

Introduction

Titanium plates have been used for osteosynthesis in oral and maxillofacial region for more than four decades.¹ Modern internal fixation devices have gained much wide acceptance since 1978 when Champy adapted techniques from Michelet and co-workers. Nowadays these devices constitute an integral part in the management of facial bone trauma, orthognathic and maxillofacial reconstructive surgery.^{2,3,4} There is, however, varied opinion but little data in the oral and maxillofacial surgery literature concerning the removal of internal fixation devices, so their long-term management remains rather controversial.^{5,6} Early systems were generally larger, bulkier, and fabricated from stainless steel or cobalt chrome, and as part of the overall treatment plan it was advocated that these fixation devices be removed after they ceased to function, however no specific reasons

were cited.⁷ In 1991, the Strasbourg Osteosynthesis Research Group suggested that "the removal of a non-functional plate is desirable provided that the procedure does not cause undue risk to the patient".⁸ For most patients there is lesser risk in leaving asymptomatic plates in situ than removing them. There is as yet no consensus among surgeons on the need for routine removal of titanium plates used for maxillofacial osteosynthesis. It is a contemporary policy in most units not to remove mini plates following bony union, but to remove them only when clinically indicated.^{6,9,10}

The present retrospective study was conducted at the oral and maxillofacial unit Pakistan Institute of Medical Sciences, Islamabad Pakistan, which is the tertiary care unit that manages maxillofacial trauma in northern region of the country. The aim of the study was to assess the incidence and indications for removal of maxillofacial implants in patients with facial bone fractures over a 5-year period.

Materials and Methods

All cases of maxillofacial trauma managed at the oral and maxillofacial unit Pakistan institute of medical sciences Islamabad Pakistan between January 1st 2007 and December 31st 2011 were evaluated. A search was conducted to identify those patients that underwent open reduction and internal fixation (ORIF) with subsequent bone plate removal. Patients less than 16 years of age were excluded from the study due to routine protocol removal of plates in these patients. A total of 51 cases of hardware removal were identified. The trauma files and medical records of these patients were examined, and following data were recorded for all patients: age and gender, cause of trauma, time between insertion and removal of plates (retention period), indications and site of plate removal and associated factors.

The removal of maxillofacial implants (Plates & Screws) used in patients at the OMFS unit Pakistan institute of medical sciences, Islamabad is carried out under a strict protocol as follows:

- Pediatric patients (less than 16 years) are advised routine removal of maxillofacial implants within 6 months after insertion.
- In adult patients (16 years or more) routine removal of maxillofacial implants is not performed unless clinically indicated.
- When it is indicated and planned that one or more bone plates are to be removed under general anesthesia, all other implants should also be removed in the same session if possible.

For the purpose of the present study the indications for removal were categorized as; infection, wound dehiscence, pain, patient demand and broken plates.

Results

A total of 861 cases of maxillofacial trauma treated by ORIF using plates and screws were identified during the study period. Removal of bone fixation devices was performed in 51 (5.9%) cases. Of the 51 patients who had plates removed, 46 (90.2%) were male and 5 (9.8%) were female. The highest incidence of plate removal was found in more than 50 years age group. (Figure 1)

With regards to the cause of trauma, 28 cases (54.9%) were due to fire arm injury (FAI), 15 cases (29.4%) of road traffic accidents (RTA), followed by industrial trauma 5 cases (9.8%). (Figure 2) Analysis of time between injury and surgical treatment showed that 94% of the cases had ORIF within 5 days and all of them received prophylactic antibiotics on admission.

The retention period (time between insertion and removal of hardware) ranged between one to 46 months. The mean retention period was 8.5 months

(range 1-46 months). Of these 51 patients, 30 (58.8%) had their plates removed in the first 6 months and 14 (27.5%) within 12 months of insertion.

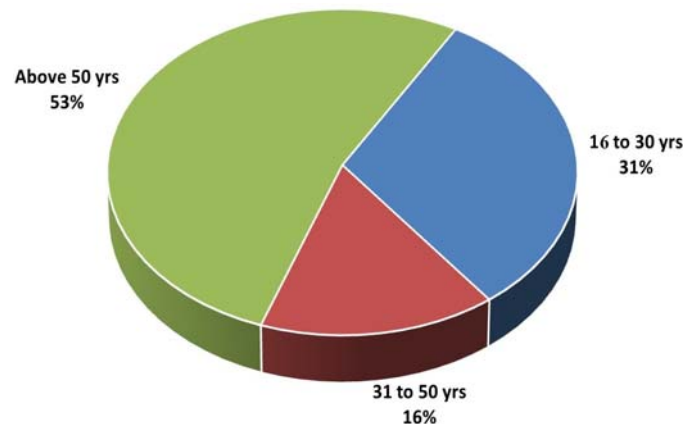


Figure 1: Age distribution in plate & screws removal patients

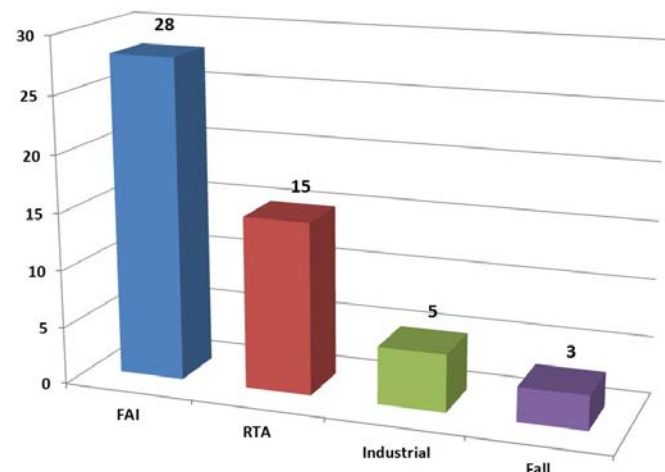


Figure 2: Cause of the trauma in study patients

Reason of plate removal was evaluated and infection was found highest etiological factor in 26 (51%) patients. (Figure 3) Other reasons were pain in 12 (23.5%) patients, followed by patients' request accounting for 9 (17.7%) removals. When infection and the cause of trauma were correlated, FAI was the cause in 16 of 26 patients (60.6%) followed by RTA in 7 (26.9%) cases. Regarding the site of plate removal, 31 cases (60.8%) were from the mandible, 12 (23.5%) from the zygoma, 5 (9.8%) from the maxilla and in 3 (5.9%) cases plates and screws were removed in a combination of sites. (Figure 4) For fixation devices removed from the mandible, the most common site was the angle (35.4%) followed by the body (22.6%). (Table 1) Within the study period, the overall removal rate was 5.9%.

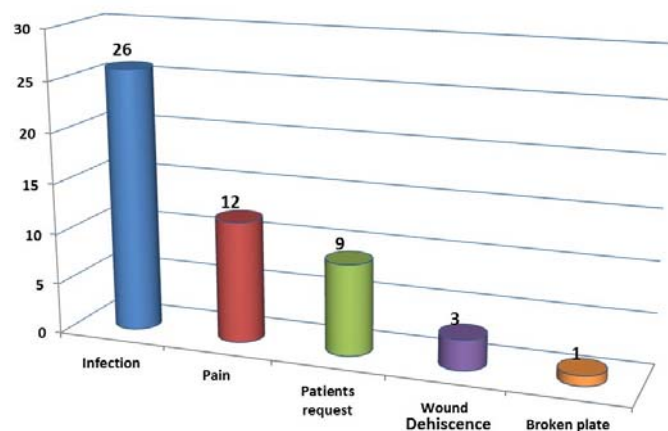


Figure 3: Indications for maxillofacial implants removal.

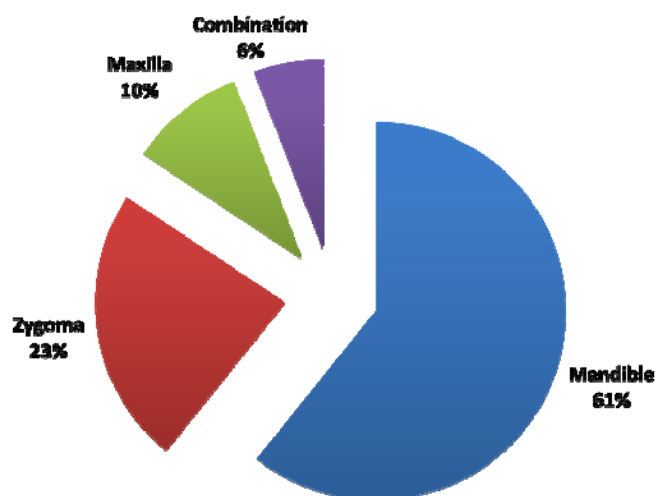


Figure 4: Site of plates and screws removal in trauma patients.

Table I: Site of removal from mandible in trauma patients

Site of Plate Removal in Mandible	No of Cases	Percentage
Angle	11	35.4 %
Body	7	22.6 %
Parasymphysis	5	16.2 %
Symphysis	4	12.9 %
Parasymphysis & Angle	2	6.4 %
Body & Angle	1	3.2 %
Symphysis & Angle	1	3.2 %

Discussion

The long-term fate of maxillofacial implants remains controversial, with some authors recommending routine removal^{11,12} and others favoring retention unless removal is clinically indicated.^{13,14,15} The arguments

against maxillofacial implant removal are based on the excellent biocompatibility of the titanium material, the low incidence of complications associated with retained plates & screws, the increased risk of subjecting a patient to general anesthesia, and the cost involved in removal.^{16,17} On the other hand, opinions in favor of removal include the plates & screws becoming foreign bodies after bone healing, the potential source of infection, pain, palpability, and avoiding potential risks of growth restriction in pediatric patients.^{18,19,20}

We have been using titanium fixation devices for maxillofacial trauma cases for more than a decade. The present study represents first analysis that looks retrospectively at the removal of plates and screws in patients with maxillofacial trauma in our center over a 5-year period. In this study we excluded pediatric patients, because literature recommends removal 2-3 months after insertion to minimize possible restrictions in growth and development.^{4,18,19,20} The protocol practiced at our unit regarding the removal of bone plates in adult patients is in line with most other international maxillofacial units, that recommend removal based only on clinical indications.^{14,15,21,22}

In the present study, plate removal rate was seen at 5.9%. This compares favorably with other published reports in which plate removal rates of 4%-17% are reported.^{3,15,22,23} The age distribution within the study group correlates well with the fact that comorbid conditions like diabetes and other metabolic diseases are more common in the over 50 year group, with most patients who required plate removal being in this group. This finding is consistent with other published studies, which report an increased incidence of plate removal over the age of 40 years.^{14,24} Another interesting observation in our study was that the maximum number of patients requiring hardware removal was treated by postgraduate residents.

When considering the retention period of plates, 86.2% of patients had plate removal within one year of insertion. This is in concurrence with other published reports which highlight that most patients get their plates and screws removed within the first year of insertion.^{22,23,25}

The main indication for removal of plates was infection/wound dehiscence, accounting for 53% followed by pain 23.5%. Pain is probably due to compression, palpability or sensitivity. This finding is in line with other reported studies which also confirm that infection is the main cause for removal of maxillofacial internal fixation hardware.^{22,23,25}

The location of plates on the facial skeleton may also influence symptoms and subsequent hardware removal.²² Brown et al. reported that there was no relationship between the site of the plates and their survival.⁵ In the present study, most of the plates removed were from the mandible (61%). According to

site, more plates were removed from the mandibular angle, followed by the body, with removal rates of 21.6% and 13.7%, respectively. The incidences of mandibular fractures in our center are 33.7%.²⁶ Present findings of a high incidence of fracture relating to location, removal rate, and infection for fracture mandible concur with those of Brown et al., Mosbah et al., and Rallis et al., who report a high removal rate from the mandible and indicate that the mandibular angle and body may be considered to be high risk for subsequent plate removal.^{5,14,23}

The delay between trauma and treatment was not significant; our unit treated 94% of the maxillofacial fracture cases in which maxillofacial implants were subsequently removed within 5 days, with all of these patients receiving prophylactic antibiotics. This finding is in agreement with other studies confirming that a delay in treatment has little effect on the survival rates of plates and screws.^{12,14} However, one earlier report suggested that a delay in the treatment of fracture may have been associated with increased complications, although in the group studied prophylactic antibiotics were not routinely administered.²⁴

Conclusion

The present study reveals that plate-related complications leading to removal are more likely to occur within the first year of insertion, a fact that should be taken into consideration during the process of obtaining informed consent. Patients with FAI and co morbid conditions should be dealt with cautions while considering ORIF. The chances of wound dehiscence reduces as the expertise of the operating surgeon increases.

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