



Causes of Removal of metallic hardware employed in oral and maxillofacial surgery - A cross sectional survey.

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ABSTRACT... Objective: This study was conducted to evaluate the causes of removal of titanium bone plates used routinely in maxillofacial region. **Study Design:** Cross Sectional Survey. **Setting:** Department of Oral & Maxillofacial Surgery, Armed Forces Institute of Dentistry (AFID). **Period:** January 2016 to June 2018. **Material & Methods:** A total of 60 patients previously operated in maxillofacial surgery department with open reduction and internal fixation with tru-dynamic titanium plating system in Operation Theater, who reported with complaints due to metallic hardware were included in the study. Data was collected regarding age, gender, time between plate insertion and removal, cause and site of plate removal was also recorded for each patient. Data was analyzed using SPSS 23.0 version. **Results:** During the study period, 60 patients underwent titanium plate removal out of which 34 were male and 26 were females. Most common cause of plate removal was infection followed by non-union. Majority of plates (43.3%) were removed within 6 to 12 months of insertion. Mandible was found to be the most common site of plate removal (60%). Gender was significantly associated with causes while age was associated with cause, site and duration of removing the metallic plates (P-Value, < 0.05). **Conclusion:** Removal of symptomatic titanium plates is likely to occur within first year of insertion. Infection was identified as the most common cause for removing the metallic plates.

Key words: Maxillofacial Bony Plates, Metallic Hardware, Plate Removal.

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INTRODUCTION

Treating craniomaxillofacial trauma involves restoring both function and form of facial bony skeleton and the surrounding soft tissue envelope. However, this was not possible until the introduction of open reduction and rigid internal fixation procedures that oral surgeons were able to restore the facial skeleton.¹ Removing metal plates after oral and maxillofacial surgery not an uncommon procedure.² Since its usage it has been considered as a source of morbidity. However, many surgeons advocate removal of plates based on their experiences, practices and observations, others suggest leaving plates in situ because of cost effectiveness. A wide variety of diseases in oral and maxillofacial region require fixation such as fractures, pathology, tumors, congenital and developmental anomalies. After surgical management the bony skeleton is either fixed or reinforced with the hardware which might be in the

forms of manipulate, micro plate, reconstruction plate or distractor. Metallic hardware use in form of titanium has long been used in maxillofacial surgery. Titanium is considered a trustworthy metal for its unique ability to bind with the bone, a characteristic known as Osseo integration. Therefore, plates made of Titanium are widely used.^{3,4} Titanium is considered biocompatible and biologically inert but its prolonged presence can cause complications leading to second surgical intervention which are performed either under local or general anesthesia to remove titanium hardware. There is a dearth of clinical guidelines for safe practices to remove tru-dynamic plating system after oral and maxillofacial surgical fixation.⁵ A clinical study reported the rated the rate for metallic plate removal ranged 2.3-28.1% among patient who suffered trauma.⁶ This fact is further supported by Hernandez et al.⁷ They observed that the plates were a source of infection

among almost half of the patient and removal of entire metal hardware was necessary for infection management. Whereas, Raja et al. examined the orthognathic procedures and recommended the partial removal of tru-dynamic plating system after oral and maxillofacial surgical fixation ranging between 9.5% -27.5%, although some surgical centers advocate removal of all plates.⁵ Furthermore, two meta-analysis highlights that removal ranged 12-22% among patients with fractured angle of mandible due to number of causes including number of plates, types of plates i.e. compression versus non-compression, type of screw i.e. mono versus bicortical contributing to the varying rate of complications.^{8,9}

Therefore, this study was set out to investigate the causes for removal of tru-dynamic plating system among patients who underwent oral and maxillofacial surgical procedures.

MATERIAL & METHODS

This descriptive cross-sectional study was conducted at oral and maxillofacial department of Armed Forces Institute of Dentistry. Census sampling was employed to recruit participants in the study. Participation was voluntary and anonymous. Approval from research board, permission from institutional head and informed consent was obtain from study participants. We collected the data over the period of 2.5 years from January 2016 to June 2018 all patients who reported to oral and maxillofacial surgery department of Armed Forces Institute of Dentistry and underwent removal of metallic hardware were included, however patients under 18 years of age were excluded from the study. All plates used were from Tru-Dynamic Plating System.

Questionnaire was designed to collect information pertinent to reasons for plate removal, time between implantation of plates and their removal, location of implant and demographic variables. Data was coded and entered into SPSS 23.0 version for analysis.

RESULTS

A total of 60 patients reported to AFID with complaints regarding metallic hardware (i.e.

micro mini and reconstruction plates) who subsequently underwent plate removal under local or general anesthesia. Study participants were predominantly male 34(56.7%) as compared to the female patients 26(43.3%). The metal plates were removed among the patients' age ranged between 20-40 years. Duration to retain the plate's prior surgical removal ranged 3-36 months. There were 26 patients whose metal plates were removed after 6-12 months of open reduction internal fixation procedure. (Table-I).

Duration	N (%)
less than 6 months	20 (33.3%)
6 to 12 months	26 (43.3%)
12 to 18 months	6 (10.0%)
24 to 30 months	4 (6.7%)
more than 30 months	4 (6.7%)
Total	60 (100%)

Table-I. Table showing duration of plate removal.

Causes of plate removal were evaluated thoroughly and infection was found to be most common etiological factor in 18 (30%) of patients followed by non-union in 8 (13.3%) patients. Pain, palpable plates, recurrence of lesion, psychological, and prosthesis rehabilitation contributed 6.7% each towards removal of hardware. While least identified causes included intolerance, patient's request and diagnostic procedure i.e. MRI 3.3% each. (Table-II).

Causes	N (%)
Infection	18 (30%)
Non-union	8 (13.3%)
Planned Removal	8 (13.3%)
Pain	4 (6.7%)
palpable plate	4 (6.7%)
Recurrence of Lesion	4 (6.7%)
Psychological	4 (6.7%)
Prosthetic Rehabilitation	4 (6.7%)
Intolerance	2 (3.3%)
Patient's Request	2 (3.3%)
MRI	2 (3.3%)
Total	60 (100%)

Table-II. Causes of plate removal.

Site	N (%)
Angle of Mandible	14 (23.3%)
Frontozygomatic buttress	14 (23.3%)
Symphysis	8 (13.3%)
Body of Mandible	8 (13.3%)
zygomaticomaxillary buttress	8 (13.3%)
Parasymphysis	6 (10%)
Anterior Maxilla	2 (3.3%)
Total	60 (100%)

Table-III. Site of plate removal.

Analysis showed that most plates were removed from the angle of mandible and frontozygomatic buttress cumulatively 46.6%. Symphysis, body of mandible and zygomaticomaxillary buttress 13.3% each. While parasymphysis 10% and least was the anterior maxilla 3.3%. For fixation devices removed from mandible most common site was angle of mandible (Table-III).

Association	Chi		P-Value
Gender -----Cause	25.28	7	0.001
Gender -----Site	11.42	6	0.076
Gender -----Duration	3.00	3	0.390
Age -----Cause	79.78	21	0.001
Age -----Site	28.94	18	0.049
Age -----Duration	18.51	9	0.030

Table-IV. Association of demographic variable with cause, site and duration of hardware removal.

Gender was significantly associated with the cause of hardware removal (P-Value, < 0.001). Age showed significant association with cause, site and duration of removing the metallic plates (P-Value, < 0.05).

DISCUSSION

Utilization of tru-dynamic plating system to reconstruct dentofacial deformities is seen as a standard practice around the world over the past few decades. However, it is not without complications i.e. infections, pain and dehiscence. As a result, routine removal of plates is a surgical debate, few supporting the removal while other assert their retention.^{10,11}

In this study a total of 60 patients reported to AFID

with complaints regarding metallic hardware (i.e. micro mini and reconstruction plates) who subsequently underwent plate removal under local or general anesthesia. This study found a comparable proportion of male 56.7% and 43.3% female patients who presented for removal of metal plates. This finding is in contrast to the other studies who did not show comparable proportion between genders.¹⁰

Current study showed higher numbers of plates were removed among the patient aged 20-40 years. This finding is consistent to a study that reported high removal of plates with patient aged around 30 years.²⁰

There is a strong association between the location of plates and their removal. In this study, 22 patients had plates removed from mandible, 2 from maxilla and 11 from zygomatic bone. For fixation devices removed from mandible most common site was angle of mandible. This is in contrast to a similar study⁴, but concurs with the findings of a similar study conducted in Birmingham.¹⁰ This can be attributed to the presence of external oblique ridge where the mucoperiosteum is thin and loose favoring plate exposure and infection.⁶

The time between insertion and removal of hardware i.e. retention period ranged from 3 to 36 months. Out of 60 patients, 26 patients had plates removed after 6 to 12 months after plate insertion showing highest incidence of plate removal. This proportion was similar to results of Bhatt and his colleagues, who also found in their research work that no plates that had been in situ for more than 30 months needed removal.²⁰

Causes of plate removal were evaluated thoroughly and infection was found to be most common etiological factor in 18 (30%) of patients followed by non-union and planned removal in 8 (13.3%) each and pain 4(6.7%) respectively. This was in accordance to similar studies conducted by Rana et al and Bhatt et al where infection was the main reason for plates removal.^{1,10}

When a hardware becomes infected, it causes

hardware exposure, fistula formation, extrusion, bony nonunion and osteomyelitis, which is managed by debridement of necrotic tissue and antibiotic administration.^{2,9}

The argument given in favor of plate removal is once the metallic hardware has served the particular purpose, it then becomes an unwanted foreign body which a tendency to cause infection and other related problems. Therefore, removal is considered a preventive measure.² On the other hand, oral and maxillofacial surgeons who support removal of osteosynthesis devices asserts the various scientific reasons, such as high corrosion resistance and excellent biocompatibility of titanium with bone.²⁰

Hence retaining or removing the miniplates remains a debate among medical and surgical fraternity, which may be resolved in future with the wide use of biodegradable plate. Therefore, British association of oral and maxillofacial surgeons recommend the removal of plates among symptomatic patients based on authentic clinical findings and expert judgment. This protocol is supported by the present study.

A small sample size and limited follow up were the main limitations. A multicenter study conducted in various large maxillofacial trauma centers will help establish protocols for removal or retention of plates.

CONCLUSION

The study reveals plate-related problems mostly develop within the first year, with infection being the primary cause of plate removal. Therefore, informed consent must comprise the removal of plates if need arise. Further research in this area, will help establish protocols for retention or removal of metallic hardware in such patients.

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




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