INCIDENCE AND CAUSES OF STAINLESS STEEL MINIPLATE (SSMP) IMPLANT EXIT FOLLOWING FACIOMAXILLARY FRACTURE FIXATION- A THREE YEAR RETROSPECTIVE STUDY

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ABSTRACT

BACKGROUND

Faciomaxillary fractures are caused mainly by road traffic accidents and are often associated with life threatening emergency situations. They are treated extensively by open reduction and internal fixation with Stainless Steel Mini Plate (SSMP) implants in our medical college hospital. We come across miniplate exit on occasions. Hence, we decided to do a retrospective study on the subject of SSMP implant exit.

The aim of the study is to find out the incidence and causes of SSMP implant exit following faciomaxillary fracture fixation over a period of three years.

MATERIALS AND METHODS

The case records of a total of 189 patients who had undergone faciomaxillary fracture fixation over a period of three years from Jan 2015 to Dec 2017 were perused with respect to the incidence and causes of SSMP implant removal. In addition, demographic parameters like age, sex and type of fracture, site of fracture, number of implants removed, and implant life in-situ were also analysed.

RESULTS

The SSMP implant exit was done in 14 cases (7.4 %); males-11, females-3. A total of 34 plates were removed. The commonest cause for implant exit was infection and the commonest site was body of mandible.

CONCLUSION

SSMP implants were well tolerated by most of the patients. SSMP implant exit was done in less than 10% of patients, the main reason being infection. This does not warrant a routine asymptomatic removal of SSMP implant in all cases.

KEYWORDS

Stainless Steel Miniplate Implant, Faciomaxillary Fractures.

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BACKGROUND

The use of miniplate in maxillofacial trauma and orthognathic surgery came into vogue in the 19th century. Champy[1] et al, in 1978 introduced the utility of the miniplates in oral and maxillo-facial area, since then the use of miniplates were increasing day by day. In earlier days alloys like Vitallium, gold, etc. were used. Then came the stainless-steel alloy in the crude form which leads to metal corrosion and leaching. Refinements were made in the stainless-steel alloy, which lead to the invention of medical grade stainless steel being used extensively in the implantology field. Then came the titanium implants which gave higher rate of tissue tolerance and bio-compatibility.[2] Now is the era of absorbable implants made of Polyglactic and lactic acid constituents, tensile strength being less than stainless steel and titanium and costlier than both of them. We cater to people of low socio-economic strata. Stainless steel implants are ideally suited for our setup as it is cheapest and readily available.[3] The tensile strength of stainless-steel implants is comparable to titanium implants.

Faciomaxillary trauma cases due to road traffic accidents (RTA) are being treated at Madras Medical College (MMC) and Rajiv Gandhi Government General Hospital (RGGGH), Chennai by Open Reduction and Internal Fixation (ORIF) with Stainless Steel Miniplate (SSMP). We do encounter cases of SSMP implant exit, though infrequently. Hence, we decided to conduct a three years retrospective study from Jan 2015 to Dec 2017.

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MATERIALS AND METHODS

A total of 189 patients had undergone faciomaxillary fracture fixation from January 2015 to December 2017 due to Road Traffic Accident. A three-year retrospective study was conducted from the case records of those 189 patients with respect to incidence and causes of implant exit. In addition, demographic parameters like age, sex and type of fracture, site of fracture, number of implants removed, and implant life in-situ were also analysed.

Inclusion Criteria

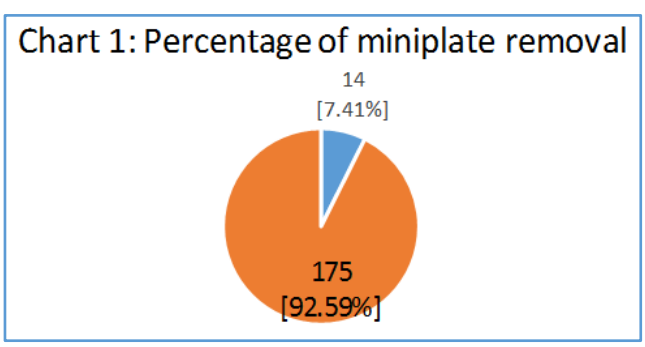
1) All cases admitted to MMC & RGGGH for faciomaxillary fracture fixation with SSMP due to RTA and subsequently had their implant exit during the period from Jan 2015 to Dec 2017.
2) Age group 10 years to 70 years.

Exclusion Criteria

1) Faciomaxillary fractures other than RTA.
2) Children below 11 years.
3) Adults above 70 years.
4) Faciomaxillary fractures managed by other than SSMP implant.

RESULTS

A total of 189 cases of faciomaxillary fractures have been treated by ORIF with SSMP implant during 2015-2017. Males were 149 (79%) and females were 40 (21%) cases. Among 189 patients, 14 underwent SSMP implant exit. Percentage of miniplate removal done in this 3 Years study is shown in chart 1.



Total number of SSMP implants exit were 34 from 14 cases. Out of 34, 26 implants were removed from male patients and 8 implants from female patients.

Table 1 shows the reasons for plate removal and number of implants removed in each category. Infection was the leading cause for implant exit with 18 out of 34 implants removed. This was followed by implant exposure and contour deformity. Patients demand without any symptoms was the least cause for removal of SSMPs. Among 189 patients who had undergone faciomaxillary fracture fixation, 18 patients had infection. Seven out of 18 patients required implant exit. Eleven patients had grade 1 and 2 infections (Southampton wound scoring system)[4] that were managed conservatively with broad-spectrum antibiotics.

Reason for Plate Removal	Number of Cases	Percentage	Number of Implants Removed
Infection	7	50	18
Implant exposure due to inadequate soft tissue coverage	2	14.2	4
Implant exposure following tooth extraction	1	7.14	4
Palpable and contour deformity	2	14.2	4
Asymptomatic patient demand	1	7.14	2
Tenderness at implant site	1	7.14	2

Table 1. Causes for Implant Exit

Sample of SSMP post fixation radiograph and implant exposure is shown in figures 1 & 2.

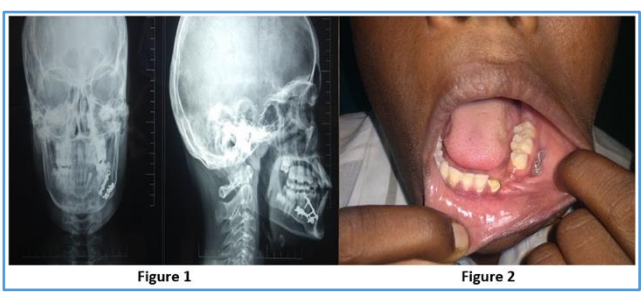
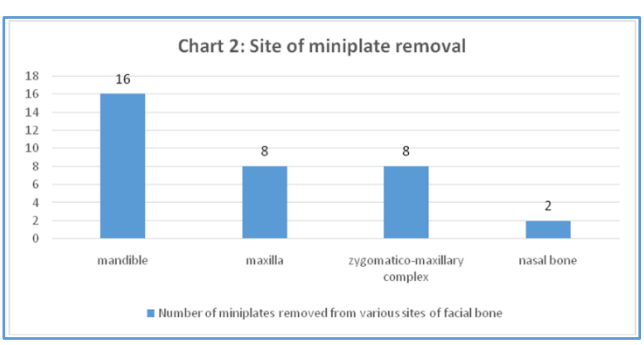


Figure 1 Figure 2

Sixteen miniplates were removed from mandible fracture fixation followed by 8 in maxillary and zygomaticomaxillary fracture fixation. Distribution of site-wise implant exit is depicted in chart 2.



Majority of patients who had undergone faciomaxillary fracture fixation belonged to 31-40 years of age. Whereas, implant exit was more in 41-50 years of age group. Distribution of fracture fixation and implant exit has been shown as age and sex wise in chart 3.

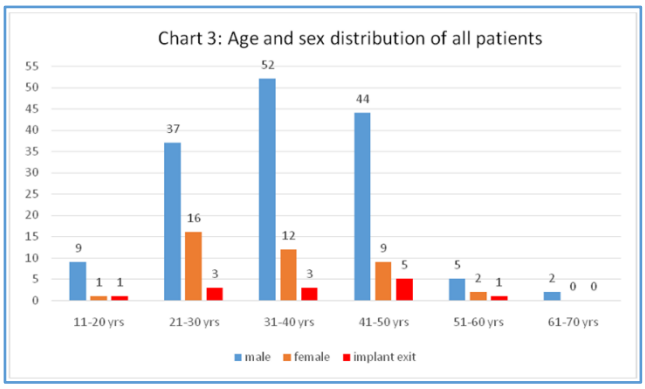


Table 2, projects in detail the sites of fracture fixation and implant life of each patient and the cause for SSMP removal. Implant was removed as early as 14 days post-operative due to infection and as late as after 2 years on asymptomatic patient's demand.

No.	Age	Sex	Diagnosis	Implant Life	Cause for Removal
1.	35	M	Right Parasymphysis of mandible fracture	14 D	IE- Inadequate soft tissue
2.	30	F	Left zygomatic arch fracture	1 Y, 5 Mo	Subcutaneously palpable
3.	29	M	Compound Right Parasymphysis of mandible fracture	23 D	Infection
4.	22	M	Left nasal bone fracture	1 Y, 8 Mo	Subcutaneously palpable
5.	47	M	Compound left ZMC fracture	19 D	Infection
6.	60	M	Compound left Parasymphysis of mandible fracture	28 D	Infection
7.	42	F	Compound bilateral Parasymphysis of mandible fracture	16 D	Infection
8.	44	M	Compound Lefort I fracture right maxilla	20 D	Infection
9.	46	M	Compound right zygoma fracture	2 Y, 2 Mo	Patient demand
10.	55	M	Lefort I fracture right maxilla	9 Mo	IE – tooth extraction
11.	15	M	Compound left Parasymphysis of mandible fracture	18 D	IE- Inadequate soft tissue
12.	48	M	Right Parasymphysis of mandible fracture	22 D	Infection
13.	40	M	Compound right angle of mandible fracture	14 D	Infection
14.	28	F	Closed fracture of right infraorbital rim	8 Mo	Tenderness

Table 2. Diagnosis and Implant Life in all Implant Exit Cases

D- days; Mo- months; Y- years; IE-implant exposure

DISCUSSION

Faciomaxillary fracture is on the rise due to increasing number of road traffic accidents. The annual incidence of faciomaxillary fractures ranges from 20 to 30%[5] in Southern states of India. In our institute soon after initial resuscitation of patients with facial injury, neurosurgery consultation was obtained. Patients with faciomaxillary fractures received broad spectrum antibiotics in trauma ward preoperatively. Second dose of broad-spectrum antibiotics were given half an hour before surgery followed by intraoperative dose. Then broad-spectrum antibiotics were continued for 48 hours. In case of infection, antibiotics were changed based on culture sensitivity report.

Vitallium, stainless steel and titanium gained popularity in internal rigid fixation for the facial skeleton. The "ideal" material should have adequate strength to maintain fracture reduction and resist physiologic stresses until bony healing was complete. Moreover, it should be sufficiently malleable to permit for in situ plate adaptation.[6] Stainless steel (alloy of chromium, nickel, and molybdenum) has adequate strength, flexibility, ductility, and bio-compatibility for most maxillofacial implant applications.[7] The disadvantage of stainless-steel implants is corrosion[8] and presence of significant radiographic scatter at MRI. Even though titanium is least corrosive and possesses the unique ability of osseointegration[9], SSMP's are popular in our set up due to cost effectiveness.

Langford et al[10] in their study with stereomicroscopy, scanning electron microscopy and energy dispersive X-ray analysis of removed plates concluded that there was no evidence supporting routine removal of miniplates. The rate of removal of miniplates has wide range in literature from 5% to 40%[11] and our current study has 7% of removal rate. Hyun-chun park et al[12] found patient's demand as the leading cause for plate removal whereas Rosenberg et al[13] in their study observed infection as the commonest cause for which plate exit had been done. In the current study 50% of miniplate removal was due to infection followed by implant exposure as the next reason for removal of miniplates.

Among 189 patients who had undergone faciomaxillary fracture fixation, 18 patients had infection. All grade 1 and grade 2 infections (Southampton wound scoring system)[4] settled with appropriate antibiotics. Seven of them who had grade 4 infections landed with implant exit. Pseudomonas, Klebsiella and mixed anaerobes were the frequently encountered organisms in these patients. They were treated with appropriate antibiotics after implant exit.

Implant exit occurred more in male population which can be attributed to more male patients getting admitted

with facial trauma in our set up. In retrospective study by Mosbah[14] et al it was found that miniplate exit was done more in 30-40 years of age group. Even though their study included both trauma and orthognathic cases, among trauma group miniplate exit was common between 30 and 40 years of age. In our study miniplate fixation was common in 30-40 years of age but implant exit peaked in 40-50 years of age group.

Patients with mandibular fractures form the most significant group among trauma series and hence in our study miniplate exit was common in patient with mandibular fractures. Infection was the commonest cause among mandible fracture group who underwent miniplate exit.[15]

Freihofer et al[16] and Champy et al supported the concept that shorter the time interval between injury and plate fixation the lesser the chances of infection. In current study all implant exit patients had their surgery done within 48 hours of trauma and everyone received broad spectrum antibiotics. So our study had no strong evidence in favour of shorter time interval between injury and plate fixation. Majority of the infected cases had compound fracture that attributed to road side contamination of wound and later infection leading to implant exit.

Implant exit within a month was solely due to infection in our study. Infection was the major cause for miniplate exit and this has been supported by many studies such as Bhatt et al,[17] Rallis et al[18] and Haraji et al[19] where 50%, 46% and 40% of the miniplate exits were due to infection respectively. The location of miniplate via oral cavity and cover by thin submucous tissue increases the risk of implant exposure to saliva, food particles and oral flora that contributes to infection. All our patients who had infection maintained poor oral hygiene which accelerates the infection rate.

As soon as the option of miniplate is explained to patient, the question of timing and necessity of removal are all at which a facio-maxillary surgeon is left with. In this era of evidence based surgical practise, the surgeons are in dilemma for removal of miniplate as there is no general consensus regarding it. A pool of surgeons favour removal of miniplate once it has served its purpose. On the contrary other pool believes in maintaining miniplate until some clinical symptoms appear. We do believe that routine asymptomatic miniplate removal is not necessary in all cases.

CONCLUSION

Stainless steel miniplate implants were well tolerated by most of the patients. SSMP implant exit was done in less than 10% of patients, the main reason being infection. This does not warrant a routine asymptomatic removal of SSMP implant in all cases. Routine implant exit will be an increase in economic burden and time-consuming procedure in referral centres where patient load and waiting list remain high.

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