
Incidence of infected hardware removal in oral and maxillofacial region

P ADITYA REDDY¹, ABDUL WAHAB P U^{2*} JAGADISH V.³

¹Department of Oral & Maxillofacial Surgery, Saveetha Dental College, Saveetha Institute of Medical And Technical Science, Saveetha University, Chennai

²Professor, Department of Oral & Maxillofacial Surgery, Saveetha Dental College, Saveetha Institute of Medical And Technical Science, Saveetha University, Chennai

³Senior lecturer, Department of Oral & Maxillofacial Surgery, Saveetha Dental College, Saveetha Institute of Medical And Technical Science, Saveetha University, Chennai

*Corresponding Author

Email ID: 151804003.sdc@saveetha.com¹, abdulwahab@saveetha.com, jegadishv.sdc@saveetha.com

Abstract: Maxillofacial fractures are typically treated with open reduction and internal fixation. Open reduction and internal fixation can be complicated by hardware exposure or infection. The literature often does not differentiate between these 2 entities; so for this study, we have considered all hardware exposures as hardware infections. Approximately 5% of adults with CMF trauma are thought to develop hardware infections. Management consists of either removing the hardware versus leaving it in situ. To evaluate the incidence of infected hardware removal in the maxillofacial region. A retrospective hospital based study, patients undergone for plate removal [hardware] were taken by analyzing and reviewing 86000 patients record, and searched for chief complaint, patient complaining of pain, swelling were noted and entered in Our study noted that 22 patients had undergone the hardware removal out of which 68% were symptomatic. 18% were plate exposure. 13% were according to patients will. Management of hardware removal needs to be done in sequential and consistent manner in order to bring better outcome. From the data available the incidence of infected hardware removal is relatively low

Keywords: maxillofacial, hardware, complications, salvage.

INTRODUCTION

The use of rigid internal fixation is part of the standard of care for various fractures following maxillofacial trauma. Anatomic reduction and rigid fixation offers pain relief and early functional recovery. Fixation may be achieved with the use of a variety of available techniques and fixation systems. The majority of the components are titanium and are designed for permanent implantation. However, the use of internal hardware is not without disadvantages as most of the human pathogens have been isolated from oral secretions. (Kumar and Rahman, 2017) The literature shows that complications are not rare. (Kelley *et al.*, 2005) (Healy *et al.*, 2017) Also Most patients are not aware of the complications of surgery. (Jesudasan, Abdul Wahab and Muthu Sekhar, 2015) Dentistry comprises of practices related to oral cavity. Oral diseases are a major problem among general population and there are various procedures carried out to prevent and treat them. Oral health have a direct impact on general health patterns as it helps to talk, eat and feel confident. (Patturaja and Pradeep, 2016) This study is designed to examine complications from internal fixation of facial fractures, and to address the need for prospective trials in regard to treatment because of the lack of empirical data available for surgeons faced with these clinical situations. An extensive literature review revealed that no studies directly address this issue. Prospective data regarding the fate of operative complications following maxillofacial trauma are scarce, if not absent. The use of well-vascularized tissue has been shown to increase the salvage rate of exposed hardware in other anatomic locations. (Viol *et al.*, 2009) There are many studies representing the infection of hardware in fractures, whereas this study was done not only in trauma but also in ocs and pathologies. Our team has rich experience in research and we have collaborated with numerous authors over various topics in the past decade (Deogade, Gupta and Ariga, 2018; Ezhilarasan, 2018; Ezhilarasan, Sokal and Najimi, 2018; Jeevanandan and Govindaraju, 2018; J *et al.*, 2018; Menon *et al.*, 2018; Prabakar *et al.*, 2018; Rajeshkumar *et al.*, 2018, 2019; Vishnu Prasad *et al.*, 2018; Wahab *et al.*, 2018; Dua *et al.*, 2019; Duraisamy *et al.*, 2019; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Gheena and Ezhilarasan, 2019; Malli Sureshbabu *et al.*, 2019; Mehta *et al.*, 2019; Panchal, Jeevanandan and Subramanian, 2019; Rajendran *et al.*, 2019; Ramakrishnan, Dhanalakshmi and Subramanian, 2019; Sharma *et al.*, 2019; Varghese, Ramesh and Veeraiyan, 2019; Gomathi *et al.*, 2020; Samuel, Acharya and Rao, 2020)

The study gives brief about incidence of infected hardware in maxillofacial region

MATERIALS AND METHODS

A retrospective hospital based study of maxillofacial injury patients carried out in a department of oral and maxillofacial surgery at saveetha dental college and hospital from June 2019 - March 2020 we reviewed and analysed the data of 86000 patient records. In patients with hardware removal cases were collected from the database. Patients' case history was taken, patient complaints were noted and reviewed. All the data was noted in EXCEL transferred to spss.

Inclusive criteria: All the patient underwent symptomatic hardware removal was noted

Excluding criteria: The hardware removal on patients' wish and exposure of the plate was excluded from the study. Patients with incomplete data were excluded from the study.

All the available data is collected in order to reduce sampling bias.

RESULTS AND DISCUSSION

A total of 99 cases were operated from June 2019 to March 2020, out of which 84.84% of the patients had no infection and 15.15% were symptomatic (figure :1). Total of 15 patients underwent symptomatic plate removal, out of which 3 were female (20%) and 12 were male (80%) (figure:2). The mean age is 32 years minimum of 4 years and maximum of 57 year. The duration of compliance was found to be highest in 2 year (26.67%) after hardware placement of the placement followed by 1 year (20%) after hardware placement (figure:3). The reason for placement of the hardware is 80% trauma, orthognathic surgeries is 12% and 8% for reconstruction purposes in cancer patients (figure:4). Out of 15 patients 80% complained pain, 12% of patient had swelling and 8% complained of numbness (figure:5). By comparing the association between reason of hardware placement and patient compliance it was found that 60% of patients complaining of pain are due to placement of hardware due to trauma, 6.67% were due to placement of hardware due to reconstructive purpose for cancer patients and 13.33% were placed in orthognathic surgeries, 13.33% patients complaining of swelling are due to placement of hardware due to trauma, 6.67% patients complaining of numbness is due to placement of hardware in trauma (figure:6). Pearson chi - square value 0.93, P value 0.909 (>0.05) and it was found to be statistically insignificant.

The overall outcome of the treatment of facial fractures has improved with advances surgical technique, as well as plating technology. The current standard care for the Management Of maxillofacial trauma involves early anatomic reduction with rigid internal fixation. This is most often accomplished by a combination of miniplates and screws. Greater Understanding Of the physiology of bone healing and the biomechanics of rigid fixation has allowed for the development of plating systems that are designed to be permanent load-bearing or load-sharing implants. The majority of the literature has focused on surgical technique or indications for device implantation. There is a paucity of literature investigating manage to complications involving maxillofacial hardware. Initial proponents of maxillofacial fracture plating, including Champy et al, Alpert and Seligson, and Cawood, recommended routine removal of the (Champy *et al.*, 1978) hardware after 3 months of insertion. (Rallis *et al.*, 2006) ('Erratum', 1985; Healy *et al.*, 2017) this was meant to avoid potential complications associated with prosthetic implants. Once Bony Union Is Achieved at an average of 4 to 6 weeks, the hardware become obsolete except for reconstruction cases. Currently, there exists no consensus on the need for routine removal of titanium maxillofacial plates; however, most authors agree that there is less risk in leaving asymptomatic plates in place compared with removing them. Most studies examining complications with maxillofacial hardware are retrospective and focus on epidemiology, timing, and risk factor identification. (Vijayakumar Jain *et al.*, 2019) Also Cancer cells exhibit a wide range of genetic alterations that include gene rearrangements, point mutations, and gene amplifications, leading to disturbances in molecular pathways modifying cell growth, survival, and metastasis. (Marimuthu *et al.*, 2018) (Patil *et al.*, 2017) (Packiri, Gurunathan and Selvarasu, 2017) Several factors may influence the perception of pain as it is a complex process. Dental pain needs to be considered more often as a possible diagnosis also. (Kumar, 2017b) (Rao and Santhosh Kumar, 2018) (Kumar, 2017c) (Sweta, Abhinav and Ramesh, 2019) The treatment of these complications and eventual outcome are often not reported, underreported, or not reported in a uniform manner between studies. Moreover, there is no uniformity in which the data are organized, which makes interpretation difficult. For example, the incidence of plate removal in the literature ranges from 5 to 40%, with most studies reporting numbers around 10%. (Gabrielli *et al.*, 2003; Murthy and Lehman, 2005) (Christabel *et al.*, 2016) The timing and nature of the hardware complication is central to the need for, and feasibility of, hardware salvage in the maxillofacial skeleton. Any infection, exposure, pain, or other morbidity that presents itself after bony union should be treated by hardware removal. A majority of the plate removal in the literature occurred within 6 months to 1 year of hardware placement. Few studies reported plate removal at less than 3 months; however, actual time of diagnosis of the potential problem or intervention taking place prior to ultimate hardware removal, such as antibiotics or irrigation and debridement, was not reported either. Mechanical hardware failure was generally treated with replacement by more rigid fixation and bone grafting. It is important for dental students to improve their

knowledge to enable diagnosis and management of patients to have a more positive attitude toward these patients [9,12](Abhinav *et al.*, 2019)(Kumar and Sneha, 2016)(Kumar, 2017a)
 Further studies need to be undertaken that examine the outcome of the treatment for these complications. Multiple studies detailed the complications following facial plate insertion, but no studies were found that followed the outcomes after the second medical or surgical intervention. Contrary to classical teaching, some postoperative complications caused by exposure, deformity, and/or infection may be successfully treated with plate salvage, but empirical data that designate which circumstances permit this are scarce. Our institution is passionate about high quality evidence based research and has excelled in various fields ((Pc, Marimuthu and Devadoss, 2018; Ramesh *et al.*, 2018; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Ramadurai *et al.*, 2019; Sridharan *et al.*, 2019; Vijayashree Priyadharsini, 2019; Mathew *et al.*, 2020)

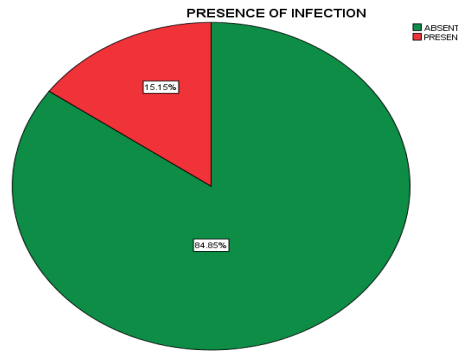


Fig.1: The following pie chart represents the presence of infected hardware from total number of patients. From the pie-chart above it is evident that patients with infected hardware are 15.15% (red color) and infection was absent in 84.85% (green color) of the patients.

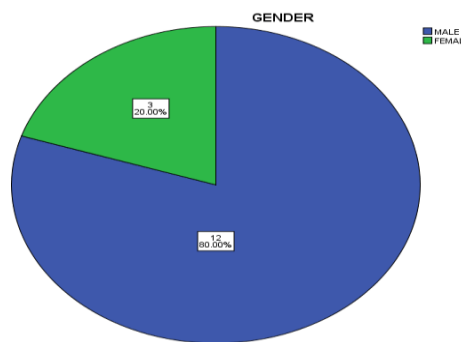


Fig.2: The following pie chart represents the gender of the patients. From the above pie chart it is evident that there is more male gender (blue) association for infected hardware when compared to the female population (green).

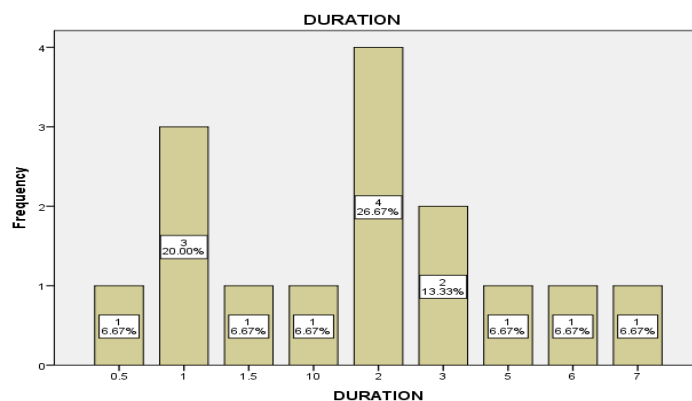


Fig.3: The following bar chart represents the duration of the placement in years. X axis represents duration of compliance in years and Y axis represents the patient count. From this bar graph it is evident that patient compliance was more in 2 years duration after hardware placement.

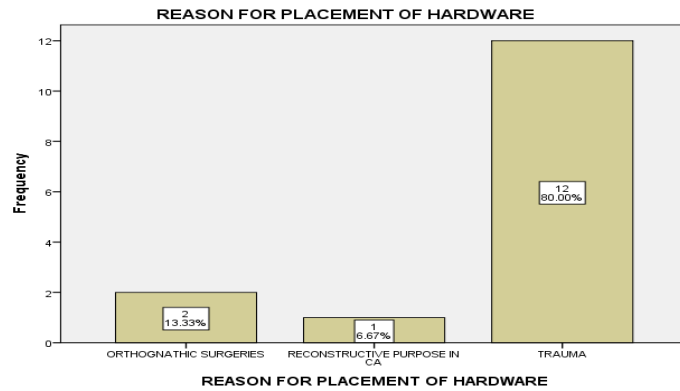


Fig.4: The following bar graph represents the reason for hardware placement. X axis represents reason for placement and Y axis represents the frequency of placement. From the above graph, placement of the hardware is mainly due to the trauma followed by orthognathic surgeries and finally reconstructive purpose in cancer patients. . The primary placement of the hardware is due to trauma followed by orthognathic surgeries and reconstructive plate in cancer patients.

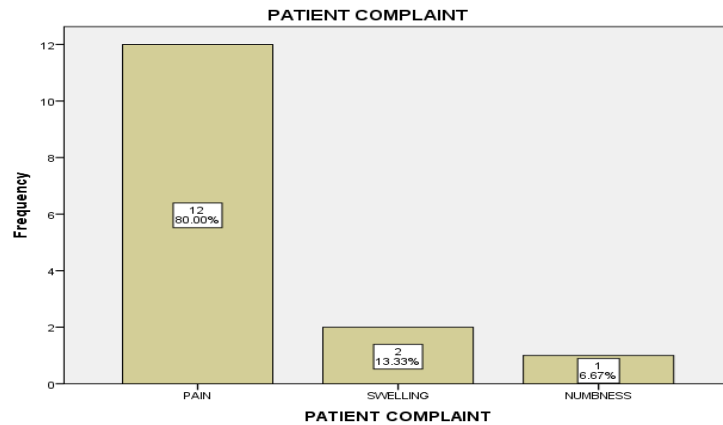


Fig.5: The following bar chart represents patients' complaints. X axis represents patients complaints and Y axis represents frequency of the patient's chief complaint. From the above graph it is evident that the patients complaints were due to pain followed by swelling and numbness.

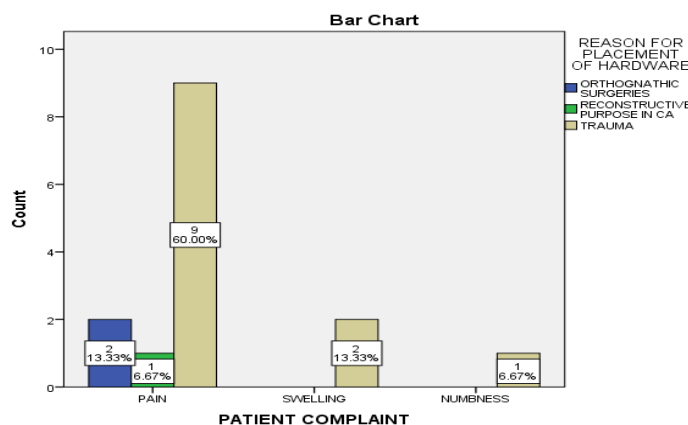


Fig.6: The following table represents the association between reason for placement and chief complaint. In the above chart X axis represents the patient complaint and Y axis represents the number of people. From this bar graph it is evident that 60% of patients who underwent surgery for trauma(brown color) had plate removal due to pain, followed by 6.67% in reconstructive purposes(green color) in cancer and 13.33% in orthognathic surgeries(blue color). Pearson chi - square value 0.93, P value 0.909(>0.05) it was statistically insignificant. Although it is statistically insignificant, we have to see the other confounding factors to arrive at the true cause.

CONCLUSION

From our present study it is evident that infected hardware removal was less when compared to overall patients who have placed hardware during surgery irrespective of their reason of placement. Pain(80%) was found to be the most common cause for the removal of infected hardware, however there is no association between patient compliants with the reason for hardware placement. Hardware removal is majorly seen in patients operated for maxillofacial trauma after an average duration of the two years from the placement of hardware. Furthermore, study in a larger population is required to find the prevalence of infection and to find out the exact cause for infection which will help in better treatment outcomes.

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