ORIGINAL ARTICLE

SCREW LOOSENING AS A COMPLICATION OF SELF-TAPPING IMF SCREWS USED FOR INTERMAXILLARY FIXATION IN MANDIBULAR FRACTURES

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ABSTRACT

Aim of the study was to find out the frequency of screw loosening in self tapping IMF screws during the treatment of mandibular fractures. It was descriptive case series.

It was carried out of oral and maxillofacial surgery, Armed Forces Institute Of Dentistry, Rawalpindi, from Oct 2012 to Jun 2013.

Patients were treated for IMF with 4 screws and were advised follow up for 4 weeks . At each follow up visit screw loosening was assessed, and the observations were recorded along with age, gender, frequency and percentage.

A total of 80 patients were selected and 320 self tapping IMF screws were used to achieve intermaxillary (IMF) fixation. Maximum number of screw loosening in any one case was one. Male patients constituted 60 % while female were 40%. The mean age was 31.20 years which ranged from 18 to 47 years. Screw loosening was observed in 33.8 % patients. The number of loose screws were related to the fracture pattern and distribution. Total number of IMF screws used were 320 with a maximum of 4 screws in each patient out of which 8.73 % screws became loose.

It was concluded that IMF screws can be used as an alternative method for obtaining quick and safe MMF in mandibular fracture with simple and undisplaced fracture patterns.

Keywords: *IMF screws, Mandibular fractures, Screw loosening, Maxillomandibular fixation*

INTRODUCTION

Trauma is the principle cause of mortality and morbidity, especially those involving road traffic accidents.[1] Maxillofacial fractures occur in a significant proportion of trauma patients because of a relatively vulnerable position of the cranium .[2] The epidemiology of facial fractures varies according to the type, severity, and cause of injury, depending on the population studied. Maxillofacial trauma represents 42% of all injuries.[3] The mandible is the tenth most often injured bone in the body and the second most often injured bone on the face. The mandibular fractures account for approx. 74% of pan facial trauma. [4]

Methods for the treatment of maxillofacial fractures include open reduction with internal fixation (ORIF) and closed reduction. ORIF is done with the help of miniplates, microplates or bioresorbable plates with/without intermaxillary fixation (IMF). In closed reduction IMF is done with Eyelets, Ivy loops, Ernst ligatures, Arch bars, Custom made splints and IMF screws.[5] Mandibular fractures can be treated with IMF in austere settings/suitable cases and satisfactory anatomical reduction can be obtained keeping in view the economy . IMF is a low cost procedure which avoids extra costs of general anesthesia and has been a time honored and versatile procedure. In developing countries, IMF is still the mainstay of treatment. Mandibular fractures must be managed carefully to maintain the function of the mandible, re-establish proper occlusion, and minimize secondary complications .[6]

IMF bone screws offer a reliable alternative to more traditional methods of obtaining IMF in the treatment of mandibular fractures and present many advantages to the surgeon and the patient. It reduces operating

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time, damage to periodontal tissues and risk of percutaneous puncture.[7] IMF with traditional methods carries an appreciable risk of occupational exposure to blood borne viruses. Most maxillofacial surgeons sustain about three needle stick injuries each year.[8]

The current study will help us and our colleagues to introduce a new modality for IMF which is less invasive and time sparing technique. It reduces the needle stick type injury, less trauma to gingivae and a relatively easier technique to master. This study will help to highlight the potential limitation and complications which the surgeon must be aware of in order to provide safe and effective treatment.

PATIENTS AND METHODS

This descriptive study was carried out at Oral and Maxillofacial Surgery department, Armed Forces Institute of Dentistry (AFID) Rawalpindi from Oct 2012 to Jun 2013. A total of 80 patients were recruited for the study, they were selected by non-probability consecutive sampling technique. Data collection was done through patient's clinical records and radiographic investigations. The patients included in our study were aged over 15 years, had no impacted permanent teeth, they were of either gender, emergency patients requiring early stabilization of fracture segments, contagious patients (MRSA positive patients, viral hepatitis), patients with compromised dentition (major tooth loss, amelogenesis imperfecta, dentinogenesis imperfecta), patients with simple, stable and nondisplaced fracture patterns. The following patients were excluded from the study, patients under 15 years of age, patients with severely comminuted and displaced fractures, unstable or segmented fractures and edentulous patients. A standard history and clinical examination chart was completed for each patient to establish a diagnosis. Orthopantomogram (OPG) was the standard radiograph supplemented by posterior anterior (PA) view of the face.

Patients fulfilling the inclusion criteria were treated for IMF as indoor/outdoor patients with 4 stainless steel IMF screws of 2mm diameter and 8 to 10mm length. After appropriate anesthesia screws were placed through mucosa. No gingival incision was given. Screws were placed between the canine and premolars, keeping them below the apices to prevent root damage. One screw was placed in each quadrant taking care not to penetrate the lingual or palatal mucosa. IMF was done using wires or elastics. The placement of the screws was evaluated immediately postinsertion with an OPG. Screws were left in place for 4 weeks. Patients were advised weekly follow up. At each follow up visit screw loosening was assessed as any mobility in the screw with the help of examination forceps and the observations were recorded. During the whole study only one operation surgeon was involved although the assistants varied. Data was analyzed using SPSS version 17. Descriptive statistics were calculated for quantitative variables like age while frequency and percentage was calculated for qualitative variables like gender and screw loosening.

RESULTS

A total of 80 patients (N=80) were included in our study, out of which 48 patients (60%) were male while 32 patients (40%) were female. In each patient, not more than 4 screws were applied, and 320 screws were used in total. Regarding age of the patients, the youngest patient was 18 years old and the oldest was 47 years old. Mean age of the patients was 31.20 ±7.511 years.

The screw loosening was observed in 27 patients (33.8 %). In none of the patients more than one screw was found loosened. The number of loose screws were related to the fracture pattern and distribution. Among the patients in the study; 23.6% (19) had condylar fractures,12.5% (10) angle fractures,16.3% (13) body fractures,10% (8) parasymphysis fractures and 37.5 %(30) had multiple fractures of mandible including more than one fracture site. Screw loosening related to fracture site was also noted and it was found that 4 (14.8%) screws were loose in condylar fractures, 5(18.5%) in case of parasymphysis fractures, 1(3.7%) in angle fracture while 17 (63.0%) screws were loose in patients with multiple fractures.

Total number of IMF screws used were 320 with a maximum of 4 screws each patient out of which 27 (8.73 %) screws became loose. Nine (33.3%) screws became loose in first week ,6(22.2%) in second week, 5(18.5%) got loose in third week while 7(25.9%) screws were found loose in fourth week of follow up.

DISCUSSION

Our study consisted of 80 patients including 48 males and 32 females yielding an overall male to female ratio of 3:2. When this ratio was compared to a local study carried out at Mayo hospital Lahore [6], it was seen that this ratio was less than that was seen in their study (5.2:1) but when compared to a study carried out in University of Maryland Medical systems, it was seen that our finding was quite different to what they observed in their study which was (6:1).[9] This shows a worldwide pattern of males being involved more than females in maxillofacial trauma. In our study mean age of 31.20 years suggests a predominantly younger population involved in traumatic events. When the age was compared with other studies which looked at trauma patterns in India, Malaysia, Turkey and Iran it was found that third decade of life is the most commonly involved age group in traumatic incidents.[10-13]

Fig 1: Clinical picture of application of IMF screws

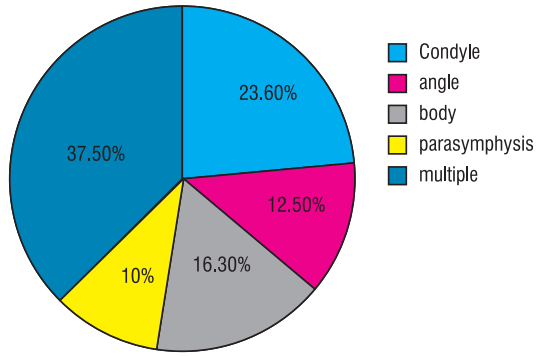

Fig 2: Distribution of fractures according to fracture site

TABLE 2: SCREW LOOSENING ON WEEKLY FOLLOW UP

	Frequency	Percentage
Week 1	9	33.3
Week 2	6	22.2
Week 3	5	18.5
Week 4	7	25.9
Total	27	100.0

TABLE 3: SCREW LOOSENING IN RELATION TO FRACTURE PATTERN/SITE

	Frequency	Percent
Condyle	4	14.8
Angle	1	3.7
Parasymphysis	5	18.5
Multiple fractures	17	63.0
Total	27	100.0

Maxillofacial trauma holds a significant value in all trauma incidents in every part of the world. The epidemiology of facial fractures varies according to the type, severity, and cause of injury, depending on the population studied. Mandible is the second most common fractured bone [2] and these mandibular fracture account for 78% of the panfacial trauma .[4] Out of all the treatment modalities of mandibular trauma, maxillomandibular fixation is the most basic and time tested. It assists in the proper reduction of fractures, provides a stable foundation so the rest of face can be reduced and fixed on a solid foundation .[9]

IMF/ maxillomandibular fixation is considered one of the most important steps in the management of maxillofacial trauma. It is required to register and secure the correct interarch relationship of the occlusal surfaces and to maintain this relation for the proper reduction and fixation of fracture fragments. Various techniques of obtaining IMF have been explained in the literature, these include but are not limited to; arch bars, ivy loop wiring and Ernest ligatures. Arch bar and eyelet loop wiring are time proven techniques. Erich arch bar itself acts as a tension band that is of maximum advantage in management of mandibular trauma by providing superior occlusion control.[4] These techniques take long time of application and have a risk of needle stick injury (NSI) to the surgeons. Most maxillofacial surgeons achieve 3 NSI each year.[8] There is a high incidence of NSI during IMF as the procedure includes 1 to 2 hours of continuous exposure to sharp wires, as wires are tightened, cut and passed multiple times around the teeth. These procedures are often done by residents who are inexperienced. Secondly oral cavity has limited access and visibility and thirdly the wires are contaminated with saliva, blood and sputum that increase the risk of transmission of hazardous infections.[14]

IMF with wires is difficult for compromised dentition including missing teeth, grossly carious teeth, mobile teeth, crowding and in patients with heavy crown and bridge work. They can cause damage to gingival tissues and compromise the oral hygiene making periodontal problems worse. Another important factor is that the time taken to apply arch bar or eyelet wiring is approximately 30 min to 1 hour which can be relatively tiring for the patient and the operating surgeon. [15]

A concept of IMF screws was introduced by Arther and Berardo in 1989[16] which was later modified by Carl Jones.[17] These screws provide a bone-borne support to the MMF wires to achieve IMF instead of tooth-borne support in the case of arch bars.[4] Initially a drill was used to drill a hole in the bone after which the screw was placed. Drilling of bone lead to thermal necrosis and eventual screw loosening of the IMF screws. To overcome the disadvantages of drilling screws a self-drilling screw was introduced by AJ Gibbons.[18] IMF screws have become one of the most common methods employed to secure maxillomandibular fixation**.** Some of the potential benefits are ; quick, easy to master technique, safe to insert , they are compatible with other plating

systems, they have minimal or no discomfort to the patient, the gingival health is easier to maintain and hence an overall improved quality of life**.** They have a reduced risk of needle stick injury, there removal is possible in the outpatient department and can be good anchors for post-operative elastic traction[15,19-22]

With all the advantages of IMF screws various complications have been reported in literature. A study conducted at university of Maryland by Colleti and Salama[9] reported hardware associated complications as screw loosening, root fracture, loose wires, screw shear, malocclusion and ingested hardware. He reported 29% of screw loosening which was the most common event out of all the complications observed during study. In relation to the total number of screws placed, 15 out of 229(6.5 %) screws became loose and were equally distributed in both the jaws.

Our study was designed to calculate the frequency of screw loosening as a complication of self-tapping IMF screws as it is the most common complication encountered. We used total of 320 IMF screws in 80 patients. Screws were equally distributed between maxilla and mandible. Patients were examined on weekly basis for screw loosening. If a screw was loose it was changed. In our study, 27 of 80 (33.8 %) patients had a screw loose in the weekly follow up visits.and 27 of 320 (8.73 %) screws were loose. Not more than 1 screw was loosened in each patient. These values are comparable to the results obtained by Colleti[9] and Salama in their study.

In another randomized control trial, B van dan bergh et al[19] reported screw loosening as 3.2 % over a follow up period of six weeks. These are quite low as compared to some international studies,in which Hashemi and Parhiz [23] reported 10.4 % and West et al [24] reported 24% screw loosening in management of mandibular fractures. In another study by Busc RF[25] also reported screw loosening as a complication and he recommended use of greater diameter screws placed away from the root apices.

The number of loose screws was related to fracture pattern and distribution. It is our observation that the worst outcome comes when IMF screws are used in the setting of multiple fragmented fractures. This is possibly due to different vector of forces acting on the bony fragments. Whether or not this problem can be overcome by using multiple screws is a matter of investigation.

CONCLUSION

IMF screws are an excellent method of obtaining IMF. This holds true in the setting of developing countries where there is lack of health care facilities. IMF screws are cost effective, they save time and lessen the chances of needle stick injuries. When used in carefully selected patients, they should be part and parcel in the essential armamentarium of the Oral and the Maxillofacial surgeon.

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5 Muhammad Umair:	Data collection, Literature review.
6 Sahrish Liaqat:	Data collection, Literature review.