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Role of intermaxillary screw fixation in maxillofacial trauma: A prospective study

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Abstract

Background & Objectives: Intermaxillary fixation (IMF) is quite widely used in the treatment of maxillofacial trauma and this treatment modality represents the cornerstone of fracture reduction and immobilization nowadays. Self-tapping Maxillo Mandibular Fixation (MMF) screws were introduced in 1989. Some of the drawbacks associated with the use of arch bars were eliminated by their emergence. Objective of this study was to characterize the various advantages, disadvantages, limitations, problems and specific complications, related to the use of self-tapping MMF screws.

Methodology: Forty patients who reported to Department of OMFS, having maxillofacial fractures requiring IMF were included in the study. Duration of IMF, screw site and complications associated with the use of IMF screws were recorded. These screws were used either as an adjunct to open reduction techniques or for definitive closed reduction. Cases were followed up for 1 month to evaluate dental occlusions and bone healing.

Results: Forty patients were analyzed out of these patients, 16 suffered with single mandibular fractures, 14 with multiple mandibular fractures, 2 with maxillary fractures and 8 with combined maxillo-mandibular fractures. 34 patients were treated with ORIF (open reduction and internal fixation) whereas 6 patients were treated with closed reduction only. The average surgical time for IMF screws fixation was about 15 ± 2.55 minutes. The most common complications were pain and edema in 14 patients. Tissue overgrowth was seen in 16 cases whereas screw loosening was seen in 2 patients where two screws loosen both in maxilla. No other complication like screw shear, fractured screws or ingested hardware was seen.

Interpretation & Conclusion: Intermaxillary fixation with IMF screws is efficacious and safe. Screw placement consumes less time and reduces the intraoperative period. However, surgeon should know the potential complications and limitations of this technique in order to provide effective treatment.

Keywords: Intermaxillary fixation, fracture, screws

Introduction

Management of maxillofacial trauma presents challenges of its own which include a need to restore normal occlusion, maintenance of facial symmetry, and complex movement of the temporomandibular joint [1]. In ancient times intermaxillary fixation was being used alone to treat fractures of maxilla and mandible but due to the lack of rigid fixation, the period of IMF was longer which used to cause discomfort to the patient [2]. Various types of tooth mounted devices like arch bars, dental and interdental wiring, metallic and nonmetallic splints are used to achieve intermaxillary fixation. Arthur and Bernado described the technique of IMF with bone screws. These bone screws were a bone borne appliance, therefore they achieve dental occlusion by bone to bone fixation [3]. This design was later modified by Jones with a capstan-shaped head design and used threaded titanium screws of 2 mm diameter and 10–16 mm length. Screws with capstan style head allow the wires and elastics to be held away from the gingival tissues [4].

IMF screws are quick and easy to use, inexpensive and also reduce the risk of needle stick type injuries associated with wires [5]. The cortical bone screws can be used in complete edentulous cases. Inter-arch plates fixed with cortical bone screws can establish MMF at an adequate vertical bite dimension without the need for interposition of dentures [6]. From their inception IMF screws have received both appreciation and criticism also. Reports available in literature demonstrate several risks and limitations of these screws [7]. These limitations include iatrogenic injury to the roots, loosening of screw, mucosal coverage, screw breakage, injuries to the root.

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The purpose of the present study was to evaluate the efficacy of the IMF screws in achieving MMF and complications associated with the use of IMF screws in maxillofacial fractures.

Aim: To evaluate the efficacy and potential complications with the use of self-tapping IMF screws in maxillofacial trauma.

Objectives: To evaluate the time taken during IMF screws fixation and to evaluate oral hygiene status of patient. To evaluate post-operative occlusion of the patient. To evaluate the potential complications associated with the use of IMF screws.

Methodology: A randomized study was carried on 40 patients of age group 20-60 years who underwent maxillofacial trauma and require intermaxillary fixation, visiting the Department of Oral and Maxillofacial surgery. Patients were included in the study after obtaining informed consent. All procedures performed in this study were in accordance with the ethical standards of the institution.

Inclusion criteria: Patients, both male and female, in the age between 20-60 years, with h/o maxillofacial trauma causing fracture of dentate maxilla-mandibular complex which are undisplaced or minimally displaced.

Exclusion criteria: Edentulous patients, patients with underlying systemic disease (American Society of Anesthesiologists III and IV) and pediatric patients in mixed dentition stages or partially dentate patients whose dentition precluded establishment of a stable occlusion were excluded. Comorbidities associated such as fractures in other parts of body (pelvic bone fractures, femur fractures etc.). Pregnant women and lactating mothers. Patients unable to give informed consent.

Proper history of the patients was taken. Risk factors (cardiovascular, pulmonary, hepatic, metabolic, allergic, CNS disease, pregnancy) were evaluated. After obtaining the informed consent each patient was randomly allocated to the study. A preoperative orthopantomograph (OPG) was done to observe the root morphology and place the IMF screws interdently, preventing trauma to the roots of the teeth (figure 1). In addition, the course of inferior alveolar nerve canal was taken into consideration. Self-tapping IMF screws used were 2 mm in diameter, 8 and 10 mm in length, and its head was 4 mm in length and 4 mm in diameter. The IMF screws were placed between the canine and first premolar in each arch (figure 2). In mandible care was taken not to place the screws too far inferiorly as there was risk of damaging the inferior alveolar nerve and vessels. The patients were divided based on age, gender, type, and site of fracture. In cases where open reduction of fractured fragments was achieved, elastic loops were used to maintain the recovered occlusion. A clinical follow-up of 1 month following removal of IMF screws was included. Cases were done only by one operating surgeon. The parameters recorded were operating time taken in minutes from start of procedure till IMF was achieved, complications of IMF screws, post-operative occlusion, oral hygiene status using Turesky-Gilmore-Glickman Modification of Quigley-Hein plaque index. Patient acceptance was measured as good, fair and poor.

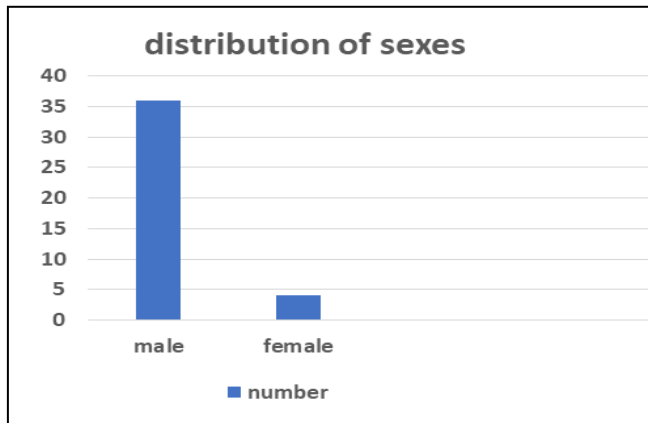


Fig 1: OPG showing left Para symphysis and condyle fracture

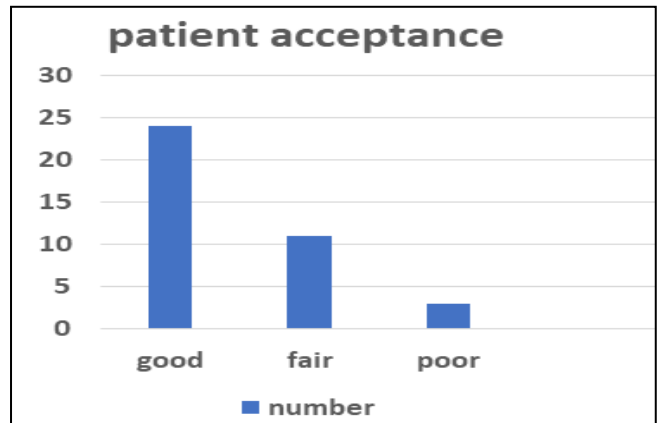


Fig 2: IMF screws placed and elastics used for treating malocclusion

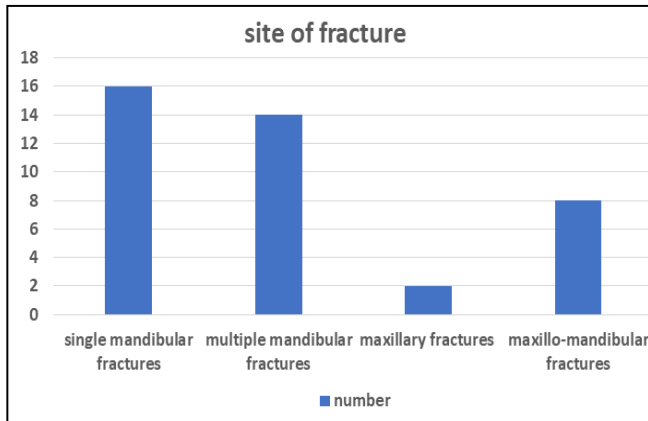
Results: Out of 40 patients 4 patients were female and 36 patients were male showing high statistically significant difference (graph 1). The average age of the patients was 36.3 ± 11.2 yrs. Of these patients, 16(40%) suffered with single mandibular fractures, 14(35%) with multiple mandibular fractures, 2(5%) with maxillary fractures and 8(20%) with combined maxillo-mandibular fractures (graph 2). Out of 16 single mandibular fractures 6 patients had condylar fracture and out of 14 multiple mandibular fractures 8 patients had associated condylar fracture. 3 patients account for condylar fracture in maxilla-mandibular fracture group. Total patients having condylar fracture were 17 out of 40 (42.5%). 34(85%) patients were treated with ORIF whereas 6(15%) patients were treated with closed reduction only. Dental occlusions of 13(38.23%) cases (out of 34 cases) were satisfied after internal rigid fixation and the screws were removed after wound closure. 21(61.76%) cases received postoperatively elastic traction for 5 to 14 days for occlusal adjustment. All the fractures healed uneventfully. The etiology of trauma included RTA (28 patients 70%), fall (8 patients 20%), sports related injury (3 patients 7.5%), assault (1 patient 2.5%) (graph 3). The average operating time taken was about 15 ± 2.55 minutes. The most common complications were pain and edema in 14 (35%) patients. Tissue overgrowth was seen in 16 cases (40%) whereas screw loosening was seen in 2(5%) patients where two screws loosen both in maxilla. Ulcers were seen in 3(7.5%) patients. Pain and edema was seen in 14(35%) patients. The remaining complications noted were damage to the roots of teeth (1 case 2.5%), malocclusion (1 case 2.5%). Malocclusion was seen in closed reduction case which was later corrected by occlusal adjustment (graph 4). No other complication like screw shear, fractured screws or ingested hardware was seen. Plaque index score was 0.87 ± 0.31 using Turesky-Gilmore-Glickman Modification of Quigley-Hein plaque index. Patient acceptance was good in 24 (60%) cases, moderate in 11(27.5%) cases whereas poor in 3(7.5%) cases (graph 5).



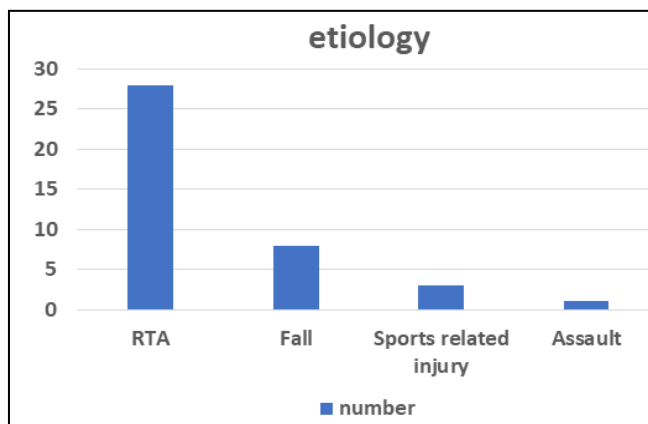
Graph 1: Distribution of sexes in group



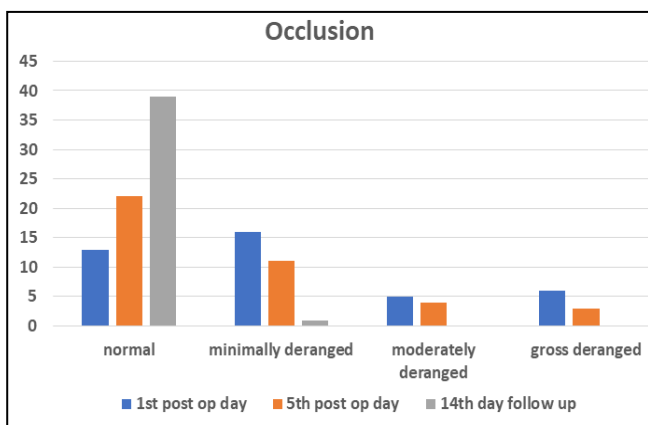
Graph 5: Patient acceptance to treatment



Graph 2: Site of fracture to be treated



Graph 3: Etiology of trauma



Graph 4: Occlusion during follow up

Discussion

The primary goal in management of fractures is to restore the form and function to its pre-traumatic condition. IMF is required to achieve temporary dental occlusion during preoperative, operative and postoperative phase of treatment. IMF screws were first introduced for treating mandibular fractures and this technique has shown more advantages over tooth borne devices for IMF [8]. Nowadays IMF screws are widely used for treatment of jaw fractures. Mono-cortical IMF screws are inserted into the alveolar process of the maxilla and mandible. These act as anchor points for MMF wires or elastics which passes through the holes incorporated in the specialized screw heads kept 4–5 mm above the alveolar mucosa or around the screw head. Transmucosal IMF screws were used in a 4-point fixation pattern with at least one screw in each quadrant [9]. Other patterns can also be used including one screw in each quadrant and two in the midline or two screws in each quadrant with or without screws in the midline. The preferred area for IMF screws implantation is from canine to first molar in maxillary quadrant¹⁰. Although arch bars provide an effective and versatile means of maxillomandibular fixation but there is risk of penetrating injury to surgeon, increased operating time both in removal and placement, trauma to periodontium, and compromised oral hygiene [11, 12]. In ORIF cases as well there is a need for temporary IMF intraoperatively that assists in reduction of fractures with the teeth in correct occlusion and postoperatively to assist in fixation or to correct minor occlusal discrepancies [4].

Coletti *et al.* [5] reported 6.5% incidence of screw loosening whereas in our study it was seen in 5% of the cases. Damage to the roots of adjacent tooth was seen in 2.5% of the cases comparable to the study done by Coburn *et al.* [7] who reported iatrogenic damage to the root in 4% of cases. Farr and Whear reported a case of fracture of screw which was at the junction of screw head and threaded portion whereas in our case no such fracture occurred [13].

4.9% of the screws were covered by oral mucosa in a study done by Roccia *et al* whereas our study had a higher number of about 40% of the patients with mucosal coverage [14]. Malocclusion was observed in one patient out of 29 patients in study done by Gordon *et al* similar to our study [15]. The average surgical time taken was about 15 ± 2.55 minutes in our study.

No other complications occurred in our study with the use of IMF screws for fixation. The sites of implantation should be carefully selected to secure screws and avoid dental root damages. Other operative precautions during placement of IMF screws include X-ray examination of alveolar bone, the

depth and direction of drilling should be controlled. Coolant to be used to minimize thermal damage. Working upon these precautions IMF screws serves as an indispensable tool for maxillomandibular fixation.

Conclusion

IMF screws are a useful modality to establish MMF. The placement of these screws is efficacious and safe. Self-tapping IMF screws reduce operating time, damage to the periodontal tissues, and offer an ease of handling. However, much attention should be paid during surgery to avoid associated complications.

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