IMF Screws: An Efficient mode of Intermaxillary Fixation in Maxillofacial Trauma Patients

Sonal¹, Meghali Diwaker¹, Sumit Aman¹, G.K Thapliyal⁴, Om Prakash⁵, Himanshu Bhutani⁶

1,2,3-Department of Oral and Maxillofacial Surgery, ITS Dental College and Research Centre, Greater Noida, U.P. 4-Head of the Department, Department of Oral and Maxillofacial Surgery, ITS Dental College and Research Centre, Greater Noida, U.P. 5- Senior practitioner, Delhi. 6- Reader, Department of Oral and Maxillofacial Surgery, ITS Dental College and Research Centre, Greater Noida, U.P.

Correspondence to: Dr. Sonal, Post Graduate Student, Department of OMFS, I.T.S Dental College, Greater Noida. Contact Us: www.ijohmr.com

ABSTRACT

Introduction: Intermaxillary fixation (IMF) is a basic and fundamental principle in the management of facial fractures. It guides in reduction and fixation of facial fractures by securing the patient’s pre trauma occlusion. Aim & Objectives: To assess the efficacy of Maxillomandibular fixation using Titanium Intermaxillary fixation screws in the management of facial bony injury. Material and Method: 30 patients presenting with facial fractures reporting to our College and hospital were randomly selected and were divided into group A (IMF Screw) and group B (Arch bar) including 15 patients in each group. Results: Study population consisted of 30 patients (mean age 31.8 for group A and 35.8 in group B). Time duration to fix IMF Screw (mean 19.8min) and for Arch bar (mean 92.4min). Glove puncture rate was markedly lower in IMF Screw group (6.7%) and in Arch bar group (40.0%). Occlusion was found to be satisfactory in both groups. Periodontal health, interdental papilla preservation, bite force, were found to be better with group A (IMF Screw).

KEYWORDS: MMF, IMF Screw, Arch Bar

INTRODUCTION

Management of mandibular fractures opens with history and evolution of treatment and dates back to Edwin Smith, an ancient Greek. He provides clear cut documentation for the treatment of mandibular fractures dating back as early as the seventeenth century. Intermaxillary fixation (IMF) is a basic and fundamental principle in the management of the facial fractures. It guides in reduction and fixation of facial fractures by securing the patient’s pre trauma occlusion. Since ancient times, IMF has been used alone to treat facial fractures. This was achieved by attaching a metallic framework to the teeth to provide support to the fractured segments and then Intermaxillary fixation was done with elastics or wires. Due to the lack of rigid fixation, the period of IMF was longer which used to cause discomfort to the patient. Maxillomandibular fixation (MMF) is considered one of the most important steps in the management of trauma of maxilla and mandible. Different methods to achieve IMF have been described in literature such as Arch bars, Risdon wiring, Ivy eyelet wiring, bonded brackets, metal splints, acrylic splints, gunning type splints for edentulous patients, and more recently self tapping and self drilling IMF screws. The Arch bar was introduced by Saures (1889) in Germany and Gilmer (1901) in the USA has been the mainstay for the management of maxillomandibular bony injuries since the World War I. Though Arch bar provide superior occlusion control and reliable fixation, they present with many disadvantages which includes difficulty in maintaining oral hygiene, trauma to the periodontium, reduced patient compliance and patient discomfort, time duration for placement of Arch bar is longer, and risk of needle stick injury is more etc. For overcoming these problems, alternate techniques such as IMF screws have been introduced. IMF screws provide bone borne support for the MMF wires to achieve IMF instead of tooth borne support in the case of Arch bars. For this reason, many complications related to tooth borne devices such as poor oral hygiene and periodontal health can be avoided. In 1989 Arthur and Berardo suggested an alternative method for intermaxillary fixation. The technique involved the use of self tapping 2.0 mm titanium bone screws (predrilled IMF screws, bicortical screws, IMF screws, translveolar screws) which were placed into the maxilla and mandible to provide points of intermaxillary fixation. Self-tapping IMF screws are quick and easy to use and greatly shorten the operating time to achieve maxillomandibular fixation. They are relatively inexpensive and reduce the risk of needle stick-type-injuries associated with using wires.

Aim & Objectives: To assess the efficacy of Maxillomandibular fixation using Titanium Intermaxillary fixation screws in the management of facial bony injury.

MATERIALS AND METHODS

The study population was randomly divided into two groups, Group A and Group B. Group A comprising of patients in whom IMF Screws and Group B whom Arch Bar were used for maxillomandibular fixation. Preoperative surgical workup was done for each patient. Patients were intubated through nasoendotracheal intubation by the Anaesthesiologist.

All important anatomic structures of the maxilla and mandible relevant to insertion of IMF Screws were identified. Preoperative radiographs (OPG) were evaluated for determining the position of placement of IMF Screws. The maxillary tooth roots were identified and traced paying particular attention to the canine roots which are the longest of the tooth roots. 2% lignocaine HCL was infiltrated at the site of mucosal entry of Screw.

Screw fixation: The first hole was drilled in dense cortical bone by 1.5mm drill bit with a straight hand piece and micromotor. Since the IMF Screws we used were of self-tapping variety, it was not necessary to give incision and elevate the gingiva. Continuous irrigation was done with normal saline by a 10ml syringe while drilling the hole. Care was taken as not to drill over inferior alveolar canal or tooth roots and not to damage, entrap, or tear patient’s soft tissue or damage critical structures. The screws were positioned superior to the maxillary tooth roots and inferior to the mandibular tooth roots at the mucogingival junction and were inserted either medial or lateral to the long axis of the canine roots (Figure 1). The screw was advanced making sure that the screw holder does not compress the mucosa and then it was tightened by the screw driver. Screw heads were kept just above the level of the oral mucosa to allow application of the fixation of wires or elastics. The procedure was repeated for inserting the other three screws. A total number of four screws were placed one in each quadrant in between 1st and 2nd premolar region of mandible and maxilla. Fracture site was exposed and reduced and teeth were brought in maximum intercuspation. 26 gauge wire was kept ready pre-stretched 10% to its original size. The wires were passed through the cross holes present in the screw head of the maxillary and opposing mandibular screws. The free ends of the wires were clamped into the Wire Twister and the wires were pulled and twisted while keeping an eye on dental occlusion. During this process, it was ensured that teeth remain in maximum intercuspation or as pre-morbid occlusion. Fixation was done with the help of Ti places and screws placed as per the AO principle. IMF was released, and the wound was closed in two layers with Vicryl sutures.

Arch Bar Fixation: Local Anaesthesia 2% lignocaine HCL with Adrenaline was administered. Bilateral infraorbital and nasopalatine nerve block for anterior teeth and posterior superior alveolar nerve block and greater palatine nerve block for posterior teeth were given. For mandibular teeth, Inferior alveolar nerve block, lingual nerve block, and infiltration into long buccal nerve region were given. Objective signs for effect of LA were checked by using a straight probe. The arch bar was adapted to the buccal surface of each arch and given the shape of the arch by bending it; Arch bar was fixed on either side of the fracture line. It was fixed to each tooth, using pre-stretched 26 gauge stainless steel wires, were passed from mesial surface of tooth to the lingual side where the wires were kept below the cingulum region using a periosteal elevator, and then the wires were passed back on the buccal side from the distal surface of the tooth, making sure that one end of the wires passes above the arch bar and the other below it. The arch bar was attached securely and firmly to the necks of each tooth on the buccal surface of the arch. Teeth were brought in maximum intercuspation (Figure 2). IMF was achieved using orthodontic elastic bands or wires inserted between the fleets of the upper and lower Arch bar.

All patients of group A and group B were evaluated immediately after fixation of IMF Screws or Arch Bar under following criteria: 1) Time, 2) Glove Puncture. Various clinical parameters such as: 1) Occlusion, 2) Periodontal pocket- depth, 3) Interdental papilla position, 4) Mucosal/gingival over growth, 5) Mobility of screw, 6) Vitality of teeth, 7) Bite force were evaluated each patient of both the groups were evaluated at one week one month and four month. The radiological parameters like 1) Proximity of IMF screws with a tooth root, 2) Radiolucency in area of the screw were evaluated at one month and four months respectively.

Statistical Analysis: Intergroup comparison of categorical variables was done using Chi - square test. Intergroup comparison of continuous variables was done.
using Independent t-test. The level of statistical significance was set at 0.05.

RESULTS

Distribution of males & females among two study groups was not found to be significantly different among two study groups p (1.000). When the distribution of study population according to the mode of injury among two study groups was compared then it was found that it was not significantly different among two study groups p (0.357). The Mean age of study population of IMF group was found to be lower as compared, to that of Arch bar group, but this difference was failed to reach the level of statistical significance p (0.227). The Mean duration of time for procedure completion in IMF group was found to be significantly less in comparison of Arch bar group p (<0.0001). Mean bite force in IMF group was found to be significantly lower as compared to that of Arch bar group p (0.002). The occurrence of Glove puncture was found to be significantly more frequent among Arch bar group p (<0.0001). Distribution of different types of occlusion among two study groups was not found to be significantly different p (0.274). The occurrence of Periodontal pockets was found to be significantly more frequent among Arch bar group p (<0.0001). Occurrence of intact papilla & detached papilla was found to be significantly higher among IMF group & Arch bar group respectively p (<0.0001). Presence of mucosal growth was not found to be significantly different among two study groups p (0.215). Presence of screw mobility was not found to be significantly different among two study groups p (0.224). Presence of root impingement was not found to be significantly different among two study groups p (0.483). Presence of radiolucency at 1 month was found to be significantly more common among IMF group p (<0.0001). Presence of radiolucency at 4 months was not found to be significantly different among two study groups p (1.000). Distribution of different types of Reduction was not found to be significantly different among two study groups p (1.000). Use of different types of Anaesthesia was not found to be significantly different among two study groups p (1.000).

DISCUSSION

Any discussion on the management of mandibular fractures opens with history, evolution of treatment, and dates back to Edwin Smith, an ancient Greek, who provided clear cut documentation for the treatment of mandibular fractures dating back as early as 17th century. Management of fractured facial bones presents some challenges of its own: a need to restore normal occlusion, maintenance of facial symmetry and balance, complex movement of Temporomandibular joint.

Successful treatment of mandible fractures depends on reduction and fixation using a closed or open technique, on restoration of normal occlusion and bony union. Before fracture reduction, temporary intermaxillary fixation with correct registration of occlusion is usually necessary. The arch bar has been the mainstay for the management of maxillomandibular bony injuries since the World War I although other methods such as interdental eyelet wiring, external pin fixation, bonded brackets, cast metal splints, embrasure wires, and pearl steel wires are also reported. Although arch bars provide an effective and versatile means of maxillomandibular fixation, their use is not without consequence. To overcome the drawbacks of arch bars, the self-tapping intermaxillary screws were first introduced by Arthur and Berardo in 1989. The study was conducted on patients with facial trauma reported to our college. This study is a randomized clinical study comprising of thirty cases with fracture of maxilla or mandible. Patients were randomly divided into 2 groups, group A (IMF Screw) and group B (Arch bar) comprising 15 patients in both group A and group B. Inter-group comparison of the mean time duration of the procedure was found to be significant, (p <0.0001). In group A, mean time taken to complete the procedure was 19.800. B.van den Berg et al had similar values for completion of the procedure of IMF Screw within 17min (range 5-30). Mastering the technique of placement of IMF Screws can result in decreased the working time. This significantly saves the intra-operative time. The occurrence of glove puncture was found to be significantly more frequent among the Arch bar group with a higher rate of 73.3% patients (p <0.001), similar results were found in a study done by Yashmeet Kaur Sandhu et al with glove perforation was noted in 71.4%. Occlusion was found to be satisfactory in all the patients included in this study. Intergroup comparison according to occlusion was found to be nonsignificant, (p 0.274). Swetha K et al and Mitul et al observed a similar result in their study. Intergroup comparison of mean Bite force was found to be significant, (p 0.002). IMF Screw group had higher mean bite force value (1.338) as compared with Arch bar group with mean bite force (1.2593). This was a unique analysis of this study, and no study has been done comparing the bite force for IMF Screw and Arch bar. Deepening of Periodontal pockets among group A (IMF Screw) was less frequent as compared with group B (Arch bar) with p value <0.0001 similar results were found by Lingraj et al. Distribution of study population according to the position of interdental papilla among two study groups was found to be significant with p value <0.0001 (Table XII). Col N K Sahoo and Mitul et al reported with a considerable reduction in damage to interdental papilla in their study. Presence of mucosal growth was not found to be significantly different among two study groups. IMF group presented with 60% patients with mucosal over growth, G.D Nandini et al found results similar to our studies. Screw mobility in IMF screw group was not found to be significant with total of 3 patients presented with mobility of the screw. This is remarkably lower when compared with international literature, in which percentage rates of between 10.4% and 24% are reported by (Hashemi and Parhiz, Rai et al. and West et al.) Group A (IMF Screw) presented with non-vital teeth on electric pulp testing in two patients which became vital on later follow up period
and did not require any endodontic treatment which is similar to the studies done by Swetha K et al. Distribution of study population according to the presence of root impingement among two study groups was not found to be significant. IMF Screw group presented with root impingement in 2 patients (13.3%) which is in accordance with results found by Roccia F et al. 18. Presence of radiolucency in IMF Screw group at 1 month was found to be significant with p value < 0.0001. Anshul Rai et al. 19 reported 13 (41.9%) of the 36 screws, there appeared to be radiographic evidence of tooth damage, with 4 screws appearing to enter the pulp. Distribution of study population according to the presence of radiolucency at 4 months among two study groups was found to be nonsignificant. The radiolucent area was replaced by radiopacity in the region of screw application indicating osseous regeneration at the site within four months.

CONCLUSION

The two basic modalities of MMF after craniofacial trauma i.e. tooth-borne devices (Arch bar) or bone screws (IMF Screw) acting as skeletal fixation points have been widely used for the management of facial trauma. Arch bars have been considered as the gold standard for achieving maxillomandibular fixation due to its rigidity and versatility. Though arch bars provide superior occlusion control and reliable fixation, arch bars have numerous disadvantages which includes difficulty in maintaining oral hygiene, and arch bar causes trauma to the periodontium, reduced patient compliance is seen with arch bars. The IMF screws can be used as an alternative to the arch bar for achieving temporary intraoperative occlusion. These screws offer the advantages of less intraoperative time, decreased risk of needle stick injuries, less trauma to surrounding soft tissues, less difficulty in maintaining oral hygiene, and ease of use. Self-tapping IMF screws offer good temporary fixation for intraoperative occlusion for open reduction. This study was conducted during November 2016–September 2018 to study the efficacy of maxillomandibular fixation using Titanium Intermaxillary Fixation Screws in facial trauma patients. Various clinical and radiological parameters were assessed for both the groups at immediate post-op, at one week, at one month and at four months.

This study demonstrates a good occlusion in symphysis, parasymphysis, body, angle of the mandible and even in unilateral subcondylar fractures. This study reveals a low percentage of iatrogenic injury to teeth, lesser damage to the periodontal tissues and interdental papilla, reduced operating time and minimal risk of needle stick injuries. After this study, we can conclude that the IMF self-tapping screw is a proven useful technique of maxillomandibular fixation. Intermaxillary fixation with self-tapping IMF screws is a more efficacious method as compared to the conventional Erich arch bars in the treatment of facial fractures.

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