



Self-tapping Intermaxillary Fixation Screw: An Alternative to Arch Bar

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ABSTRACT

Introduction: The use of intermaxillary fixation (IMF) in the treatment of faciomaxillary fractures is the key factor for reduction and immobilization. Various techniques of IMF have been described in the past and recently IMF screws have been introduced. This technique has various advantages, including ease of use, less time consumption, less trauma to the surrounding soft tissues, and relatively reduced risk of needle stick injury. This study evaluates the efficacy of IMF screws over arch bar IMF before definitive fixation of facial fractures.

Materials and methods: This study is a randomized clinical study. Study population consists of 20 patients with mandibular fractures requiring IMF with open reduction and reported to Department of Oral Surgery, Modern Dental College and Research Centre, Indore, Madhya Pradesh, India between September 2012 and April 2015. Two groups were formed with 10 patients in each group. In the first group, IMF was achieved using the Erich's arch bar and wires. In the second group, IMF was achieved using self-tapping IMF screw. The patients were assessed for various parameters, such as the time required in minutes for the IMF stability of fixation, postoperative occlusion, postoperative pain, periodontal health, oral hygiene, and incidence of needle stick injury.

Results: All the cases had stable IMF in both groups. At the end of 14th day, overall oral hygiene was poor in group I and

good in group II, significant statistically ($p = 0.031$). Iatrogenic injury to tooth was absent in group I and present in 1 case in group II, not significant statistically ($p = 0.305$). Average time taken for the IMF in group I was 74.9 minutes, with the range of 58 to 88 minutes, and in group II was 16.1 minutes, with the range of 11 to 22 minutes, which is highly significant statistically ($p = 0.001$). Needle stick injuries were taken as positive if glove perforation was present and these were reported in four cases in group I, whereas in group II, no case had incidence of needle stick injuries, which shows significant statistically ($p = 0.025$).

Conclusion: After this study, we can conclude that IMF self-tapping screw is a proven useful technique of IMF. Intermaxillary fixation is a safe and less time-consuming method but with various shortcomings and complications, which the surgeon must be aware of while providing treatment.

Clinical significance:

Keywords: Erich's arch bar, Intermaxillary fixation, Self-tapping intermaxillary fixation screws.

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INTRODUCTION

Intermaxillary fixation (IMF) is a basic and fundamental principle in the management of the facial fractures. It serves as a key factor for maxillofacial reconstruction. Intermaxillary fixation provides a steady framework by which normal facial appearance and function can be restored. It guides in reduction and fixation of facial fractures by securing the patient's pretrauma occlusion. Many methods for IMF have been proposed but arch bars are proved to be the gold standard. Arch bars are effective and versatile method of IMF, but their use is associated with various complications, such as risk of needle stick

injuries, time-consuming procedure, soft tissue trauma, and difficult to maintain oral hygiene. The use of IMF screw has overcome many of these complications. The various benefits of intermaxillary screws over arch bars are fast and safe placement and retrieval, less trauma to surrounding soft tissues, and better oral hygiene status.¹ Many surgeons use IMF screws to overcome the problems associated with arch bars like more operating time and more needle stick injuries, but studies also show various risks and limitations associated with IMF screws.²⁻⁴

MATERIALS AND METHODS

This study was a randomized clinical trial. Informed consent was obtained from all patients who were enrolled in the study. The patients that reported to the Oral Surgery Department, Modern College of Dental Science, Indore, Madhya Pradesh, India between September 2012 and April 2015 were taken for study. The criteria for the inclusion in this study were: Patients aged 18 years, older males and females, unilateral, bilateral, simple or compound, mildly, moderately displaced, or undisplaced fractures of mandible requiring IMF with open reduction.

Patients with comminuted fractures, severely displaced fractures, and children with erupting teeth, crowding of teeth, and the presence of systemic conditions like bronchial asthma were excluded from this study. The patients were evaluated in this study for the following variables, such as:

- The time required in minutes for the IMF,
- Stability of fixation,
- Postoperative occlusion,
- Postoperative pain,
- Periodontal health and oral hygiene,
- Iatrogenic injury to the tooth, and
- Incidence of needle stick injury.

The included patients were divided into two groups:

1. Group I comprised 10 patients in which IMF is achieved using the Erich's arch bar, and
2. Group II included 10 patients in which IMF is achieved using self-tapping IMF screw. In group I IMF was achieved using prefabricated Erich arch bars. In patients with complete dentition, it was extended on both sides to the second molar and in the case of a deficient number of teeth, third molars were also included. To secure the arch bar to the teeth, 24-gauge wire was used, while 26-gauge wire was used for achieving IMF.

In the second group, IMF was achieved using IMF screw of 2.0 mm diameter and 10 mm length. After clinical and radiographic evaluation, screw insertion site was decided. Screws were inserted in the area that provided suitable vectors to reestablish the pretrauma occlusion and maximal safe distance from root of adjacent teeth. The screws were placed bicortically at the level of mucogingival junction. The most preferred site for screw placement was between the canine and first premolar taking care that the screws were positioned interdentally or in edentulous areas (Figs 1 and 2). Further care is also taken so that screw was not placed too far below the root apex as the screw is than covered by vestibule. Long axis of the screws was oriented at 90° from the root prominences. Postoperative orthopantomograms were used to evaluate screw positions (Fig. 3). All patients were given postoperative antibiotic therapy for 7 days. Regular follow-up was performed on weekly basis until fracture healing was complete.

Removal of the self-tapping IMF screws or Erich's arch bars was done after 2 weeks on outpatient basis with/without the need of local anesthesia. Preoperative and postoperative clinical and radiological records were maintained. Collected data were entered into an Excel spreadsheet. Statistical analysis was performed using the chi-square test and Student's t-test.



Fig. 1: Intermaxillary fixation screw in maxillary arch



Fig. 2: Intermaxillary fixation screw in mandibular arch

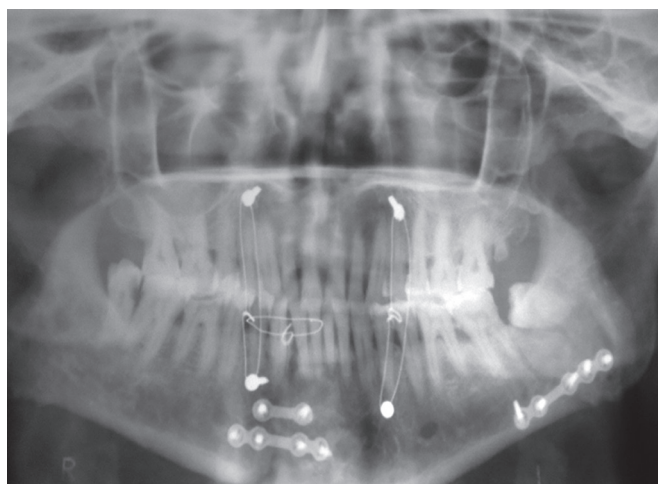


Fig. 3: Postoperative orthopantomogram

RESULTS

Twenty patients met the criteria for this study. Of the 20 patients involved, all were males. Ages ranged from 17 to 68 years of age. All patients were kept in IMF post-operatively with 26-gauge wire for 2 weeks. The etiology of fractures was 19 fractures due to road traffic accidents and 1 due to fall.

Out of 20 cases, 1 (5%) had fracture of symphysis, 3 (15%) had parasymphysis fracture, 5 (25%) had angle fracture, 2 (10%) had body fracture, 6 (30%) cases reported with parasymphysis and subcondylar fracture, 3 (15%) cases had angle and parasymphysis fracture, 14 (73.9%) patients had no fractures at other sites, 3 (4.4%) patients had midface fractures, 2 (17.4%) patients had extremity fractures, and 1 (4.4%) patient had a skull fracture.

Among these, 4 (20%) were minimally displaced, 12 (60%) were moderately displaced, and 4 (20%) were undisplaced (Table 1). All the cases had stable IMF in both groups.

Single-fracture cases had no postoperative occlusal discrepancy, hence, elastic traction was not used. Mild postoperative occlusal discrepancy was noted in 1 case with multiple mandibular fractures, and this was corrected by elastic traction for 3 to 4 days.

On 1st postoperative day, all the patients in group I had moderate pain; whereas in group II, on 1st day, 3 patients had mild pain, 6 patients had moderate pain, and 1 patient had severe pain. On 7th postoperative day, all the patients reported with mild or no pain.

At the end of 14th day, overall oral hygiene was poor in group I and good in group II, significant statistically

Table 1: Type of fracture

Type of fracture	Number of patients (%)
Undisplaced	4 (20)
Minimally displaced	4 (20)
Moderately displaced	12 (60)

Table 2: Oral hygiene

Oral hygiene	Day 14	
	Arch bar	IMF screw
Good	0	4
Fair	3	4
Poor	7	2

Table 3: Tooth morbidity

Tooth morbidity	Erich arch bar	IMF screw
Present	0	1
Absent	10	9

Table 4: Time taken for IMF

Time taken in minutes	Erich arch bar	IMF screw
Range	58–88	11–22
Mean	74.9	16.1
Standard deviation	9.267	3.755
Unpaired t	p = 0.001 (highly significant)	

Table 5: Needle stick injury

Needle stick injury	Erich arch bar	IMF screw
Present	4	0
Absent	6	10
	p = 0.025	

(p = 0.031) (Table 2). Iatrogenic injury to tooth was absent in group I and present in 1 case in group II, not significant statistically (p = 0.305) (Table 3). Average time taken for the IMF in group I was 74.9 minutes, with the range between 58 and 88 minutes, and in group II was 16.1 minutes, with the range between 11 and 22 minutes, which is highly statistically significant (p = 0.001) (Table 4).

Needle stick injuries were taken as positive if glove perforation was present and these were reported in four cases in group I, whereas in group II, no case had incidence of needle stick injuries, which shows significant statistically (p = 0.025) (Table 5).

DISCUSSION

Intermaxillary fixation is a basic principle for management of maxillofacial trauma. It assists in reduction of facial fractures; it is a reliable method as a sole or adjunctive modality in management of facial trauma; it provides stable framework to reconstruct facial form and function.⁴ Various techniques, such as Ivy eyelet, suspension wires, and arch bars have been described for maxillo-mandibular fixation and many studies have compared these techniques by different methodical approach. Arch bars are time-proven method for IMF, with the known advantages. They are useful for reduction and immobilization of fracture fragments. It acts as a tension band

in the treatment of mandible fractures, and it is versatile in directing complex forces for reducing fractures. Arch bars are preferable treatment modality in case of complex displaced fracture. The disadvantages of arch bars are trauma to the surrounding soft tissues, compromised oral hygiene maintenance, more time consumption for applying and retrieval, and increased risk of needle stick injuries to operator and assistant.^{5,6}

Intermaxillary fixation screw is described as a sole modality for management of facial fractures by Arthur and Berardo.⁷ The first generation of IMF screws was to imply modified monocortical self-tapping screws.^{8,9} Because there are requirement of drilling a hole for placement of IMF screws, there are chances of root damage that occurred during placement.¹⁰ The second-generation self-drilling self-tapping screws have improved tactile feedback as they do not require drilling a hole for their placement, which in turn can limit the possibility of root damage. Tooth root anatomy is a restricting factor in obtaining the adequate site of screw placement to achieve the vectors required for fracture segment reduction.

Intermaxillary fixation screw can be used in edentulous spaces in the arch, provided sufficient bone is available for their placement like in the posterior maxilla, but pneumatized sinus often limits their placement.⁴

The IMF screws were not suitable in patients who require long-term IMF, i.e., more than 5 to 6 weeks because the screws start to loosen after 5 weeks. In these cases, IMF using arch bars is the preferred option.¹¹

The IMF with screws is a quick and easy method, as the mean time required for placement and removal in group I is significantly less than in group II. Gordon et al reported that the average working time was 25.8 minutes, which could be further reduced to approximately 12 minutes with experience. In our study, the average time taken for the IMF in group I was 74.9 minutes, with the range of 58 to 88 minutes, and in group II, it was 16.1 minutes, with the range of 11 to 22 minutes, which is highly significant statistically ($p = 0.001$). As accepted by several authors in the literature, oral hygiene is difficult to maintain when arch bars and eyelets are used for IMF.¹²

The teeth damage was seen in one case in group II, which were evaluated on postoperative panoramic X-ray. The vitality of tooth was tested after screw removal by thermal test using hot gutta-percha points and ethyl chloride spray. In group I, there was the incidence of glove perforation and trauma to the operator's fingers (20%), gingival papillary hyperplasia, whereas no such complications were seen in group II. Avery and Johnson¹³ showed that the incidence of operator glove perforation was significantly high with wiring techniques. The incidence of surgical glove perforation during treatment of some maxillofacial fractures was as high as 50%.

The primary goal in successful management of maxillofacial trauma patient includes: Fracture reduction, immobilization of the fracture segment, and achievement of pretrauma occlusion. It is beneficial to use methods that reduce the following: The risk of needle stick injuries, operating room and general anesthesia times, and hospital costs.⁵ Arch bars are more time-consuming and place the surgeon in high risk for needle stick injuries. Intermaxillary fixation with IMF screws can be done with ligation of only two wires. Placement and removal of IMF screws involves reduced risk of needle stick injuries. The IMF screws are also easier to use and are less time-consuming compared with arch bars.

CONCLUSION

The IMF screws can be used as an alternative to arch bar for achieving temporary intraoperative occlusion. These screws results into acceptable malocclusion, while offering 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. The IMF screws are contraindicated in severely comminuted mandibular fractures. Prospective randomized studies in the future can further evaluate the use and effectiveness of this method and also provide more specific guidelines for its use.

After this study, we can conclude that IMF self-tapping screw is a proven useful technique of maxillomandibular fixation. It is a safe and less time-consuming method but with various shortcomings and complications which the surgeon must be aware of while providing treatment.

REFERENCES

1. Gordon KF, Reed JM, Anand VK. Results of intraoral cortical bone screw fixation technique for mandibular fractures. *Otolaryngol Head Neck Surg* 1995 Sep;113(3):248-252.
2. Coburn DG, Kennedy DW, Hodder SC. Complications with intermaxillary fixation screws in the management of fractured mandibles. *Br J Oral Maxillofac Surg* 2002 Jun;40(3):241-243.
3. Roccia F, Tivolaccini A, Dell'Acqua A, Fasolis M. An audit of mandibular fractures treated by intermaxillary fixation using intraoral cortical bone screws. *J Craniomaxillofac Surg* 2005 Aug;33(4):251-254.
4. Coletti DP, Salama A, Caccamese JF Jr. Application of intermaxillary fixation screws in maxillofacial trauma. *J Oral Maxillofac Surg* 2007 Sep;65(9):1746-1750.
5. Vartanian AJ, Alvi A. Bone-screw mandible fixation: an intraoperative alternative to arch bars. *Otolaryngol Head Neck Surg* 2000 Dec;123(6):718-721.
6. Ho KS, Tan WK, Loh HS. Case reports: the use of intermaxillary screws to achieve intermaxillary fixation in the treatment of mandibular fractures. *Ann Acad Med Singapore* 2000 Jul;29(4):534-537.
7. Arthur G, Berardo N. A simplified technique of maxillomandibular fixation. *J Oral Maxillofac Surg* 1989 Nov;47(11):1234.

8. Schneider AM, David LR, DeFranzo AJ, Marks MW, Molnar JA, Argenta LC. Use of specialized bone screws for intermaxillary fixation. *Ann Plast Surg* 2000 Feb;44(2):154-157.
9. Onishi K, Maruyama Y. Simple intermaxillary fixation for maxillomandibular osteosynthesis. *J Craniofac Surg* 1996 Mar;7(2):170-172.
10. Jones DC. The intermaxillary screw: a dedicated bicortical bone screw for temporary intermaxillary fixation. *Br J Oral Maxillofac Surg* 1999 Apr;37(2):115-116.
11. Rai A, Datarkar A, Borle RM. Are maxillomandibular fixation screws a better option than Erich arch bars in achieving maxillomandibular fixation? A randomized clinical study. *J Oral Maxillofac Surg* 2011 Dec;69(12):3015-3018.
12. Busch RF. Re: Jones. Intermaxillary fixation using intraoral cortical bone screws. *Br J Oral Maxillofac Surg* 1999 Oct;37(5):422.
13. Avery CM, Johnson PA. Surgical glove perforation and maxillofacial trauma: to plate or wire? *Br J Oral Maxillofac Surg* 1992 Feb;30(1):31-35.