

Comparison of the Efficiency of Maxillomandibular Fixation Screws over Erich Arch Bars in achieving Intermaxillary Fixation in Maxillofacial Trauma: A Clinical Study

¹Rahul Jain, ²Richa Pathak, ³Shubham Agrawal, ⁴Kamini Dadsena, ⁵Varun Kumar, ⁶Manthru N Ramavath

ABSTRACT

Introduction: Intermaxillary fixation (IMF) is regarded as a significant step in the management of maxillofacial trauma. Various techniques have been mentioned in the literature for achieving maxillomandibular fixation (MMF). Conventional methods like arch bars and eyelet wiring are the most commonly used, but these methods have their own shortcomings. With the introduction of self-tapping MMF screws in 1989, many of the drawbacks with the use of arch bars can be eliminated. Hence, the aim of this study was to compare the efficiency of MMF screws over arch bars in achieving IMF.

Materials and methods: A total of 30 patients who required IMF as a part of their treatment and reported to the Department of Oral and Maxillofacial Surgery, KLE VK Institute of Dental Sciences and KLE Dr Prabhakar Kore Charitable Hospital, Belgaum were included in the study. Patients were divided randomly into two groups: group I: patients treated using MMF screws and group II: patients treated using arch bars. Statistical analysis was performed using the Mann–Whitney U test and unpaired t-test.

Results: There was a significant difference in oral hygiene index between the two groups at the end of 14th postoperative day. The time taken for the placement of MMF screws was significantly less (mean 18.7 minutes) as compared with arch bars (mean 41.2 minutes). Screw loosening was seen in 4 (26%) out of 15 patients and 3 screws (4.5%) out of 66 screws used showed partial mucosal coverage at the end of 2 weeks. There

were no cases of penetration injury in group I while in group II, penetration injury to the surgeon was noted in 5 (33.3%) cases.

Conclusion: Maxillomandibular fixation screws provided good intraoperative MMF. Placement of screws consumes less time and reduces the intraoperative period and also the risk of penetration injury to the surgeon. We also observed better oral hygiene, better patient compliance, and no major complications with the use of MMF screws. Hence, MMF screws proved to be an efficient alternative to the conventional methods of achieving IMF.

Keywords: Erich arch bars, Intermaxillary fixation, Maxillomandibular fixation screws.

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INTRODUCTION

Evolution has made humans quite susceptible to frontal impacts. Trauma to the facial region is common in road traffic accidents, sports-related injuries, and assaults. Maxillofacial trauma represents 42% of all injuries. In these, 70% are mandibular fractures and 30% are maxillary fractures. Since the ancient times, IMF has been used alone to treat fractures of maxilla and mandible as the knowledge of plating systems was rudimentary. This was achieved by attaching a metallic framework to the teeth to provide support to the fractured segments and then IMF 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.¹

Intermaxillary fixation/MMF 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 methods to achieve IMF have been described in literature, such as Ivy eyelet wiring, Risdon wiring, arch bars, metal splints, acrylic splints, gunning-type splints

¹Consultant, ^{2,4}Postgraduate Student, ³Fellow, ⁵Oral Surgeon
⁶Resident Specialist

¹Department of Plastic Surgery, Medanta Hospital, Gurugram Haryana, India

²Department of Oral and Maxillofacial Surgery, Government College of Dentistry, Indore, Madhya Pradesh, India

³Department of Facial Plastic Surgery and Oral Oncology Mukhakriti Dental Clinic, Jhansi, Uttar Pradesh, India

⁴Department of Oral and Maxillofacial Surgery, New Horizon Dental College & Research Institute, Bilaspur, Chhattisgarh India

⁵S.P Dental and Maxillofacial Trauma Centre, Jammu and Kashmir, India

⁶Department of Oral and Maxillofacial Surgery, Government Dental College and Hospital, Hyderabad, Telangana, India

Corresponding Author: Shubham Agrawal, Fellow, Department of Facial Plastic Surgery and Oral Oncology, Mukhakriti Dental Clinic, Jhansi, Uttar Pradesh, India, Phone: +918889913272 e-mail: drssos97@gmail.com



Fig. 1: Placement of screws



Fig. 2: Intermaxillary fixation with MMF screws

for edentulous patients, bonded brackets, Dimac wires, and Leonard button,² And, more recently, self-tapping and self-drilling MMF screws.

Erich arch bars have been considered as the standard for achieving MMF because of its rigidity, versatility, and popularity.³ Although they provide superior occlusal control, reliable fixation, and superior stability during long-term IMF,² they have many disadvantages, including difficulty in maintaining oral hygiene, trauma to the periodontium, reduced patient compliance and discomfort, longer time required for placement, and risk of needle stick injury. Tooth avulsion during the twisting and tightening of the wire around the tooth has also been reported in literature. Also, wires tightened during the application of arch bars around the teeth may cause ischemic necrosis of the mucosa and the periodontal membrane and if damage is extensive, tooth loss may result.⁴

To overcome these problems, alternate techniques like self-tapping IMF screws have been introduced. These screws provide a bone-borne support for the MMF wires to achieve IMF instead of a tooth-borne support in the case of arch bars. Due to this, many complications related to tooth-borne devices like poor oral hygiene and periodontal health can be avoided.⁵ The concept of direct transosseous wiring for MMF has been previously communicated in the literature, but is no longer routinely used. But with the use of cortical bone screws, these traditional techniques can be implemented more readily and effectively.

The purpose of this prospective study was to assess the efficacy of MMF screws in both maxillary and mandibular fractures and to compare it with Erich arch bars to identify the better method of achieving IMF and to record the complications related to both.

MATERIALS AND METHODS

The study was carried out on a total of 30 patients to compare the efficiency of MMF screws over Erich arch

bars as a means of IMF in the treatment of maxillary and mandibular fractures that were reported to the Department of Oral and Maxillofacial Surgery, KLE VK Institute of Dental Sciences and KLE Dr Prabhakar Kore Charitable Hospital, Belgaum. The study subjects were selected by random sampling.

Patients aged 18 years and above and patients with fractures of maxilla and mandible which require IMF as a part of their treatment were included in the study. However, those with dentoalveolar and panfacial fractures, patients having primary and mixed dentition, and patients having systemic diseases like rheumatoid arthritis and bronchial asthma were excluded from the study.

Parameters taken into consideration were the surgical time taken for placement and removal of both IMF screws and Erich arch bar, plaque index scores, and complications related to both techniques.

During the stipulated timeframe of the trial, patients were randomly allocated into two groups. Intermaxillary fixation in both groups was done using 26-gauge wire. The IMF screws were used in group I, while Erich arch bar was used in group II. Self-tapping IMF screws with Capstan Head were 2 mm in diameter, 8 and 10 mm in length, and its head was 4 mm in length and 4 mm in diameter.⁶ The screw had a pointed tip and its head had a slot where the wire can be passed for IMF (Figs 1 to 3).

After removal of the screws and arch bars, oral hygiene status was evaluated using Turesky-Gilmore-

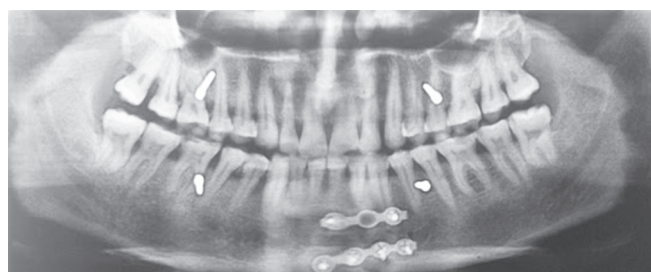
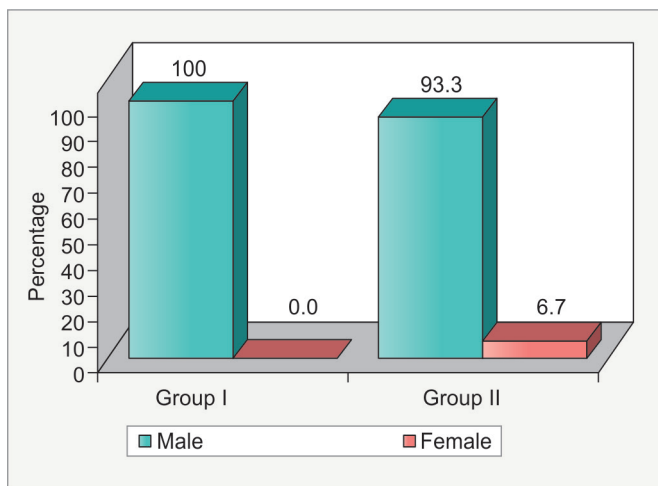
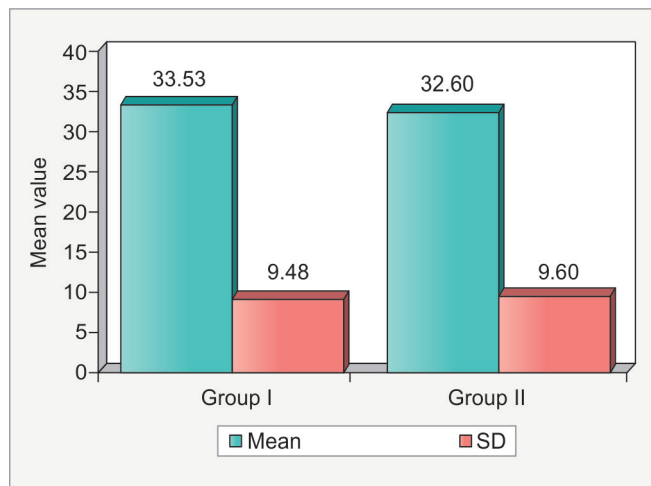


Fig. 3: Postoperative OPG



Graph 1: Distribution of males and females in groups I and II



Graph 2: Comparison of groups I and II with mean age

Glickman modification of Quigley-Hein plaque index and also vitality of teeth adjacent to screws was checked with electrical pulp testing.

RESULTS

In group I, all the 15 patients were males (100%). In group II, among the 15 cases, there were 14 males (93.3%) and 1 female (6.7%) (Graph 1); 1 (3.3%) patient was below 20 years, 12 (40%) patients were between 20 and 30 years, 12 (40%) patients were between 30 and 40 years, and 5 (16.6%) patients were between 40 and 50 years of age. In group I, the mean age was found to be 33.53 [standard deviation (SD) 9.43] and in group II, the mean age was 32.6 (SD 9.6) (Graph 2).

Among the 30 patients, 4 (13.3%) had fracture of parasymphysis, 6 (20%) had Le Fort II fracture, 6 (20%) patients had angle and parasymphysis fracture, 3 patients (10%) had angle fracture, 2 (6.7%) had Le Fort II fracture, 2 (6.7%) patients had symphysis fracture, 2 (6.7%) patients had body of mandible fracture, 1 (3.3%) patient had Le Fort III fracture, 1 (3.3%) patient had body of mandible and angle fracture, 1 (3.3%) patient had angle and zygomaticomaxillary complex (ZMC) fracture, 1 (3.3%) patient had body of mandible and parasymphysis fracture, and 1 (3.3%) patient had parasymphysis and ZMC fracture.

The mean time taken for the placement of MMF screws in group I was 18.73 minutes (SD 3.26) and the mean time taken for the placement of arch bars in group II was 41.27 minutes (SD 5.20). The results were

Table 1: Comparison of groups I and II with time taken by unpaired t-test

Groups	Mean	SD	Median	t-value	p-value
I	18.73	3.26	18.00	-14.2126	0.00001*
II	41.27	5.20	41.00		

*p<0.05

statistically significant using unpaired t-test with p-value 0.00001 (Table 1).

Plaque index score was calculated using Turesky-Gilmore-Glickman modification of Quigley-Hein plaque index. The mean plaque index score in group I was 0.95 (SD 0.26) and in group II the mean plaque index was 3.14 (SD 1.21). The results were statistically significant using Mann-Whitney U test with p-value 0.00001 (Table 2).

There were no cases of penetration injury in group I while in group II, penetration injury to the surgeon was noted in 5 (33.3%) cases. Screw loosening was seen in 4 (26%) out of 15 patients. Out of the total number of screws placed (66) in our study, 7 (10.6%) screws became loose at the end of 2nd week. Three screws (4.5%) out of 66 screws used showed partial mucosal coverage at the end of 2nd week. No case was reported with root damage and screw breakage.

DISCUSSION

Intermaxillary fixation is an essential step to achieve temporary dental occlusion during operative and post-operative phase of treatment. However, in the present

Table 2: Comparison of plaque index in groups I and II with Turesky-Gilmore-Glickman modification of Quigley-Hein plaque index score by Mann-Whitney U test

Groups	Mean	SD	Median	Sum of ranks	U-value	Z-value	p-value
I	0.95	0.26	0.95	120.00	0	-4.6663	0.00001*
II	3.14	1.21	3.28	345.00			

*p<0.05



era of miniplate osteosynthesis, open reduction is preferred to reduce the duration of hospitalization with minimal discomfort to the patient and early return to the work.

The aim of this study was to find an improved technique for achieving IMF. These screws were first introduced in the year to overcome the problems associated with tooth-borne devices. The IMF screws are inserted into the alveolar process of the maxilla and mandible monocortically and act as an anchor point for MMF wires which pass through the holes incorporated in the specialized screw heads known as Capstan heads⁶ kept 4 to 5 mm above the alveolar mucosa. Transmucosal IMF screws were first described in a 4-point fixation pattern with at least one screw in each quadrant.⁴ The MMF screws with different screw heads can also be used in different patterns like one screw in each quadrant and two in the midline, or two screws in each quadrant with or without screws in the midline.⁷ The choice of different patterns of screw placement depends on the site of fracture and the time period for which IMF is required. The MMF screws have advantage along with a few disadvantages (Table 3).

In the present study, we compared the plaque accumulation in both the groups in order to identify a technique with better ease of maintaining the oral hygiene. The mean plaque index value was found to be higher in group II, i.e., patients treated using Erich arch bars. This implies that with the use of MMF screws, maintenance of oral hygiene is improved, and also the risk of periodontal diseases is significantly reduced. We also noticed better patient compliance with the use of MMF screws than arch bars. Rai et al⁸ in a comparative study also reported more plaque accumulation in patients treated using Erich arch bars as compared with MMF screws. Similar results were documented by Qureshi et al,⁶ Nandini et al,⁹ and Barodiya et al.¹⁰ They found a significant difference between the plaque index values of both the groups and based on this, they concluded that maintenance of oral hygiene is better in patients treated using MMF screws.

The data showed that maximum time (approximately 45 minutes) was required for the placement of Erich arch

bars. The average time for the placement of MMF screws was found to be 18.7 minutes, which suggested reduced intraoperative time and shorter duration of general anesthesia. This was significantly more when compared with Nandini et al⁹ (8.52 ± 2.7 minutes). Barodiya et al¹⁰ and Qureshi et al⁶ documented the time range similar to our study: 16.1 and 15.56 minutes respectively.

Various complications with the use of MMF screws have been mentioned in the literature. Farr¹¹ reported a case of fracture of screw at the junction of screw head and threaded portion. In the present study, no such case of screw fracture was encountered. Another complication mentioned with the use of MMF screws was iatrogenic injury to the roots of the teeth adjacent to the site of screw insertion. Coletti et al¹² advised the use of self-drilling screws, as they have higher tactile feedback during placement. It can prevent root damage, as it allows the surgeon to modify the insertion position of the screw in case of high resistance. Despite this, the author encountered root fracture during screw placement in 2 (4%) out of 49 patients. Both the teeth were eventually extracted. Similar complications were noted by few researchers as well.^{6,9,10} In this study, there were no occurrences of root damage associated with IMF screws. Hence, proper planning prior to the insertion of MMF screws is essential. The site for screw placement should be determined after comprehensive radiographic assessment with the use of orthopantomographs (OPG) and intraoral periapical radiographs. The three-dimensional relationship of the path of insertion of the screw with the surrounding dental structures should be carefully assessed to reduce the iatrogenic dental trauma.¹²

In the present study, the most common complication that occurred with the use of MMF screws was screw loosening. At the 14th postoperative day, screw loosening was seen in 4 (26%) out of 15 patients. Out of the total number of screws placed (66) in our study, 7 (10.6%) screws became loose at the end of 2nd week. This is in accordance with Qureshi et al⁶ who reported screw loss in 3 of 30 cases. Screw loosening mainly occurs due to the force exerted by the oral musculature while the patient is in IMF. It can also occur when the direction of screw is not perpendicular to the occlusal plane.⁸

Another complication that occurred with the use of MMF screws was the coverage of the screw head with oral mucosa. Rai et al⁸ reported a high incidence of mucosal coverage of the screws. Out of the 240 screws used in the study, 44 (18.3%) screws were completely submerged in oral mucosa at the end of 4th week. The author stated that the cause behind the high occurrence of this complication was perhaps the IMF screws were placed high up in the movable alveolar mucosa rather than in the adherent mucosa.

Table 3: Advantage and disadvantage of IMF screws

Merits	Demerits
Much less time for placement hence shortens the operating time	Iatrogenic injury to the roots
Easy to maintain good oral hygiene	Screw loosening,
Minimal trauma to the periodontium	Mucosal coverage of screw
Reduced risk of needlestick injury with the sharp wires	Long-term IMF not possible
Better patient compliance	Expensive

In our study, the incidence of needle stick injury was also noted. We found 33% incidence of penetrating injury to the surgeon with the use of Erich arch bars. These results were in close association with results from various other studies.^{6,9,10} There was no such occurrence with the use of MMF screws.

CONCLUSION

The study was conducted on 30 patients who reported to the Department of Oral and Maxillofacial Surgery that required IMF as a part of their treatment. Based on this study, we can conclude that MMF screws provided good intraoperative MMF. Placement of screws consumes less time and reduces the intraoperative period. The risk of penetration injury to the surgeon with the use of sharp stainless steel wires is also reduced. We also observed better oral hygiene and better patient compliance with the use of MMF screws. Postoperatively, there was no incidence of pain, infection, injury to adjacent tooth root, or nerve damage. The only complication encountered with the use of MMF screws was screw loosening at the end of 2nd week. Hence, if IMF is desired for a longer time period, MMF screws may not be the best choice.

REFERENCES

1. Banks, P. Killey's fracture of mandible. 4th ed. Bombay: Varhese publishing house; 1991. p. 46.
2. Falci SG, Douglas-de-Oliveira DW, Stella PE, Santos CR. Is the Erich arch bar the best intermaxillary fixation method in maxillofacial fractures? A systematic review. *Med Oral Patol Oral Cir Bucal* 2015 Jul;20(4):e494-e499.
3. 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.
4. Gibbons AJ, Hodder SC. A self-drilling intermaxillary fixation screw. *Br J Oral and Maxillofac Surg* 2003 Feb;41(1):48-49.
5. Littre, A. Hippocrates, *Œuvres complètes*. Withnington ET, English translation. Cambridge (MA): Loeb Classical Library; 1928.
6. Qureshi AA, Reddy UK, Warad NM, Badal S, Jamadar AA, Qurishi N. Intermaxillary fixation screws versus Erich arch bars in mandibular fractures: a comparative study and review of literature. *Ann Maxillofac Surg* 2016 Jan-Jun;6(1):25-30.
7. Cornelius CP, Ehrenfeld M. The use of MMF screws: surgical technique, indications, contraindications, and common problems in review of the literature. *Cranio Maxillofac Trauma Reconstr* 2010 Jun;3(2):55-80.
8. 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.
9. Nandini GD, Balakrishna R, Rao J. Self tapping screws v/s Erich arch bar for inter maxillary fixation: a comparative clinical study in the treatment of mandibular fractures. *J Maxillofac Oral Surg* 2011 Jun;10(2):127-131.
10. Barodiya A, Thukral R, Agrawal SM, Chouhan AS, Singh S, Loksh Y. Self-tapping intermaxillary fixation screw: an alternative to arch bar. *J Contemp Dent Pract* 2017 Feb;18(2):147-151.
11. Farr DR. Intermaxillary fixation screws and tooth damage. *Br J Oral Maxillofac Surg* 2002 Feb;40(1):84-85.
12. Coletti DP, Salama A, Caccamese JF Jr. Application of intermaxillary fixation screws in maxillofacial trauma. *J Oral Maxillofac Sur* 2007 Sep;65(9):1746-1750.