Are Maxillomandibular Fixation Screws a Better Option Than Erich Arch Bars in Achieving Maxillomandibular Fixation? A Randomized Clinical Study

Anshul Rai, MDS, Abhay Datarkar, MDS, DNB,† and Rajeev M. Borle‡*

Purpose: The aim of this study is to see the efficacy of maxillomandibular fixation (MMF) screws with arch bars and to compare the plaque index in between 2 methods of MMF.

Materials and Methods: This study is a randomized clinical trial. The study sample was derived from the population of patients who reported to Department of Oral and Maxillofacial Surgery, Wardha, Maharasthra, India between October 2006 and September 2008 and who required MMF. The patients were assessed for the time required in minutes for the placement and removal of screws and arch bar. Postoperative stability after achieving the MMF of both groups was analyzed and the plaque that was accumulated in both groups was evaluated by using TURESKY–GILMORE–GLICKMAN modification of the QUIGLEY–HEIN plaque index. Statistical analysis was performed with SPSS statistical software for Windows, version 8.0 (SPSS, Inc, Chicago, IL) using the χ^2 test and Student t test.

Results: The average working time for placement and removal of MMF screws is 18.67 minutes and 10.20 minutes, respectively, and for arch bars is 95.06 minutes and 29 minutes, respectively. The mean value of plaque index in group I is 1.88 and in group II is 2.69. It signifies that plaque deposition was more in group II. No occlusal disturbance was seen in both groups. Incidence of MMF screws causing damage to tooth root is 5.81% and incidence of screw breakage was seen in 3.33% of patients.

Conclusions: Oral hygiene maintenance is better in patients with MMF screws than with arch bars with fewer complications and less operating time. Erich arch bars are the preferred choice in patients who require long-term MMF, because the screws start loosening after 5 to 6 weeks.

J Oral Maxillofac Surg 69:3015-3018, 2011

There are varieties of techniques mentioned in the literature[1] for achieving the maxillomandibular fixation (MMF), including arch bars and screws. MMF with bone screws was described as the only means of fracture treatment in 1989.[2] Advantages of screws include ease of use, quickness, shortened operating time, and reduced risk of needle stick-type injuries associated with using wires. Furthermore, compared with arch bars or eyelets, there is no trauma to the gingival margin and gingival health is easier to maintain.[3] Because of discomfort, difficulty in wire removal, and maintaining oral hygiene, patients have a low acceptability to arch bars.[4] In addition, the incidence of glove perforation was significantly high with wiring techniques, which increases the percutaneous injury risk.[5] This study was designed to identify the better method of achieving MMF, with the specific goals of seeing the efficacy of MMF screws in comparison with arch bars and of comparing the plaque index of each method.

*Senior Lecturer, Department of Oral and Maxillofacial Surgery, Rishi Raj Dental College, Bhopal, India.

†Professor and Head, Department of Oral and Maxillofacial Surgery, Kalmegh Dental College, Nagpur, India.

‡Professor, Department of Oral and Maxillofacial Surgery, Sharad Pawar Dental College, Wardha, India.

Address correspondence and reprint requests to Dr Rai: Sharad Pawar Dental College Wardha (MH), Oral Surgery, J.N.M.C. Campus Wardha, Wardha, Maharashtra, India; e-mail: anshulrai007@yahoo.co.in

0278-2391/11/6912-0024$36.00/0
doi:10.1016/j.joms.2010.12.015

Materials and Methods

This study was a randomized clinical trial. Approval for the present study was obtained from our institution's Experimental Medical Research and Practicing

Center Ethical Committee. Informed consent was obtained from all patients who were enrolled in the study after they received an explanation of the advantages and disadvantages of open and closed reduction.

The study sample was derived from the population of patients who reported to the Department of Oral and Maxillofacial Surgery, Sharad Pawar Dental College (Wardha, India) between October 2006 and September 2008. The criterion for the inclusion in this study was patients aged 18 years or older, minimally displaced favorable fractures of mandible and maxilla, and a requirement of open or closed reduction.

Patients with dentoalveolar fracture, panfacial fractures, comminuted fractures of the mandible, crowding of teeth, and the presence of systemic conditions like rheumatoid arthritis and bronchial asthma were excluded from this study.

The patients were evaluated in this study for the following variables:

1. The plaque accumulation in both groups was evaluated using TURESKY–GILMORE–GLICKMAN modification of the QUIGLEY–HEIN Plaque index.
2. The duration required for both techniques was evaluated in minutes.
3. Postoperative stability after achieving the MMF of both groups was analyzed.
4. The complications encountered during and after the surgery were also analyzed.

The included patients were divided into 2 groups. Group I comprised 60 patients (n = 60), who were treated using stainless steel MMF screws and mini-plates (Orthomax Shreerang Apartments, Kothi, Baroda, India) with or without open reduction. Group II included 30 patients (n = 30) treated using an Erich arch bar (Dentaurum's Barres Eaich Arch Bars; KG Marburg Cenavisa SA Combiphrar CSC Pharmaceuticals, Marburg, Germany).

Stainless steel, self-drilling/tapping screws of 2.0-mm diameter (12-mm length) and 26-gauge wire were used for achieving the MMF.

The most preferred site is between the canine and first premolar.[6] Attempts were made to orient the long axis of the screws at 90 degrees from the roots of the adjacent teeth. Postoperative orthopantomograms were used to evaluate screw placement. Follow-up examinations were performed weekly or biweekly and extended until fracture healing was complete.

Under local anesthesia, open reduction and fixation with mini-plates were performed for fractures except for condylar fracture. Condylar fractures were treated by closed reduction with placement of MMF screws under local anesthesia. The patients with condylar fractures were placed into MMF for 4 weeks and transitioned to guiding elastics for 2 weeks.

In group II MMF 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. Twenty-four-gauge wire was used to secure the arch bar to the teeth, while 26-gauge wire was used for achieving MMF.

Oral hygiene of the patients was assessed by TURESKY–GILMORE–GLICKMAN[7] modification of the QUIGLEY–HEIN Plaque index. Plaque was assessed on the labial, buccal, and lingual surfaces at the gingival third of all the teeth using a disclosing agent.

Statistical analysis was performed by a statistician with SPSS statistical software for Windows, version 8.0 (SPSS, Inc, Chicago, IL) using the χ^2 test and Student t test.

Results

Of the 90 patients involved, 84 were male and 6 were female, with a mean age of 28 years. All patients remained in MMF postoperatively with 26-gauge wire for 4 weeks, and those patients with condylar fractures were later transitioned to guiding elastics for 2 weeks. The etiology of fractures was 58 fractures due to road traffic accidents, 2 from assault, and 30 due to falling.

The study variables and treatment assigned to them are shown in Table 1.

The mean value of plaque index of both groups is shown in Table 2 and the result signifies that plaque deposit is more in group II. As shown in Tables 3 and 4, the average working time for placement and removal of MMF screws was significantly less than arch bars. Table 5 shows the complications that were encountered in group I.

As shown in this study, 1 of the major complications in group I was the coverage of screw head with mucosa (Table 6). Retrieval of these screws required a stab incision, for which local anesthesia was necessary. In group I, local anesthesia (LA) was required in 28 patients; however, in group II, LA was required for arch bar removal in 2 cases per patient request. No occlusal disturbances were seen in either group.

Discussion

The goal of this study was to identify a better method for achieving MMF. Specifically, the intent was to see the efficacy of MMF screws in comparison with Erich arch bars and to compare the plaque index in both. The results of this study confirmed MMF screws are a quick method of achieving MMF. Furthermore, oral hygiene maintenance was better in patients treated with MMF screws than with arch bars.

Table 1. STUDY VARIABLES AND TREATMENT ASSIGNED TO THEM

Study Variables	Group 1	Group 2	Total	Treatment Given to Patients
Parasymphysis, condyle	30	20	50	ORIF for parasymphysis and CR for condylar#
Condyle	10	6	16	CR
Body, condyle	5	1	6	CR
Symphysis	1	0	1	CR
Angle, condyle	4	0	4	CR
Angle	2	1	3	CR
Condyle, zygomaticomaxillary complex fracture	2	0	2	ORIF for zygomaticomaxillary complex fracture and CR for condylar#
Parasymphysis, angle	2	1	2	CR
Body, angle	2	0	2	CR
Symphysis, condyle	1	1	2	ORIF for symphysis and CR for condylar#
Ramus	1	0	1	CR

Abbreviations: ORIF, open reduction and internal fixation; CR, closed reduction; ZMC, zygomaticomaxillary complex fracture; #, fracture.

Rai, Datarkar, and Borle. A Better Option in Achieving MMF. J Oral Maxillofac Surg 2011.

The MMF screws were not suitable in patients who require long-term MMF, ie, more than 5 to 6 weeks, because the screws start to loosen after 5 to 6 weeks. In these cases, MMF using arch bars is the preferred option. The most common complication in group I is the mucosal coverage of the screw. For instance, 48 of 240 screws placed were partially covered with mucosa at the end of first week, and at the end of fourth week 48 screws were partially covered while 44 screws were completely covered. The mucosal covering is common in both maxilla and mandible. The reason behind this higher percentage of this complication might be due to the placement of MMF screws in alveolar mucosa rather than in attached mucosa. Furthermore, the reason for placement of intermaxillary fixation (IMF) screws high up in alveolar mucosa is due to the alveolar bone loss, which is more prevalent in the Indian population due to periodontal disease activity.

The MMF 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. The incidence of mucosal coverage of the screws was significantly high in their study. Furthermore, MMF was maintained for 6 weeks in their study and all their screws showed mucosal coverage.[8] The mean plaque index value is higher in group II, which suggests that oral hygiene maintenance is easy when MMF was achieved with the screws. As accepted by several authors in the literature, oral hygiene is difficult to maintain when arch bars and eyelets are used for MMF.[9] In contrast, Roccia et al in their study reported an incidence of 5% of screws being totally covered by mucosa. This low incidence was perhaps due to early removal of screws.[10] The screw loosening is seen in 16.67% of cases, which is equal in both maxilla and mandible. The reason for screw loosening is due to the force of the musculature, which is exerted while the patient is in MMF, or in patients where the direction of screw is not perpendicular to the occlusal plane. The percentage of screw loosening in the study by Coletti et al is 29%, which is slightly higher compared with our study.[11] The teeth damage was seen in 5.81% (14 teeth of 240) of cases, which were evaluated on postoperative panoramic x-ray. The vitality of these teeth was tested after screw removal by thermal test using hot gutta percha points and ethyl chloride spray. All injured teeth were asymptomatic. Farr and

Table 2. MEAN VALUE OF PLAQUE INDEX

Group	n	Mean	Std. Deviation	Std. Error Mean	*t* Value	*P* Value
I	60	1.88	0.36	0.06	7.36	.000
II	30	2.69	0.31	0.08		HS, $P <$ .0001

Rai, Datarkar, and Borle. A Better Option in Achieving MMF. J Oral Maxillofac Surg 2011.

Table 3. AVERAGE TIME OF PLACEMENT OF MMF SCREWS AND ERICH ARCH BARS

Group	n	Mean	Std. Deviation	Std. Error Mean	*t* Value	*P* Value
I	60	18.67	2.62	0.47	28.85	.000
II	30	95.06	14.17	3.66		HS, $P <$ .0001

Rai, Datarkar, and Borle. A Better Option in Achieving MMF. J Oral Maxillofac Surg 2011.

Table 4. AVERAGE TIME OF REMOVAL OF MMF SCREWS AND ARCH BARS

Group	n	Mean	Std. Deviation	Std. Error Mean	*t* Value	*P* Value
I	60	10.20	1.97	0.36	24.23	.000
II	30	29.00	3.22	0.83		HS, $P <$ .0001

Rai, Datarkar, and Borle. A Better Option in Achieving MMF. J Oral Maxillofac Surg 2011.

Whear conducted a prospective study to check the incidence of tooth damage during placement of MMF screws. Of the 36 screws, roots could be visualized in 31 cases. In 13 (41.9%) of the 36 screws, there appeared to be radiographic evidence of tooth damage, with 4 screws appearing to enter the pulp.[12] The screw breakage was seen in 3.33% of patients. Coburn et al reported fracture of screws in 3 of 122 patients (2.4%) treated by maxillomandibular screws.[13] The rate of infection was 6.67%, which was managed by antibiotic therapy. In group II there was incidence of glove perforation (36.66%), gingival papillary hyperplasia (36.36%), and trauma to the operators' fingers (18.18%), whereas no such complications were seen in group I. Avery and Johnson[5] showed that the incidence of 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%. Local anesthesia was required for screw removal in 14 patients (40.66%) compared with 1 (3.33%) in group II. The percentage is high in group I due to the secondary surgical retrieval of screws covered by the mucosa. Fabbroni et al reported that LA was not required in 49 of their patients, while 6 required LA. According to them, LA was administered either because of patient request or if it was deemed painful, as it was covered by the mucosa.

To our knowledge, no prospective study has compared these 2 modalities of achieving the MMF, which makes the present study unique. The small sample size and limited follow-up could be considered the limitation of the study. Furthermore, the problem of mucosa covering the screw can be eliminated using customized MMF screws.[14]

In conclusion, the use of MMF screws for MMF is a quick and easy method that reduces the operating time. Oral hygiene maintenance is better in patients with MMF screws than with arch bars. However, for patients who require long-term MMF, arch bars are the preferred choice because the screws start loosening after 5 to 6 weeks.

Table 5. THE COMPLICATIONS ENCOUNTERED IN GROUP I

Complications	Absent	Present	Total	Percentage
Screw breakage	58	2	60	3.33
Drill bit breakage	58	2	60	3.33
Tooth damage n = 240	226	14	240	5.83
Infection	58	4	60	6.67
Screw loosening	50	10	60	16.67

Rai, Datarkar, and Borle. A Better Option in Achieving MMF. J Oral Maxillofac Surg 2011.

Table 6. COVERAGE OF SCREW HEAD WITH MUCOSA IN GROUP I AFTER FIRST AND FOURTH WEEKS

		1st Week	4th Week
Mucosal growth	No growth	192 screws	148 screws
	Partial growth	48 screws	48 screws
	Completely covered with soft tissue	0	44 screws

Rai, Datarkar, and Borle. A Better Option in Achieving MMF. J Oral Maxillofac Surg 2011.

Acknowledgment

The authors wish to thank Dr Neha Rai and Zapf Angela for grammatical corrections in the manuscript.

References

1. Mukerji R, Mukerji G, McGurk M. Mandibular fractures: Historical perspective. Br J Oral Maxillofac Surg 44:222, 2006
2. Arthus G, Berardo N: A simplified technique of maxillomandibular fixation. J Oral Maxillofac Surg 47:1234, 1989
3. Jones DC: The intermaxillary screw: A dedicated bicortical bone screw for temporary intermaxillary fixation. Br J Oral Maxillofac Surg 37:115, 1999
4. Fabbroni G, Aabed S, Mizen K, et al: And the incidence of dental damage. Int J Oral Maxillofac Surg 33:442, 2004
5. Avery CME, Johnson PA: Surgical glove perforation and maxillofacial trauma: To plate or wire? Br J Oral Maxillofac Surg 30:31, 1992
6. Gibbons AJ, Hodder SC: A self-drilling intermaxillary fixation screw. Br J Oral Maxillofac Surg 41:48, 2003
7. Tursky S, Gilmore G: Reduced plaque formation by chloromethyl analogue of Vit. C. J Periodontol 41:41, 1970
8. Gordon KF, Reed MJ, Anand VK: Results of intraoral cortical bone screw fixation technique for mandibular fractures. Otolaryngol Head Neck Surg 113:248, 1995
9. Busch RF. Re: Jones. Intermaxillary fixation using intraoral cortical bone screws. Br J Oral Maxillofac Surg 37:422, 1999
10. Roccia F, Tavolaccini A, Dell'Acqua A, et al: An audit of mandibular fractures treated by intermaxillary fixation using intraoral cortical bone screws. J Craniomaxillofac Surg 33:251, 2005
11. Coletti DP, Salama A, Caccamese JF Jr: Application of intermaxillary fixation screws in maxillofacial trauma. J Oral Maxillofac Surg 65:1746, 2007
12. Farr DR, Whear NM: Intermaxillary fixation screws and tooth damage. Br J Oral Maxillofac Surg 40:84, 2002
13. Coburn DG, Kennedy DWG, Hodder SC: Complications with intermaxillary fixation screws in the management of fractured mandibles. Br J Oral Maxillofac Surg 40:241, 2002
14. Rai AJ, Datarkar AN, Borle RM: Customised screw for intermaxillary fixation of maxillofacial injuries. Br J Oral Maxillofac Surg 47:325, 2009