



TO COMPARE THE EFFECTIVENESS OF INTERMAXILLARY FIXATION USING ERICH ARCH BAR AND SCREWS IN MANDIBULAR FRACTURES – A RANDOMIZED CLINICAL STUDY.

Surgery

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ABSTRACT

Purpose: Intermaxillary fixation (IMF) is an essential principle in the management of mandibular fractures; but with the recent advent of open reduction and internal fixation (ORIF), the use of IMF is almost limited to intraoperative procedure only. This study aims to investigate and compare the effectiveness of Erich arch bar & intermaxillary fixation (IMF) screws for the management of mandibular fractures.

Materials And Method: A randomized prospective study was conducted on 20 patients with mandibular fracture, who were randomly allotted to two groups. Group A patients received intermaxillary fixation using Erich arch bar and group B patients received IMF screws. The parameters assessed were time taken for application and removal of appliance, stability of occlusion, glove perforation, and pre-and post-operative plaque accumulation.

Results: The mean time for placement of the Erich arch bar was 43.10 minutes as compared to 18.60 minutes with intermaxillary fixation screws. Better occlusal stability was shown with an arch bar over IMF screws, and was statistically significant. More glove tears or penetrations occurred during application in group A than Group B ($p < 0.01$). Also, The Plaque Index assessment on removal of appliance showed a statistically significant difference between the two groups; higher in the arch bar group.

Conclusion: This study indicates that with acceptable occlusal stability, IMF screws technique is an effective and favourable alternative to Erich arch bars for temporary intermaxillary fixation in mandibular fractures.

KEYWORDS

Intermaxillary fixation, Mandibular fractures, Arch bar, IMF screw

INTRODUCTION:

Mandibular fractures are quite common due to the jaw's prominent position in the facial skeleton and correspond to almost two-thirds of facial fractures¹. They can be treated through closed reduction using intermaxillary fixation alone, or by osteosynthesis with or without intermaxillary fixation². IMF can be achieved by eyelets, arch bars, bonded brackets, cast metal splints, vacuum-formed splints, pearl steel wires, self-tapping IMF screws, and self-drilling IMF screws². The introduction of open reduction internal fixation (ORIF) using a bone plating system has reduced the prolonged periods of intermaxillary fixation². However, there is a need for temporary IMF intraoperatively to assist in the reduction of fractures with the teeth in correct occlusion and thereby assist in fixation, or to correct minor occlusal discrepancies².

Conventional methods like Erich arch bars and eyelet wires were the most commonly used methods of intermaxillary fixation before the conception of ORIF³. However, these appliances have their disadvantages; such as being time-consuming, posing a constant threat of injury to the surgeon's fingers from sharp wire ends, damaging mucosa, and causing discomfort to the patient, as well as resulting in unhealthy oral hygiene maintenance².

In 1989, intermaxillary fixation screws were developed to substitute Erich arch bar². They are relatively inexpensive, easy, and quick to use, and promote the decreased risk of needle stick-type injuries associated with using wires; Moreover, compared to arch bars or eyelets, there is no trauma to the gingival margin and exhibits better gingival health maintenance⁴. Although with these advantages, IMF screws were noted with few pitfalls such as loosening of screws, overgrowth of mucosa on the screws; requiring incision placement at the time of the removal of a screw, and possible damage to the tooth roots adjacent to the placement of the screws⁵.

Hence, the present study was conducted to assess and compare the effectiveness of Erich arch bar & IMF screws for the management of

mandibular fractures.

MATERIALS AND METHODS:

Trial Design-

The study was planned as a single-center, randomized, prospective, parallel-group study with an allocation ratio of 1:1. The Ethical committee approval was taken and this trial was organized following the Consolidated Standards of Reporting Trials Guidelines (CONSORT).

Participants-

Subjects for the study were recruited from the OPD of the Department of Oral and Maxillofacial surgery at Y.M.T. Dental College and Hospital, Navi Mumbai. Twenty selected subjects diagnosed with mandibular fractures from August 2018 till January 2020 were recruited in this study.

Inclusion Criteria: -

1. Any gender with an age group of 15 to 60 years.
2. Subjects with simple, isolated, non-pathologic unilateral and bilateral fractures of mandible.
3. Subjects who gave consent before the procedure.

Exclusion Criteria: -

1. Subjects with underlying systemic diseases.
2. Completely edentulous patients.
3. Subjects with multiple, pathologic, comminuted, and condylar fractures.
4. Subjects where IMF is contraindicated.

Intervention-

The patients were selected based on the above-stated criteria and were provided with the information about the treatment options in language best understood by them; along with duly signed informed consent was obtained before the surgical procedure. Patients were randomly divided into two groups; Group A using Erich arch bar and Group B

using IMF screws.

Operative Technique-

A thorough medical history was taken followed by detailed extra oral and intraoral examination. Tetanus toxoid 0.5ml intramuscular injection was administered and patients were started on antibiotics and analgesics. A preoperative orthopantomogram was taken to evaluate the fractures in all the cases. All the cases were performed by the same operator to minimize bias. Additionally, this trial was designed to compare and evaluate the effectiveness of both the appliances; with no interference of ORIF in gauging the parameters.

Group A:

This method was implemented using a prefabricated Erich arch bar which was adjusted in shape and length according to the individual situation. Local anesthesia was given using 2% lignocaine, and the arch bar was fixed in place by preparing a ligature in the premolar region of each side. The bar was positioned and fixed using 26-gauge stainless wire with the wire twister. The wire loops were then placed over the maxillary and mandibular lugs of the arch bar and the wire loops were tightened to bring IMF.

Group B:

In this technique, 2mm diameter and 8 mm long screws for maxilla whereas, 2 mm diameter and 10 mm long screws for mandible were used in all the patients. Local anesthesia was given using 2% lignocaine, followed by cortical perforation using a 1.5 mm drill bit attached to a straight handpiece was performed directly through the mucosa under the copious amount of irrigation of normal saline. The screw mounted on the screwdriver was used to place the IMF screw in the drilled hole in each quadrant between canine and the first premolar, at the junction of attached mucosa and mobile mucosa; and tightened using the screwdriver. IMF was performed by passing a 24-gauge wire through the hole in the screw head.

Outcomes-

Primary:

1. Time required for placement and removal of the appliance was recorded in minutes.
2. Occlusal stability by gauging maximum intercuspation after IMF.

Secondary:

1. Glove perforation at the time of intermaxillary fixation was noted by inspection of the gloves.
2. The preoperative and post-operative plaque accumulation using the Turskey-Gilmore-Glickman index.

Sample Size, Randomization, And Allocation Concealment-

The Sample size was determined using the expected proportion of event/outcome in each group, values of which were estimated from literature & using suitable formula. A minimum of 10 subjects per group was included in the study. There were no dropouts. A simple randomization of the subjects was done using a coin toss method. Blinding had no scope in this study.

Statistical Method-

Data obtained was compiled on an MS Office Excel Sheet (v 2010) and was subjected to statistical analysis using Statistical package for social sciences (SPSS v 21.0, IBM). Comparison of Mean of outcome variables like time required for placement, removal, Plaque Index preoperative & post-operative between the groups was done using the "t" test. And for parameters of occlusion and glove perforation between the groups were done using chi-square test.

For all the statistical tests, $p < 0.05$ was considered to be statistically significant, keeping α error at 5% and β error at 20%, thus giving power to the study as 80%. (Note- *significant; **highly significant; # not significant).

RESULTS:

A total of 20 patients were included in the study between August 2018 and January 2020. The mean age of the patients was 30.20 years in group A and 33.30 years in group B. The male to female ratio was 2:1 in which males constituted about 65%. The Parasymphysis region was found to be the most common site of fracture in this study; accounting for 70%.

The Time needed for placement and removal of appliance showed a

highly statistically significant difference between the 2 groups ($p < 0.05$) with the mean time taken being higher for group A as compared to group B (Table 1).

Table 1: Comparison Of Mean Of Time For Placement And Removal Of Appliance Between Both Groups.

	Groups	N	Mean	Std. Deviation	Std. Error Mean	p value of t test
Time for placement	A	10	43.10	4.81	1.52	0.000**
	B	10	15.50	2.677	.847	
Time for removal	A	10	18.60	2.319	.733	0.000**
	B	10	9.90	1.449	.458	

Furthermore, occlusal stability after intermaxillary fixation was evaluated clinically by visual inspection of maximum intercuspation. This was assessed on the next day and categorized as stable (S), minimally displaced (MD), and severely displaced (SD). Table 2 depicts that in Group A, all 10 patients showed stable occlusion, as compared to only 5 patients in group B, and was statistically significant. Figure 1 a-c and 2 a-c demonstrate the pre-operative orthopantomogram, deranged occlusion and occlusion restored using appliance respectively for both the groups.

Table 2: Comparison Of Frequencies Of The Occlusal Stability Between The Groups On The Next Day.

		Groups (No of patients)		p value of chi square test
		A	B	
Occlusion on next day	MD	0	4	0.036*
	S	10	5	
	SD	0	1	



Figure 1a: Preoperative orthopantomogram showing right Para symphysis fracture (Group A)



Figure 1b – Preoperative occlusion (Group A)



Figure 1c: Occlusion Achieved After IMF Using Erich Arch Bar (Group A)



Figure 2a: Preoperative Orthopantomogram Showing Left Para Symphysis Fracture (Group B)



Figure 2b: Preoperative Occlusion (Group B)



Figure 2c: Occlusion Achieved With Intermaxillary Fixation Screws (Group B)

The comparison of frequencies of glove perforation between both the groups showed a highly statistically significant difference ($p < 0.01$) with higher perforations seen in group A & none in group B. (Table 3)

Table 3: Comparison Of Frequencies Of Glove Perforation Between Both The Groups.

	Group		Total	p value of chi square test
	A	B		
Absent	4	10	14	0.003**
Present	6	0	6	
Total	10	10	20	

Table 4: Comparison Of Plaque Index (PI) Preoperatively & Postoperatively Between Two Groups.

Plaque index		Mean	N	Std. Deviation	Std. error Mean	p value of t test
Group A	Preoperative	1.419000	10	.1500704	.0474564	0.000**
	Postoperative	1.815000	10	.1633163	.0516452	
Group B	Preoperative	1.432000	10	.23189	.07333	0.026*
	Postoperative	1.559000	10	.2372739	.0750326	

The preoperative and post-operative plaque accumulation was checked using the Turskey-Gilmore-Glickman index in both groups. There was a highly statistically significant difference seen with the pre-operative and post-operative plaque index ($p < 0.05$) in the intragroup comparison. Higher mean post-operatively plaque was observed in both groups when compared to its pre-operative scores; significantly higher in the arch bar group (Table 4).

DISCUSSION:

This study was designed to evaluate the use of Erich arch bar and intermaxillary screws for the treatment of mandibular fractures. A total of 20 patients were included in the study and equally divided into two groups; Group A of 10 patients with Erich arch bar, and Group B of 10 patients with IMF screws.

Intermaxillary fixation with screws is a relatively quick and easy method. Gordon et al, reported that the average working time was 25.8 minutes, which could be further reduced to approximately 12 minutes with experience⁶. Rai et al, found the average working time for placement and removal of IMF screws are 18.67 minutes and 10.20 minutes, respectively, and for arch bars is 95.06 minutes and 29 minutes, respectively⁴. Similarly, in our study, the meantime for placement and removal for Erich arch bar was 43.10 minutes and 15.50 minutes respectively. The time for placement and removal of intermaxillary fixation IMF screws was 18.60 minutes and 9.90 minutes respectively which goes consistently with the reported literature; and in favor of the IMF screws.

Occlusal stability in this study was evaluated on the following day; and categorized as minimally displaced, severely displaced, and stable. In Group A, all 10 patients showed stable occlusion and this can be attributed to the greater span of stability provided by the arch bar. However, only 5 patients showed stable occlusion on the next day in group B, implying a 50% success. This goes as per the study done by Vatsa et al, where the arch bar provides superior occlusal stability⁷. Yet there are authors such as Roccia et al and Qureshi et al, who suggest that IMF screws either provide superior occlusal stability or there is no statistically significant difference respectively when compared to Erich arch bar^{8,9}. Hence, further deliberation is needed regarding the use of IMF screws in consideration to this parameter; and whether screws are equally effective when compared to the arch bar.

The glove perforation rate was significantly higher while using the Erich arch bar. This observation was similar to Nandini GD et al, where the mean number of perforations was significantly more with the arch bar when compared to IMF using screws¹⁰. This can be ascertained by the fact that a greater number of wires are needed to bring IMF when using an arch bar, posing an increased risk of injury to the operator's fingers. Likewise, oral hygiene is difficult to maintain when arch bars are used for IMF. Rai et al, noted that the mean plaque index value was higher with arch bar, suggesting that oral hygiene maintenance is cumbersome when using it due to its extensive design and presence of lugs⁴. A comparable outcome was seen in this study, with better plaque control in the IMF screw group.

However, with numerous merits, IMF screws present some complications as well. The risk of tooth root damage is the most common error; conversely, none of the patients faced this complication in our study. Farr et al, in a prospective study to check the incidence of tooth damage during placement of IMF screws, found that 41.9% of cases had inadvertent damage to the roots¹¹. Stevens et al, recommended a thorough clinical and radiographic assessment of the adjacent teeth at the site of screw placement; and advocated placing the screws between the canine and first premolar region at the mucogingival junction or placing it below the root apices of the mandibular teeth or above the root apices of the maxillary teeth¹². Apart from this, screw loosening and overgrowth of mucosa over the screw head are few other minor difficulties encountered while using screws for intermaxillary fixation.

Erich arch bars have been the conventional treatment modality for intermaxillary of mandibular fractures; nevertheless, with its proven drawbacks, IMF screws have paved their way. The latter is superior to arch bars in terms of ease and quicker application, better oral hygiene maintenance, acceptable occlusal stability, and negligible incidence of injury from wires.

CONCLUSION:

Thus, within the limited sample size of this study, we conclude that

intermaxillary fixation screws are a suitable and promising alternative to the Erich arch bar for mandibular fractures.

Acknowledgement:

Consent: -

The Institutional Ethical Committee approval was obtained and All consent forms were duly signed by the patient after explaining the entire procedure in the language best understood by them.

Conflicts of Interest: -

All the authors declare that they have no conflicts of interest.

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