

A Juxtaposition of Bi-Cortical Screws and Erich's Arch Bar for Maxillomandibular Fixture

Dr. Nilesh Odedra, ¹ Dr. Amit Kumar Sharma, ² Dr. Akshat Gupta, ³ Dr. Chetna Gabhane, ⁴
Dr. Mahek Modi ⁵

1. Dr. Nilesh Odedra

Associate Consultant, Department of Oral Maxillofacial Surgery, Daswani Dental College and Research Centre, Kota, Rajasthan, India

2. Dr. Amit Kumar Sharma

Professor & Head, Department of Oral Maxillofacial Surgery, Daswani Dental College and Research Centre, Kota, Rajasthan, India

3. Dr. Akshat Gupta

Reader, Department of Oral Maxillofacial Surgery, Daswani Dental College and Research Centre, Kota, Rajasthan, India

4. Dr. Chetna Gabhane

Post Graduate Student, Department of Oral Maxillofacial Surgery, Daswani Dental College and Research Centre, Kota, Rajasthan, India

5. Dr. Mahek Modi

Post Graduate Student, Department of Oral Maxillofacial Surgery, Daswani Dental College and Research Centre, Kota, Rajasthan, India

Abstract

Background and Objectives:

Inter-maxillary fixation (IMF) plays a vital role in management of fractures involving maxilla and mandible. Various methods to achieve IMF were practiced in history. Most popular methods of IMF are by using Erich arch bar and IMF screws. Every method used for IMF have their own merits and demerits.

The objective of the study is to evaluate and compare the various parameters of the conventional arch bars and IMF screws in achieving inter-maxillary fixation.

Method:

Thirty dentulous patients who reported to Department of Oral and Maxillofacial Surgery, Daswani dental college & research Centre, Ranpur, Kota with maxillo-mandibular fractures and required inter-maxillary fixation as a part of treatment plan followed by open reduction and internal fixation were selected and randomly divided into 2 groups of 15 patients each that is Group A and Group B. Group A included patients who received inter-maxillary fixation with Erich arch bars. Group B includes patients who received inter-maxillary fixation with IMF Screws. The parameters compared in both the groups included, surgical time taken, post-operative mobility, IMF stability, oral hygiene and weight loss at the time of end of the 1st, 3rd and 6th week post-operatively.

Results:

The average surgical time taken and patient's weight loss were more in Group A, and oral hygiene was better in Group B but immobilization and stability of the jaws were comparatively better in Group-A, there was not much statistically significant difference in postoperative immobilization and IMF stability in both groups.

Conclusion:

Both the techniques offer good temporary inter-maxillary fixation. The benefits and risks of both the techniques should be weighed depending on the type of fracture we are dealing with.

Keywords:

Erich's arch bar, IMF screws, Inter-maxillary fixation.

INTRODUCTION

Mandibular fractures were first described in 1650 BC, when Papyrus, an Egyptian described the examination, diagnosis, and treatment of mandible fractures. Mandibular fractures during that period had high morbidity due to lack of proper treatment. Occlusion is the way in which one's maxillary and mandibular teeth relate to each other when the jaw is closed. When treating fractures of the mandible, the first and primary objective is to re-establish the patient's premorbid occlusion.

Inter-maxillary fixation (IMF) plays a vital role in management of fractures involving maxilla and mandible & helps in stabilizing the patient's occlusion and thus reduction in fracture segments. The purpose of this randomised prospective controlled clinical study is to compare the efficacy of IMF screws with Erich arch bars in achieving intermaxillary fixation for treatment of mandibular fractures. Various parameters for comparison include: occlusal stability during fixation, Mobility of the fracture segments, time taken for each procedure during placement, weight loss and Oral hygiene intra & post operatively.

AIMS & OBJECTIVES**Aims:**

- To assess the ideal technique of immobilization for inter-maxillary fixation in maxillo-mandibular trauma.

Objectives:

- To assess and determine the time period for inter-maxillary fixation (IMF).
- To assess intra and post-operative occlusion stability and mobility.
- To compare the amount of weight loss.
- Assess the oral hygiene during the treatment period.

MATERIAL & METHODOLOGY**Materials:**

A prospective randomized Comparison clinical study was conducted between 2018 to 2020. The study was conducted in the Department of Oral and Maxillofacial surgery, Daswani dental college and research Centre, Ranpur, Kota. 30 patients were randomly selected for the study to evaluate the efficacy of Erich's arch bar and IMF screws as a mean of intermaxillary fixation in the treatment of mandibular fractures. The selected cases will be treated by closed reduction and internal fixation under GA. In these, 15 cases with Erich's arch bar with 26 gauge stainless steel wire and 15 cases with IMF screws will be used as a method of inter-maxillary fixation intra-operatively. Here, All the procedures for IMF were performed in the same institution. After that, Pre-operative, intra operative and post-operative on end of the 1st, 3rd and 6th week assessment was done. Inter-maxillary fixation will be achieved with Erich's arch bar and 26 gauge stainless steel wire. (Figure-1)

IMF screws of 2/2.5mm diameter, 8/10 mm length. The screw has a pointed tip and its head having a slot where the 26 gauge wire can be passed for inter-maxillary fixation. (Figure-2)

SELECTION CRITERIA**Inclusion Criteria:**

- patients undergoing close reduction
- all types of mandibular fractures
- unilateral maxillary fractures
- dento-alveolar fractures.

Exclusion Criteria:

- Le-fort I, II, III
- Zygomatic and naso-ethmoidal fractures
- Orbital fractures
- Pediatric patients.
- Patients with mobile teeth.
- Edentulous patients.
- Panfacial trauma

METHODOLOGY

The patients between the age group of 16–60 years with single or multiple maxillary / mandibular fracture were included in this study. Edentulous patients, patients with underlying systemic disease (American Society of Anaesthesiologists III and IV), pathologic fractures, comminuted fracture of mandible, patients with multiple fractures (para-symphysis with angle, associated condylar fractures, and maxillary fractures), and patients having primary and mixed dentition were also included from the study. The selection of the patients was done by simple randomized enveloped method and designated as Group A and Group B. Group A patients received IMF with Erich arch bars and Group B patients received IMF with IMF screws. Group-A patients would be treated with Erich arch bar for either of the jaws which is stabilized by 26 gauge stainless steel wires and further inter-maxillary fixation is done with the box wires. Irrespective of open or closed method, this group had 15 patients. The method used for the placement of Erich arch bar is as follows. (Figure-1)

After appropriate anaesthesia, a prefabricated arch bar with hooks incorporated on the outer surface with flat malleable stainless steel metal strip was cut accurately to the length of both upper and lower dental arches. On the upper jaw, the hooks were arranged in an upward direction and to the lower jaw in a downward direction. The arch bar was adapted to the buccal surface of each arch and given shape of the arch by bending it, starting from the mesial part of last tooth progressing past the midline and finishing at the other end. It was fixed to each tooth, using prestretched 26-gauge stainless steel wire, which is passed from mesial surface of tooth to the lingual side and back on the buccal side from the distal surface of the tooth, making sure that one end of the wire is passing above the arch bar and the other below it. (Figure-4 A,B,C)

After this, both ends of the wire were twisted together in a clockwise manner and the arch bar was attached securely and firmly to the necks of each tooth on the buccal surface of the arch. Open reduction and internal fixation were then carried out using conventional miniplate/screw system with a single design and configuration, i.e., 2 mm thickness,

4-hole plate with gap in all cases based on Champy's lines of osteosynthesis. Arch bar was left in place for 4–6 weeks to enable the postoperative traction to correct the small discrepancies in occlusion.

Group-B patients inter-maxillary fixation is done by IMF was achieved by the use of six stainless steel IMF screws of 2 mm diameter and 8 mm or 10 mm length. (Figure-2)

After appropriate anesthesia, holes are drilled through mucosa with 1.5 mm or 1.7 mm drill bits, without any gingival incision preferably between the canine and first premolar teeth in each quadrant, and the third pair of IMF screws was inserted in the same way in the upper and lower dental midlines. After this, IMF screws were inserted through the predrilled holes, taking care not to penetrate the lingual or palatal mucosa. IMF was achieved using wires or elastic bands. (Figure-7 A,B) (CUT) Open reduction and internal fixation were then carried out using conventional miniplate/screw system with a single design and configuration, i.e., 2 mm thickness, 4-hole plate with gap in all cases based on Champy's lines of osteosynthesis. Screws were left in place for 4–6 weeks.

The follow-up periods were 1 week post-operative, 3 week post-operative and 6th week post-operatively. During the whole study, only one operating surgeon was involved although the assistants varied. The following parameters were recorded, tabulated, and subjected to statistical analysis. In our present study intra-operative occlusion is taken as a key for further follow-up of stability of occlusion, mobility of the jaw, time required for fixation, maintenance of oral hygiene (Figure-10,11) (CUT) and amount of weight loss.

Criteria Used:

- a) **Time:** It is noted from the start of the first wire passed till inter-maxillary fixation.
- b) **Occlusion Stability:** This is measured by the occlusion achieved at the time of reduction which is adequate or present and inadequate or absent. The molar relations are key for occlusion, which is assessed in the follow-up after the release of inter-maxillary fixation.
- c) **Weight:** The weight of the patient is taken pre-operatively and it re-measured every follow-up visit.

- d) **Oral Hygiene:** This is measured by OHIS index in every follow-up as oral hygiene maintenance by patient.
- e) **Occlusion Mobility:** This is measured by observation and palpation of the fracture segments of the jaw and evaluated as mild, moderate, severe and absent according to the mobility of the segments.

RESULTS

The results showed that erich’s arch bar needed more time for fixation when compared with IMF screws. (Fig.a) Erich’s arch bar had superior stability and poor oral hygiene (Fig. b & e) than IMF screws. Weight was reduced with both arch bar and IMF screws but arch bar showed more reduction comparatively (Fig. c).

Timing

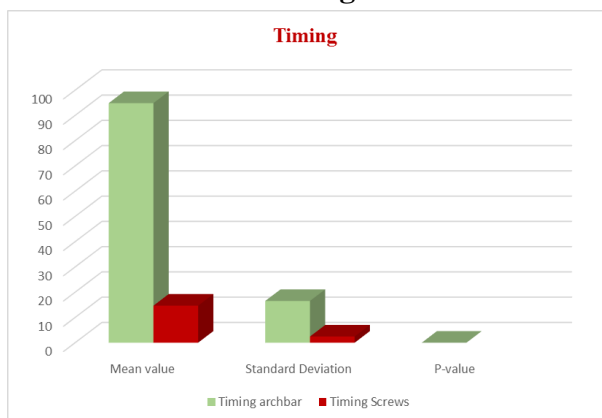


Figure a.

Oral Hygiene

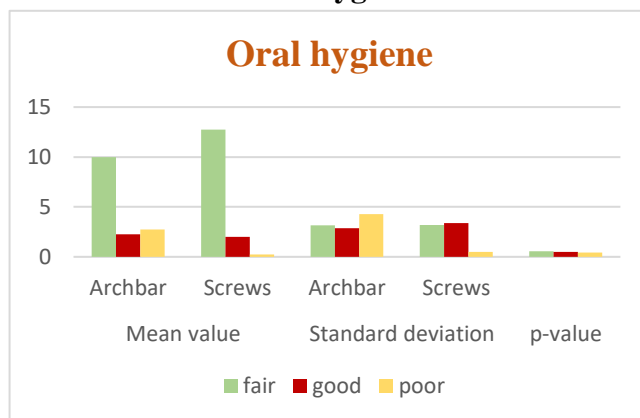


Figure b.

Weight

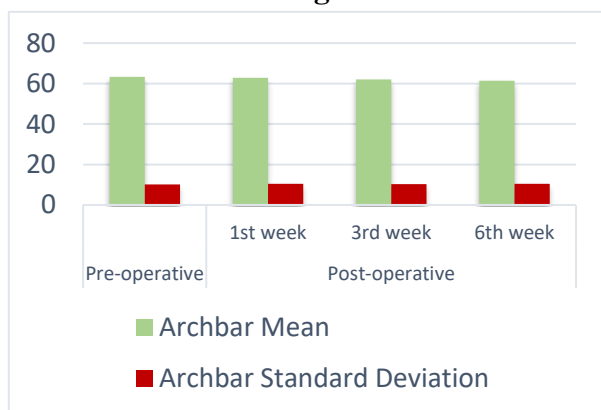


Figure c.

Mobility

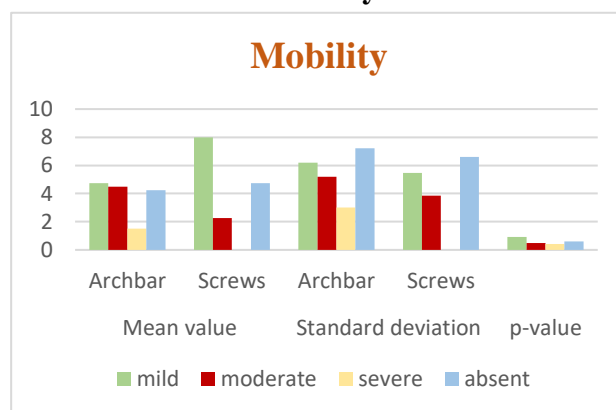


Figure d.

Stability

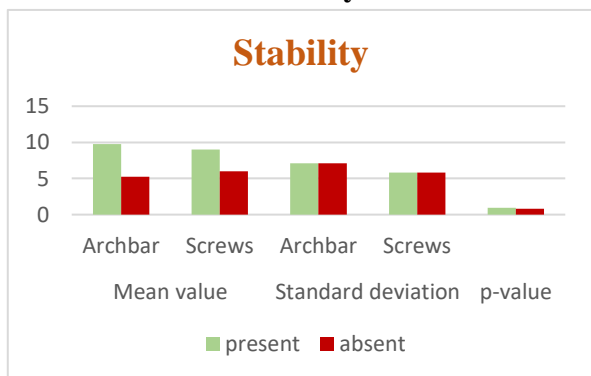


Figure e.

DISCUSSION

As said by **Arthur and Berardo, Jones, Fabbioni et al., Roccia et al., and Coletti et al**^{5,6,7}, the maximum time taken for arch bar fixation was 120 min and in case of IMF screws only 20 min in this study. IMF screws fixation is four to six points fixation where Erich's arch bar fixation includes whole dentition which have multiple point fixation, so the Erich's arch bar technique is more time consuming for fixation when compare with IMF screws technique.

As said by **Roccia et al. and Qureshi AA et al**^{4,7}, stability was found more adequate in relation to Erich's arch bars compared to IMF screws. In Erich's arch bar fixation it includes complete dentition for fixation and there are multiple points for fixation where as in IMF screws fixation there are only four to six point of fixation that's the reason that the stability is comparatively better in Erich's arch bar technique compare to IMF screw technique.

As said by **Nandini et al and Bergh et al**^{1,2}, Oral hygiene of all the patients was found to be good, and in fact, it had improved postoperatively after meticulous oral hygiene instructions with IMF screws, but it was found to be very poor in patients with Erich arch bars.

As said by **Nandini et al and Anshul et al**^{1,8}, it was found that due to inadequate nutrition intake in cases of Erich's arch bar and IMF screws. The patients were advised to adhere to strictly liquid diet to immobilize the maxilla-mandibular relation for competent healing. Liquid diet is nutritionally insufficient as many macro nutrition cannot be given to the patient by the oral route. As the Erich's arch bar involves too much of the wire components, patients were unable to keep a proper oral hygiene. Lack of oral hygiene, psychologically deprived the patients from accepting food and hence more weight reduction was found in this patients. In IMF

screws, limited wire component did not caused the patients the lack of oral hygiene hence the psychologically the acceptability of the food was maintained. So, the weight reduction was less in relation to the Erich's arch bar. But weight loss was a consistent feature in both, due to liquid diet.

As said by **Bergh et al and YK Sandhu et al**^{2,3}, IMF screw have only four to six point fixation hence less stable and of limited use, on the contrary Erich' had multiple point of fixation and generally involves the entire dentition hence more stable and rigid. Because of four to six stable points are there in IMF screws it has limited application for simple fractures (symphysis & para-symphysis) on the contrary in the Erich's ach bar as it has multiple stable points it can be used for right from the simple fracture to all types of comminuted fractures.

SUMMARY AND CONCLUSION

Inter-maxillary fixation (IMF) plays a vital role in management of fractures involving maxilla and mandible & helps in stabilizing the patient's occlusion and thus reduction in fracture segments. Erich arch bar provides good stable immobilization of fracture fragments during fixation. We conclude that the use of both the techniques in achieving inter-maxillary fixation is efficacious with both the techniques having merits and demerits over each other. Use of arch bars as seen in our results has a few disadvantages over IMF screws like time consumed in application and removal is more, increased number of needle stick injuries, difficulty in maintaining oral hygiene and weight loss due to lack of nutrition, however it has its own advantages like it can be used in the treatment of dento-alveolar fractures, multiple teeth bearing fractured fragments can be reduced into an arch form and comparatively good stability and rigidity of the jaws.

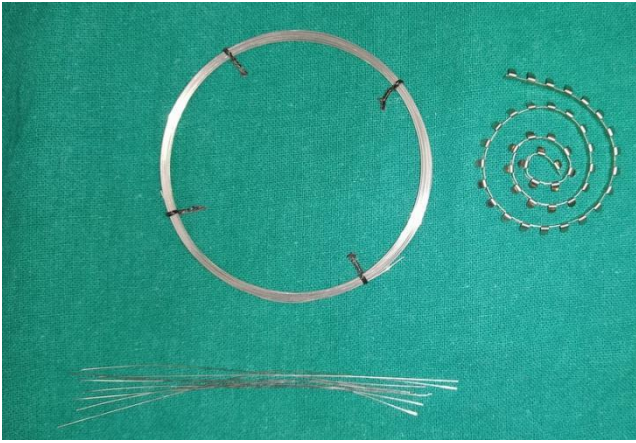


Figure-1: Erich's Arch Bar, 26 Gauge Stainless Steel Wires



Figure-2: 2.5 mm * 8mm/10mm length IMF Screws



Figure-3: Instruments & Materials



Figure-4 (A)



Figure-4 (B)



Figure-4 (C)

Figure-4: (A, B, C): IMF Wiring with Erich's Arch Bar Technique



Figure -5 (a)



Figure-5 (b)



Figure-6: Occlusal after Erich's Arch Bar Removal



Figure-7: Occlusal after Erich's IMF Screws Removal

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