A COMPARATIVE ANALYSIS OF BI-CORTICAL SCREWS V/S ERICH'S ARCH BAR FOR MAXILLOMANDIBULAR FIXATION

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ABSTRACT

Background: 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.

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.

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.

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 was 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)

Figure-1: Erich's Arch bar, 26 gauge stainless steel wires

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)

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

Figure-3: Instruments & Materials

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)

Figure-4 (A)

Figure-4 (B)

Figure-4 (C)

Figure-4 (A,B,C) : IMF wiring with Erich's Arch bar technique

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) 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.

Figure-7 (A)

Figure-7 (B)

Figure-7 (A,B): IMF wiring with IMF Screws technique

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) and amount of weight loss.

Figure-10: Occlusal after Erich's Arch bar removal

Figure-11: Occlusal after Erich's IMF Screws removal

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

Timing:

In 30 patients, 15 each patients were evaluated in both Erich's arch bar and IMF screw technique. Time required for Erich's arch bar technique, mean value was found

to be 94.86 and the standard deviation for it is 16.51 and for IMF screws technique, mean value was found to be 14.66 and the standard deviation for it was 2.43. P-value was concluded to be 0.003 which is statistically significant.

Oral hygiene

Here the mean value for fair oral hygiene in Erich's arch bar technique was found to be 10 with standard deviation of 3.16 , for IMF screws the mean value was found to be 12.75 with standard deviation of 3.20 , and P- value was 0.54 . The mean value for good oral hygiene in Erich's arch bar technique was found to be 2.25 with standard deviation of 2.87 , for IMF screws the mean value was found to be 2 with standard deviation of 3.36 , and P- value was 0.48. The mean value for poor oral hygiene in Erich's arch bar technique was found to be 2.75 with standard deviation of 4.27, for IMF screws the mean value was found to be 0.25 with standard deviation of 0.5 , and P- value was 0.42 .

Weight:

Pre-operatively the mean value for Erich's arch bar was found to be 63.33 and for IMF screws 64.8, standard deviation for Erich's arch bar was 10.18 and for IMF screws 6.95, P- value was 0.028 which is

statistically significant. Post-operatively at the end of the 1st week, the mean value for Erich's arch bar was found to be 62.8 and for IMF screws 64.93, standard deviation for Erich's arch bar was 10.41 and for IMF screws 6.26 , P- value was 0.03 which is statistically significant. At the end of 3rd week, the mean value for Erich's arch bar was found to be 62.06 and for IMF screws 64.26, standard deviation for Erich's arch bar was 10.27 and for IMF screws 6.26, P- value was 0.03 which is statistically significant. At the end of the 6th week, the mean value for Erich's arch bar was found to be 61.33 and for IMF screws 63.466, standard deviation for Erich's arch bar was 10.41 and for screws 6.02, P- value was 0.03 which is statistically significant.

Mobility:

For mild mobility in Erich's arch bar and IMF screws technique, the mean value was found to be 4.75 and 8 with standard deviation was 6.18 and 5.47 and the P-value for it was 0.9. For moderate mobility in Erich's arch bar and IMF screws technique, the mean value was found to be 4.5 and 2.25 with standard deviation was 5.19 and 3.86 and the P-value for it was 0.4. For severe mobility in Erich's arch bar and IMF screws technique, the mean value was found to be

1.5 and 0 with standard deviation was 3 and 0 and the P-value for it was 0.4. For absent mobility in Erich's arch bar and IMF screws technique, the mean value was found to be 4.25 and 4.75 with standard deviation was 7.22 and 6.60 and the P-value for it was 0.6.

Stability:

While comparing the present stability in Erich's arch bar and IMF screws technique, the mean value was found to be 9.75 and 9 with standard deviation was 7.08 and 5.83, the P-value for it was 0.9. For absent stability in Erich's arch bar and IMF screws technique, the mean value was found to be 5.25 and 6 with standard deviation was 7.08 and 5.83, the P-value for it was 0.8.

DISCUSSION

As said by **Arthur and Berardo, Jones, Fabbioni *et al.*, Roccia *et al.*, and Coletti *et al***^{12,21,22}, 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 **Bergh *et al* and YK Sandhu *et al***^{8,10}, 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 arch bar as it has multiple stable points it can be used for right from the simple fracture to all types of comminuted fractures .

SUMMARY & CONCLUSION

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. Erich arch bar provides good stable immobilization of fracture fragments during fixation. This method is

useful for treating both alveolar fractures, subluxated teeth, simple dento-alveolar fractures and where multiple tooth bearing fragments in either jaw require reduction into an arch form before inter-maxillary fixation is applied. Although arch bar has been extensively used for achieving inter-maxillary fixation, the use of inter-maxillary fixation screws (IMFS) is gaining popularity. Compared with arch bars, inter-maxillary fixation screws are quick and easy to place & are ideal for use when the teeth have been periodontically compromised, heavily restored and are insufficient in number to place an arch bar. In this study “a comparative analysis of Bi-cortical screws v/s Erich’s arch bar for maxillo-mandibular 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.

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