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Comparison of Efficacy of Bone- Supported Arch Bar versus Erich Arch Bar in Maxilla-Mandibular Fixation

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ABSTRACT

Maxillomandibular fixation is termed to be basic and fundamental treatment of maxillofacial trauma. It is a cornerstone for reconstruing maxillofacial anatomy as it provides a stable base from which facial form and function can be restored. It has been the mainstay of treatment since world war. Erich arch bar has been an effective and versatile means of MMF from a long time, but the operator is at the risk of having penetrating injury, not only this there is increased surgical time both in placement as well as removal in addition to this trauma to the periodontium along with compromised oral hygiene are the shortcomings of traditional arch bars. One of the modifications is Universal bone-supported arch bar that although is similar to traditional Erich Arch bar but it gets integrated in both maxilla and mandible through bone-borne locking. For this reason, it can be efficiently applied in cases of poor dentition or in partially edentulous patients, it also serves as a tension band and less time is required for device application with this it also gives the advantage of decreased risk of needle stick injuries. The aim of this study was to compared Bone-Supported Arch Bars with Erich Arch Bars in Intermaxillary Fixation. The objective of this study was to evaluate and compare the effect of control group in term of time of application, time of removal, gloves perforation, loose fragments and cost with bone supported arch bar in IMF.

KEYWORDS

Maxillomandibular fixation; Maxillofacial trauma; Penetrating injury; Bone-borne locking

INTRODUCTION

Maxillomandibular fixation is termed to be basic and fundamental treatment of maxillofacial trauma. It is a cornerstone for reconstruing maxillofacial anatomy as it provides a stable base from which facial form and function can be restored [1,2]. It has been the mainstay of treatment since world war [3].

Erich arch bar has been an effective and versatile means of MMF from a long time, but the operator is at the risk of having penetrating injury, not only this there is increased surgical time both in placement as well as removal in addition to this trauma to the periodontium along with compromised oral hygiene are the shortcomings of traditional arch bars [1].

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Owing to the latest advancement in the field of maxillofacial hardware various options that has the potential to improve the speed and safety for the MMF during the surgical repair of mandibular fractures without compromising the versatility of the traditional enrich arch bar has been introduced.

One of the modifications is Universal Bone-supported arch bar that although is similar to traditional Erich arch bar but it gets integrated in both maxilla and mandible through bone-borne locking. For this reason, it can be efficiently applied in cases of poor dentition or in partially edentulous patients, it also serves as a tension band and less time is required for device application with this it also gives the advantage of decreased risk of needle stick injuries. The only risk associated with this is however tooth root or mucosal injury [4].

The aim of this study was to compared bone-supported arch bars with Erich arch bars in Intermaxillary Fixation. The objective of this study was to evaluate and compare the effect of control group in term of time of application, time of removal, gloves perforation, loose fragments and cost with bone supported arch bar in IMF.

MATERIALS AND METHOD

This prospective randomized study was conducted in department of oral and maxillofacial surgery and oral implantology, ITS Centre for dental studies and research, Muradnagar, Ghaziabad in which 20 patients who fulfilled the study criteria were included. All the patients that were above 18 years of age irrespective of the gender having maxillary and mandibular fracture and presenting to the department within 10 days of trauma were included in this prospective study. While any patient under 18 years of age having any other associated with facial fractures and reporting after 10 days of trauma were not made part of this study.

The included patients (n = 20) were randomly divided into two groups. In group A, the (n = 10) IMF was done using Erich arch bar while in group B, (n = 10) IMF was done using bone supported arch bars.

The parameters to be evaluated were:

1. Time of application and time of removal was calculated using stopwatch.
2. The number of loose screws and wires in every visit were evaluated using a probe
3. The number of gloves perforated were counted during both the application and removal of both the arch bars by manually counting the number of gloves that were discarded.
4. The cost of both the procedures was also evaluated.
5. The health of the gingiva surrounding the devices was evaluated and recorded using the descriptors “poor,” “fair,” “good,” or “excellent”. This was converted to a numerical score of 1-4 (table 1).

Score	Descriptor
1	Poor
2	Fair
3	Good
4	Excellent

Table 1: Gingival health grading.

After obtaining the informed consent from the patient (Annexure I & II), the patient was scrubbed with the help of betadine solution and then draped. This was followed by infusion of local anesthetic (2% lignocaine with 1:100,000 adrenaline) agent at the procedural site (the blocks were preferred but if the patient felt any pain at some particular site, then local infiltration was also given). The treatment was then done according to the group to which the patient belonged:

A) *Group A*

The Erich arch bar was appropriately measured, and it was cut accordingly. On the upper jaw the hooks are to be directed in upwards direction while it was directed in

downwards direction in mandibular arches. The arch bar was adapted at the buccal surface of the both the arches and the fixation was initiated from 1st molar of one side and then it was proceeded towards the midline of the arch and then progressed to the 1st molar of the other side (Figure 1). The arch bar is fixed to tooth with the help of 26 gauge wire. First the wire was passed from the mesial surface of the tooth to the lingual side and then back on the buccal surface from the distal surface of the tooth with one end of the wire above the bar and the other below the bar. The arch bar was secured by twisting the wires in clockwise direction around the neck of the tooth.

Figure 1: Erich arch bar.

B) Group B

Five 2.0 mm and 6 mm long stainless-steel screws were used in the maxilla and Five 2.0 mm and 8 mm long screws were used in the mandible. The number of screws placed was based on ensuring that there were at least 2 screws on either side of a fracture. The length of bone supported arch bar was measured from 1st molar of one side to 1st molar of other side in both the maxillary and mandibular arches. The morphology of the roots was analyzed and with the help of straight fissure bur (no 702) the holes were drilled between the two roots. The drilling started with the anterior region: The first hole was drilled between the central incisors of the maxillary arch and the arch bar was stabilized by tightening the screw with the help of screwdriver, then the screw placement was done on either side between 2nd premolar and molar and then the last two screws were placed according to the need of stability (Figure 2). This same procedure was repeated in mandibular arch. Then the IMF was done.

Figure 2: Bone-supported arch bar.

The occlusion was guided into ideal positions with the help of elastics, in both the groups.

RESULTS

The collected data were analyzed using student's unpaired t test or the chi-square test. P <0.05 was considered significant. The data were analyzed using the Statistical Package for Social Sciences software, version 10.

Out of 20 people included in the study, 17 were male and 3 were female.

The first factor analyzed was time for application of bone supported arch bar and Erich arch bar. The mean time taken for inter-maxillary fixation was 55.10 minutes with standard deviation of 16.203 minutes in Group A while in Group B it was only 26.90 minutes with standard deviation of 2.685 minutes (Figure 3).

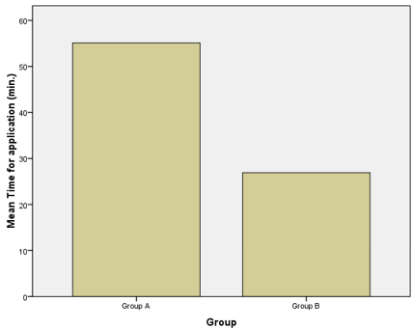

Figure 3: Time of application.

Surgeon glove perforation was observed intraoperatively with 9 patients in group A and 3 patients in group B. Thus, the glove perforation rate was much less in group B compared with group A, with, consequently, less risk of needle stick injuries and cross-infection to surgeon (Figure 4).

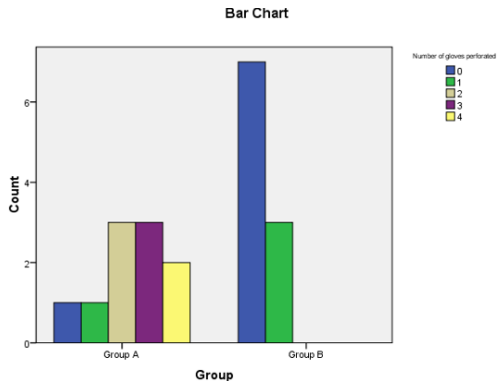

Figure 4: Number of gloves perforated.

After 2 weeks the patients were analyzed for gingival health and number of loose fragments. The mean gingival health score for group A was 2.20 while in group B was 2.30 with no significant difference in p value (Figure 5).

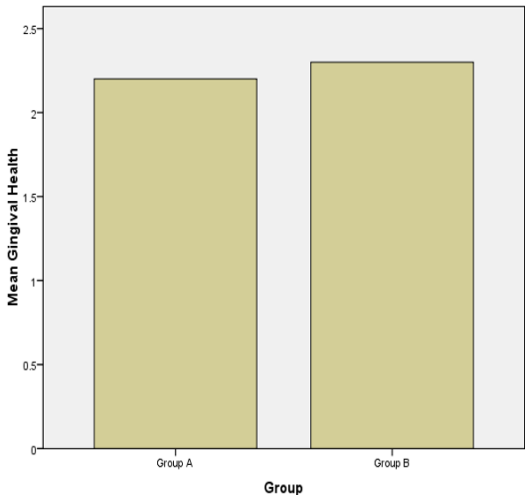

Figure 5: Gingival health.

Iatrogenic damages such as loose fragments were also analyzed in both the groups - the most common iatrogenic shortcoming encountered were loose fragments either screws or wires: In group A the loose fragments were 9 patients and in group B only 4 patients suffered iatrogenic damage (Figure 6).

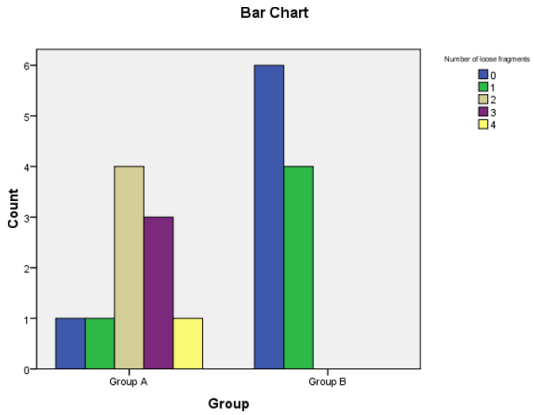

Figure 6: Number of loose fragments.

After satisfactory occlusion was achieved, IMF removal was done and the time for removal of IMF was noted. The mean time taken for the removal of IMF for group A was 40.10 minutes with standard deviation of 14.705 minutes and for group B was 18.40 with standard deviation of 8.222 minutes (Figure 7).

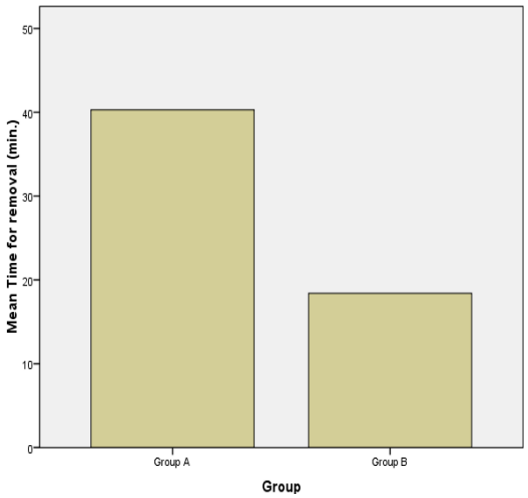

Figure 7: Time of removal.

The last criteria analyzed was the cost required in both the groups. In group A the rate charged was one thousand rupees while it was 2500 rupees in group B.

DISCUSSION

IMF is an important step in obtaining proper reduction of maxillofacial fractures by providing a stable foundation to reconstruct the facial form and obtain satisfactory occlusion. The average time required for application of Erich Arch Bar was 55.10 minutes which is not in

agreement with studies reporting the average time of 35.08 minutes [5-8]. The time required for bone-supported arch bar was only 26.90 Minutes which is somehow greater when compared with studies reporting an average of 10 minutes to 15 minutes required for insertion of IMFS [6,8].

The number of gloves perforation was also less in application of bone-supported arch bar as compared to Erich arch bar with glove perforation seen in only 9 patients in placement of Erich arch bar while it was seen in 3 patients in the other group. Hence risk of needle stick injury was less with Bone-supported arch bar. At start of the treatment only one pair of gloves were given to the operator but in case of perforation a new glove was given to change the perforated glove. In total 23 gloves were found to be perforated in Erich arch bar group while only 3 gloves were perforated in bone-supported application.

The stability was also more in bone-supported arch bars as compared to Erich arch bars. The number of loose wire fragments were seen in 9 patients in Erich arch bar groups while only 4 patients in bone supported group had loose screw which was observed at the follow-up. The total number of wires applied in Erich arch bar group were 120 among them 22 wires were found to be loose after 2 weeks while among the 60 screws placed only 4 screws were found to be loose in bone supported arch bar group.

The average time for removal of the IMFSs was 40.80 minutes for Erich arch bar and for the eyelets was 18.40 minutes for bone-supported arch bars, correlating with the average reported time for removal of IMFSs of approximately 20 minutes to 40 minutes.

The gingival index score signified the gingival score was 2.20 for group A (2.20) and 2.30 for group B. Similar findings have been observed in previous studies, and investigators have also stated that it was difficult to maintain oral hygiene when IMF was done.

During surgery on 9 patients in group A and 3 patients in group B, surgeon glove's perforations occurred. A similar finding was reported of a high glove perforation rate when placing eyelets and arch bar wiring. Many studies have reported that IMFSs are safe to use, with a low risk of causing injury to the surgeon by sharp-ended wires, decreasing the risk of transmission of blood-borne disease.

Bone-supported arch bar proved to be a costlier alternative than Erich arch bar.

In conclusion, IMFS application is an uncomplicated and rapid technique, useful for intraoperative ORIF and long term for CR. Because IMFSs provide stable occlusion, the technique is a viable alternative to eyelets and other interdental wiring. The removal of IMFSs was an easy and relatively painless procedure compared with the cumbersome removal of eyelets or arch bar wiring. Patients can maintain their oral hygiene with the IMFSs in place, in contrast to conventional wiring. The incidence of glove perforation was visibly lessened with the IMFS technique; it also reduced the risk of needle stick injuries and cross-infection in operating time. The postoperative occlusion was stable. The results of our study have shown that IMFSs will be well tolerated by patients and accepted by surgeons because of the ease of the technique when compared with ORIF because it is a very economically viable technique for securing IMF. The patient will although suffer due to increased costs of IMF in bone supported arch bar as compared to Erich arch bar but rapidity of the procedure, and better aesthetics in the interim period are the potential benefits.

CONCLUSION

The bone-supported arch bar proved to be a better alternative in terms of time of application and removal in comparison with Erich arch bars. It is also above conventional arch bar in terms of stability and to avoid needle-stick injury to the operator. In ground of costs and

soft-tissue injury, bone-supported arch bars proved to be a poor alternative to Erich arch bars.

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