Section: Dentistry

Original Research Article

TO COMPARE THE EFFICACY OF HYBRID ARCH BARS TO ERICH'S ARCH BARS DURING THE APPLICATION OF INTERMAXILLARY FIXATION: AN HOSPITAL BASED OBSERVATIONAL STUDY

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Received : 05/07/2025
Received in revised form : 26/07/2025
Accepted : 10/08/2025

Keywords:
Hybrid Arch Bars, Erichs Arch Bar, Interdental Wiring, Maxillomandibular Fixation.

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DOI: 10.47009/jamp.2025.7.5.40

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2025; 7 (5); 194-197

ABSTRACT

Background: Maxillomandibular fixation (MMF) is a fundamental procedure in the management of maxillofacial trauma, crucial for re-establishing pre-morbid occlusion and ensuring stable reduction of mandibular fractures. Recently introduced Hybrid arch bar (HAB) is a modification of conventional EAB which is fixed to the bone with the help of screws. There are only few studies that have compared the efficacy of HAB with EAB. The purpose of the study was to compare the efficacy and safety of HAB with EAB in the management of jaw fractures and also evaluate various complications associated with the HAB. **Materials and Methods:** This was a hospital based prospective randomized controlled trail on 30 patients participants in the study out of which 20 were males and 10 were females at department of dentistry in Government Medical College, Bhilwara, Rajasthan, India during 6 months period. In group A the hybrid group had the arch bars placed and secured with self drilling locking bone screws. In group B the arch bars are placed and secured with 24-gauge stainless steel circumdental wires. The primary outcome variable was arch bar placement time. The secondary outcomes were glove tears during application and removal, patient comfort and the removal time of the device. The groups were compared using t tests. **Result:** Our study shows the comparison of demographic variables for both arch bars. Significant difference was not observed in age, sex distribution, or etiology of trauma between the two groups. The intraoperative placement times differed significantly (P<0.05*) between the groups; Group 1 (received hAB) averaged 25.8±7.9 minutes and Group 2 (received EAB) averaged 55.3±12.7 minutes. However, significant difference was not observed in ease of occlusion perioperatively between the two groups (P>0.05); 93.33% and 80% of patients achieved the best reproduction of occlusion perioperatively in Group 1 and Group 2, respectively. The average time for removal for the hybrid arch bars was 30.7 minutes, which was significantly higher than the average 16.8 minutes for the removal of erichs bar (p<0.05*). **Conclusion:** Hybrid arch bar system is associated with significantly less operating time and greater safety to the surgeon. The benefits associated with this novel system has led to the evolution of this system into a surgeon's practice.

INTRODUCTION

Facial fractures are very common in the Indian health care system due to a variety of reason. Among the various locations in which facial fracture can occur, the mandible is considered as the most commonly location for mandibular fractures which requires medical intervention.[1] Maxillomandibular fixation (MMF) is a fundamental procedure in the management of maxillofacial trauma, crucial for re-establishing pre-morbid occlusion and ensuring stable reduction of mandibular fractures. Traditionally, MMF is required for 4–6 weeks, though more severe fractures may necessitate up to 8 weeks, depending on factors such as fracture pattern, anatomical location, severity, and associated comorbidities.[2]

ISSN (O): 2687-5365; ISSN (P): 2753-6556

The three main principles of MMF are to establish occlusion, provide stability, and immobilize the jaws.[3] Whether the management of jaw fracture is through open or closed reduction the application of Erich arch bar (EAB) for MMF has been the superior technique of fixation of jaws so far. Some significant disadvantages associated with EAB are increased time taken for its application and removal, wire prick injury, and glove puncture. Other underreported or unreported occurrences are the injuries related to periodontium and poor oral hygiene status.[4] MMF screws were introduced to overcome these limitations, but the reinforcement provided by these screws is significantly less than EAB and also, they do not exert tension band effect.[5] They are primarily used for short-term MMF or minimally displaced fractures. Many other alternatives for EAB like Ivy loops, Leonard buttons, and plastic anchorage points are also in use. However, the versatility of EABs for both long and short-term MMF is generally undisputed because of its simplicity in use and long history of successful treatment.

Recently introduced Hybrid arch bar (HAB) is a modification of conventional EAB which is fixed to the bone with the help of screws. The screws are placed in the interradicular area below the level of marginal gingival tissue in the eyelet that extends from the arch bar without affecting the periodontium.[4] One possible concern is that it may cause root injury while drilling for screws in the interradicular area. There are only few studies that have compared the efficacy of HAB with EAB. The purpose of the study was to compare the efficacy and safety of HAB with EAB in the management of jaw fractures and also evaluate various complications associated with the HAB.

MATERIALS AND METHODS

This was a hospital based prospective randomized controlled trail on 30 patients participants in the study out of which 20 were males and 10 were females at department of dentistry in Government Medical College, Bhilwara, Rajasthan, India during 6 months period. A written informed consent was obtained from all the participants. The participants involved in the study were between the age group 25 - 40 years. All the patients with mandibular parasymphysis fractures were enrolled in the study. Patients with systemic diseases, active infections, pregnant women, drug abusers, alcohol users were excluded from the study. These patients were also excluded if they declined to participate.

The treating surgeon explained the risks and benefits of study participation in detail to each patient, and patients were enrolled in the study. All the participants were enrolled into 2 groups. In group A the patients received hybrid MMF arch bar. In group B the patients received Erichs arch bar. A single operator performed the arch bar fixation on both the groups. All the patients underwent maxillomandibular fixation using lignocaine which consisted of 1:200000 adrenaline.

In group A the hybrid group had the arch bars placed and secured with self drilling locking bone screws. In group B the arch bars are placed and secured with 24-gauge stainless steel circumdental wires. In group B, the arch bars placed and secured with 24-gauge stainless steel circumdental wires. The arch bars were adapted to the maxillary and mandibular dentitions spanning from first molar to first molar and cut to an appropriate length for each arch.

In the hybrid group, the Stryker Universal SMART Lock Hybrid small arch bars were adapted to the maxilla and mandible. The midline locking screw was typically the first screw placed on each arch using a screwdriver. Next, a series of additional self-drilling bone-borne locking screws were placed in each arch, adapting the arch bar eyelets as needed to ensure placement in bone while avoiding the roots of the dentition, with 5 screws used in each arch for a total of 10 bone screws placed for both the upper and lower arches, except in cases in which additional screws were placed as clinically indicated.

The duration (minutes) from adaptation of hAB to dental arch and placement of the last screw was recorded separately for the upper and lower arch bar and totalled for final analysis by an impartial observer not involved in the study. Similarly, time from start of adaptation of EAB to either dental arch was measured, and placement of last circum-dental wire was recorded by an impartial observer using a stopwatch for both the upper and lower arch bar separately and then totalled for final analysis. Intraoperatively, reproducible pre-traumatic occlusion was observed, characterized by interdigitation of occlusion facets and categorized based on the ease of reduction of occlusion.

Patients in each group were followed at typical postoperative follow-up intervals for mandibular fracture patients at our institution: 1 week, 4 weeks, and 6 weeks. Additional follow-up between these intervals, when indicated, was recorded. Typically, the devices were removed at 6 weeks after surgery by an operating surgeon without an assistant with the patient under local anesthesia. At each follow-up appointment, any issues or findings directly or indirectly related to the devices as well as other unrelated issues that occurred during the postoperative period were recorded. The primary outcome variable was arch bar placement time. The secondary outcomes were glove tears during application and removal, patient comfort and the removal time of the device. The groups were compared using t tests.

RESULTS

Our study shows the comparison of demographic variables for both arch bars. Significant difference was not observed in age, sex distribution, or etiology of trauma between the two groups. The majority

ISSN (O): 2687-5365; ISSN (P): 2753-6556

(73.33%) of patients who received the hAB had mandibular trauma, and patients who received the EAB were equally divided into mandibular and midface fractures (table 1).

The intraoperative placement times differed significantly (P<0.05*) between the groups; Group 1 (received hAB) averaged 25.8±7.9 minutes and Group 2 (received EAB) averaged 55.3±12.7 minutes. However, significant difference was not observed in ease of occlusion perioperatively between the two groups (P>0.05); 93.33% and 80% of patients achieved the best reproduction of occlusion perioperatively in Group 1 and Group 2, respectively.

The average time for removal for the hybrid arch bars was 30.7 minutes, which was significantly higher than the average 16.8 minutes for the removal of erichs bar (p<0.05*). The patients were more comfortable during the maxilla-mandibular fixation in group 1 when compared to group 2. No adverse effects during the placement of hybrid arch bar (table 1).

Table 1: Demographic variables & clinical outcome in groups

Variables	Group 1 (hAB) (N=15)	Group 2 (EAB) (N=15)	P-vale
Mean Age (yrs)	32.5±10.3	31.6±11.7	>0.05
Gender (Male/female)	10:5	9:6	>0.05
Aetiology of trauma (Road accident)	93.33%	100%	-
Intraoperative placement time (Minutes)	25.8±7.9	55.3±12.7	<0.05*
Reproduction of Occlusion	93.33%	80%	>0.05
Timing of removal of arch bar (Minutes)	30.7±9.6	16.8±4.2	<0.05*

DISCUSSION

Erich arch bar, MMF screws, and direct wiring techniques, etc., are routinely used for MMF in closed reduction or prior to open reduction. Even though other wiring techniques like bridle wiring, MMF screws can be used in the management of few cases successfully, and they do not provide complete bracing effect like arch bars and often leads to posterior open bite and mild occlusal discrepancies. EAB is the gold standard for jaw immobilization due to the unparalleled reinforcement provided,[6] but it has some limitations. It takes a longer time to pass wire around each tooth with an increased risk for prick injury. At the same time, HAB has a high risk root injury and it is expensive.

According to a study conducted by King et al the mean application time was 31 minutes for Erich arch bars and 6 minutes for hybrid arch bars. This finding was similar to the results that we obtained.[7] A study done by Chao and Hulsen,[5] found the average time of 42 minutes to place the hybrid arch bars, which was significantly less than the 62 minutes required to place the EABs. The difference in application time between the two groups is 20 minutes. This finding was similar to the result that we obtained.

In another study conducted in 2018, it was stated that though a reduction in application time with the use of the Hybrid Arch-bars was present the overall length of surgery was not different between the erich arch bar group and hybrid arch bar group. However, it was stated that for relatively quick procedures such as closed reduction (CR) of routine mandible fractures that overall length of surgery time would also be significantly reduced when the Hybrid system is used.[8]

The potential safety benefit is a significant advantage to the surgeon. Surgical glove perforation during maxillomandibular fixation can pose to be a serious threat to the surgeon. The applications of erichs arch bar consists of extended time using sharps via interdental wiring and other instrumentations. The reported rates of sharp injury are between 23-27%.[9] There are studies that demonstrates that the surgical treatment of a mandibular fracture is associated with a relatively high incidence of glove perforation. Furthermore, the overall incidence of perforation is especially high when a wiring technique is used. It was observed that wire-stick injuries occurred whilst passing wire interproximally and also due to an inadequately positioned interproximal wire. Majority of the glove perforations goes unnoticed.[10] This study also proved that high incidence of glove perforation was present when Erichs bar was used for fixation. This draw back can be overcome by the usage of hybrid arch bar which consists of self tapping screws used for the stabilisation the arch bar. The versatility of this hybrid arch bar system includes the placement of wire and elastic in different vectors as in the need of the situation. These are factors which offered surgeon satisfaction during the usage of hybrid arch bar when compared to erichs arch bar.[11] EAB allows manipulation of fractured jaw segments because wires can be tightened after satisfactory reduction. The rigidity of hABs after screw tightening limits accurate correction of minor discrepancies in fracture reduction. Due to the non-homogeneous distribution of cases in the two groups, we cannot infer the superiority of hAB over EAB in achieving occlusion.

The hybrid arch bar system is associated with high cost, which makes it difficult for the patients to afford it. According to our experience this draw back can be addressed by sterilising and reusing the titanium arch bar and the screws. The limitations of this study included the small sample size and the subjective judgments of the surgeons.

CONCLUSION

The hAB offers distinct advantages over EABs in terms of clinical convenience, reduced time required

ISSN (O): 2687-5365; ISSN (P): 2753-6556

for MMF, enhanced stability, versatility in directing elastic force, and preventing risk of injuries posed by wires. Hybrid arch bar system is associated with significantly less operating time and greater safety to the surgeon. The benefits associated with this novel system has led to the evolution of this system into a surgeons practice.

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ISSN (O): 2687-5365; ISSN (P): 2753-6556