

# Comparative Evaluation of Conventional Arch Bar Fixation versus a New Method of Arch Bar Fixation with a Single Wire - A Prospective Study

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## ABSTRACT

**Background:** Maxillo-mandibular fixation is a common procedure performed to ensure the accurate interrelationship of dental occlusion which is necessary for functional rehabilitation. Various methods to achieve maxillomandibular fixation have been described in the literature. **Aims and Objectives:** The aim of the present study was to evaluate the effectiveness of a new method of arch bar fixation using a single wire compared to arch bar fixation with multiple wires. **Methods:** The study was conducted on a sample of 20 patients, requiring arch bar placement for intraoperative and post-operative Inter-maxillary fixation in maxillofacial trauma patients. Patients were divided into two groups: group A in which Erich arch bar fixation was done with multiple wires and in group B Erich arch bar fixation was done with a single wire. The patients were followed up on 1<sup>st</sup> day, 3<sup>rd</sup> day 1<sup>st</sup> week and 4<sup>th</sup> week. The parameters assessed were operative time, operator injury, soft tissue injury, stability, and oral hygiene. **Results:** The mean time taken for fixation in group B was  $61.5 \pm 5.80$  min as compared to  $87 \pm 8.56$  min in group A ( $P = 0.000$ ). There were significantly less multiple operator injuries and soft tissue injury in group B than group A. The oral hygiene was fair to poor in 80% patients in group A and in group B 10% patients showed fair oral hygiene ( $P = 0.007$ ). In terms of stability, both the techniques were equally efficient. **Conclusion:** The new technique of arch bar fixation is effective in few ideal cases with advantages of decreased operative time, minimal incidence of operator injury, soft tissue injury, and better maintenance of oral hygiene but it is ineffective in treating cases where split arch bar is required. The conventional technique has numerous advantages over new technique including less kinking of wire, its usage in partially edentulous arches, in cases with split arch bar requirement and easy replacement during occurrence of wire breakage.


**Key words:** Intermaxillary fixation, Erich arch bar, soft tissue injury.

## INTRODUCTION

Maxillomandibular fixation (MMF) is a common procedure performed to ensure the accurate interrelationship of dental occlusion which is

necessary for functional rehabilitation.<sup>[1]</sup> It plays an important role in restoring the anatomical reduction and stabilization of intraoperative and postoperative management of traumatic patients.

Various methods to achieve MMF have been described in the literature. Erich arch bar have been considered the gold standard for achieving MMF because of their rigidity and versatility.<sup>[2]</sup> Despite offering stable fixation and desirable occlusion control, they have many disadvantages, including difficulty in maintaining oral hygiene, reduced patient compliance and discomfort, relatively longer operating time, and a higher risk of operator

Quick Response Code	Article Info:
	doi: 10.5866/2023.13.10056
	Received: 09-04-2023
	Revised: 24-04-2023
	Accepted: 18-05-2023
	Available Online: 02-07-2023, (www.nacd.in) © NAD, 2023 - All rights reserved

injury.<sup>[3]</sup> To overcome these disadvantages a new method of fixation of an arch bar using a single long wire was used in the present study.

The present study aimed to evaluate the effectiveness of a new method of arch bar fixation using a single wire compared to arch bar fixation with multiple wires.

## MATERIALS AND METHODS

The study was conducted on a sample of 20 patients, who required arch bar placement for intraoperative intermaxillary fixation (IMF) to monitor the occlusion and in patients who required postoperative IMF to maintain the stability or to guide the inter-cuspal dental occlusion. The institutional ethical committee approval was obtained before start of the study. (KIDS/IEC/2020/403)

Patients in the age group of 15–60 years, who suffered from fractures of the mandible or midface, associated with occlusion derangement requiring intermittent IMF for intraoperative occlusal achievement or who required IMF for correction of postoperative occlusal discrepancy, were included in the study after obtaining the written consent. Patients with severe periodontitis, partially edentulous, completely edentulous, severe crowding, deep bite, and medically compromised patients were excluded from the study. Patients were divided into two groups, that is, group A in which Erich arch bar fixation was done as a conventional technique with multiple wires [Figure 1], and group B in which Erich arch bar fixation was done with a single wire [Figure 2].

## Procedure

The Erich arch bar was cut to the appropriate size and adapted to each arch. The 0.4 mm (26 Gauge) soft stainless-steel wire measuring 40 cm was taken and pre-stretched by 10% in group B and then twisted around the 1<sup>st</sup> molar [Figure 3]. Then both ends of the wire were passed through interproximal space from the buccal side, keeping one wire above and one below the arch bar, then crossed and passed through the next interproximal space from the lingual to the buccal surface [Figure 4]. This procedure was continued until the last tooth on the other side was reached and then the wires were twisted around the bar at the end [Figure 5]. The same procedure was performed on the opposite arch. In the group A, Erich arch bar fixation done with multiple wires in all patients.



**Figure 1:** Clinical picture showing arch bar fixation in group-A study sample



**Figure 2:** Clinical picture showing arch bar fixation in group-B study sample



**Figure 3:** Twisting of wire around the first molar tooth in group-B samples

The patients were evaluated in the preset study for the following variables:

- A. Time of placement from start of fixing of arch bar with wire to 1<sup>st</sup> tooth to last tooth was recorded in minutes.
- B. Operator injury: Occurrence of any prick injuries was noted as absent, single or multiple times.
- C. Soft tissue injury such as erythema and ulcer was assessed on 1<sup>st</sup> day, 3<sup>rd</sup> day, 1<sup>st</sup> week.
- D. Stability of arch bar was assessed on 1<sup>st</sup> day, 3<sup>rd</sup> day, 1<sup>st</sup> week and 4<sup>th</sup> week
- E. Oral hygiene by OHI-S index and gingival scoring was by Lobene *et al.* were recorded at 4<sup>th</sup> week.

Statistical analysis was performed by a statistician with SPSS statistical software for Windows, version 26, using Chi-square test and Student *t*-test. *P* < 0.05 was considered statistically significant.

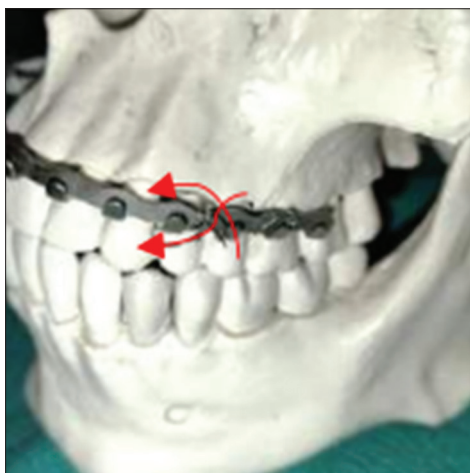


Figure 4: Criss-crossing of wire in group-B samples



Figure 5: Final twisting of wire in group-B samples

**RESULTS**

Out of twenty patients, 18 were male and two were female with a mean age of 28.15 years. The average time taken for fixation of arch bar for both arches in group A was 87 ± 8.56 min and group B was 61.50 ± 5.80 min. The difference between the two groups is statistically significant, (*P* = 0.00). Operator injury was noted in six cases (60%) in group A and one case (10%) in group B. The difference between the two groups is statistically significant with *P* = 0.034 [Table 1]. Group A had higher incidence of soft tissue injury than group B (*P* < 0.05) [Table 2]. There was no statistically significant difference in stability of arch bar between the groups (*P* > 0.05) [Table 3]. Oral hygiene was recorded on 4<sup>th</sup> week after arch bar removal and it was fair to poor in 80% patients in group A and in group B 10% patients showed fair oral hygiene there was a statistically significant difference between the two groups (*P* = 0.007) [Table 4].

**DISCUSSION**

The main goal was to treat successfully maxillofacial trauma and achieve functional rehabilitation. Immobilization by MMF is the basic and fundamental principle in the management of maxillofacial trauma. The most widely used technique for MMF is the use of Erich arch bar. This

**Table 1:** Comparison of incidence of operator injury between two groups

Operator injury	Group A (%)	Group B (%)
Absent	40	90
Single	30	10
Multiple	30	0

*P*=0.034 (statistically significant)

**Table 2:** Comparison of soft tissue injury between two groups

Soft tissue injury	1 <sup>st</sup> day (%)	3 <sup>rd</sup> day (%)	1 <sup>st</sup> week (%)
<b>Group A</b>			
Absent	30	30	20
Erythema	70	30	20
Ulcer	0	40	60
<b>Group B</b>			
Absent	90	70	70
Erythema	10	30	30
Ulcer	0	0	0
	<i>P</i> =0.08	<i>P</i> =0.032	<i>P</i> =0.006

**Table 3: Comparison of stability of Arch Bar**

Stability	1 <sup>st</sup> day (%)	3 <sup>rd</sup> day (%)	1 <sup>st</sup> week (%)	4 <sup>th</sup> week (%)
Group A				
Excellent	100	100	70	40
Good	0	0	30	40
Poor	0	0	0	20
Group B				
Excellent	100	100	100	70
Good	0	0	0	30
Poor	0	0	0	0
	<i>P</i> =1	<i>P</i> =1	<i>P</i> =0.105	<i>P</i> =0.226

**Table 4: Comparison of oral hygiene**

Oral hygiene (OHI-S)	Group A (%)	Group B (%)
Good	20	90
Fair	60	10
Poor	20	0

is considered as the gold standard in the treatment of facial trauma because of their rigidity and versatility.<sup>[2]</sup> There are various techniques reported in the literature for fixation of Erich arch bar such as bone supported arch bar, resin bonded arch bar and screw retained arch bar.<sup>[4-8]</sup> The technique of arch bar fixation by multiple circumferential wires around each individual teeth was associated with disadvantages such as a long operative time, difficulty in maintaining oral hygiene, reduced patient compliance and discomfort, and risk of needle stick injury.<sup>[2]</sup>

In the present study the operative time for fixation of arch bar in group B was less compared to group A. The operative time depends on various factors such as, type of anesthesia, patient's cooperation and operator experience. In this study all the cases were performed under local anesthesia by a single operator. In group B as the arch bar was being stabilized sequentially by the same wire and not requiring twisting and bending of ends on labial and buccal surface separately for individual teeth, contributing to increased ease of placement and reduced operative time. Various studies in the literature reported the mean duration of Erich arch bar fixation with multiple wires ranging from 82 to 110 min.<sup>[7,9,10]</sup>

In the present study, there was higher incidence of multiple injuries to the operator in the group A (30%) than the group B due to multiple twisting

of wires and exposed sharp wire ends resulting in greater probability of injury. In group B as there were no adjacent exposed wire ends while stabilizing the arch bar, the incidence of injury was very low. Only two cases had injury and the reason was due to final twisting of the wire. Various studies reported in the literature of about 18% to 50.5% incidence of operator injury when conventional wiring techniques were employed.<sup>[11-13]</sup>

Occurrence of frictional abrasions to the fingers while performing the procedure was not recorded separately in the study but it was noted as a part of injuries sustained in three cases in the group A. Similar injuries have been reported in the literature as a common problem.<sup>[14]</sup> There was no frictional abrasion over the finger recorded in placing the arch bar in the group B.

In the present study, soft tissue injury in group A (80%) was more likely than in group B (30%) due to multiple projecting ends of wire knots, which irritate oral mucosa and cause ulcerations due to repeated abrasion. Literature reported about 73.33% of soft tissue injury with Erich arch bar IMF.<sup>[15]</sup> In the follow-up period as soon as the soft tissue injury was noted, an immediate intervention was taken, and the patients were advised for application of modeling wax over the arch bar and knot ends, to protect the oral mucosa of cheeks and lips. Thus, in the study the cumulative count of the ulcers was taken including those healed after 3<sup>rd</sup> day intervention. No patients in either group had soft tissue injury by the 4<sup>th</sup> week of observation because all instances that suggested the possibility of damage were treated with protective measures.

In terms of stability, both the techniques of arch bar fixation were equally efficient. There was no statistically significant difference between the groups. But there was clinical significance in stability in between the groups. In group A as the wires were twisted around the individual teeth, there was more chances of wire fatigue failure and less resistance to fracture resulting instability of arch bar. Wire fatigue failure is common from overtightening when securing the arch bar. In the present study, it was observed that in group B, if the wire gets loosened, then it can be re-tightened. The retightening of the arch bar cannot be done with a new method of arch bar fixation. However additional circumferential ligation can be placed if required to avoid replacement of the complete wire.

In the present study, fair to poor results of oral hygiene in the group A were likely due to the presence of multiple wire bent ends on the labial and buccal surface of teeth, which collects food debris and causes gingival inflammation and difficulty in performing oral hygiene habits, like brushing. Various literature reported oral hygiene as fair to poor with the use of Erich arch bar with multiple wires.<sup>[6,9,16]</sup> In Pathak *et al.* study, the oral hygiene status at 6<sup>th</sup> postoperative week was good in 20% and fair in 80% in Erich arch bar group of patients.<sup>[7]</sup> Various other factors also influence the maintenance of oral hygiene like patient habits, presence of pain at surgical site, difficulty in mouth opening, post-operative IMF.

The added advantage of single wire technique is that there will be no catch hold of gauze and suture material to the bent ends intraoperatively while performing intraoral scrubbing and preventing interference with the placement of vestibular incision.

In the group B, it was noted that the main difficulty was encountered during the initial placement of the wire around the first tooth. This was due to the length of the wire and the relatively low accessibility in the posterior region. As the first loop of the wire was stabilized the further loops were found to be easier to place.

It was found that the stability of arch bar in the new technique was inadequate when large interdental spaces were present as the wires crossing over in each interdental space stabilized the arch bar by forming tight loops around the cervical region of the associated tooth. As these loops were looser in areas where interdental spaces were present the wires failed to stabilize the arch bar adequately. After the first experience with such case no such cases were further included in the group B. Similar issues rose in cases with missing teeth and crowded teeth. As the ability to give IMF in partially edentulous arches is considered on the advantages of Erich's arch bar, this is one of the major disadvantages of the single wire technique as noted in this study. This new technique has limitations in that it cannot be applied in situations where split arch bars are necessary such as parasymphysis and symphysis fractures of mandible.

## CONCLUSION

Considering the advantages, disadvantages and observing the results of this study, we conclude that

the new technique of arch bar fixation is effective in few ideal cases with advantages of decreased operative time, minimal incidence of operator injury, soft tissue injury and better maintenance of oral hygiene but it is ineffective in treating cases where split arch bar is required. The conventional technique has numerous advantages over new technique including less kinking of wire, its usage in partially edentulous arches, in cases with split arch bar requirement and easy replacement during occurrence of wire breakage.

## CONFLICT OF INTEREST

None.

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