



## RESEARCH ARTICLE

## COMPARATIVE EVALUATION OF HYBRID ARCH BAR AND ERICH ARCH BAR IN THE MANAGEMENT OF MAXILLOMANDIBULAR FRACTURES

Sree Harika Thatavarthi<sup>1</sup>, Nagendra Srinivas Chunduri<sup>1</sup>, Sri Surya Tejaswini<sup>1</sup>, Shruthi Kandlapalli<sup>1</sup>, Sunnypriyatham Tirupathi<sup>2\*</sup>, Lamea Afnan<sup>3</sup>, Diana Russo<sup>4</sup>, Marco Ciccì<sup>5</sup>, Giuseppe Minervini<sup>6,7</sup>

1. Department of Oral and Maxillofacial Surgery, Malla Reddy Institute of Dental Sciences, Malla Reddy Vishwavidyapeeth, Hyderabad, India
2. Department of Pedodontics and Preventive Dentistry, Saveetha Dental College and Hospital, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Chennai, India
3. Department of Public Health Dentistry, Coorg Institute of Dental Sciences, Virajpet, Karnataka, India
4. Multidisciplinary Department of Medical-Surgical and Odontostomatological Specialties, Oral Surgery Unit, University of Campania "Luigi Vanvitelli", 80138 Naples, Italy
5. Department of Biomedical and Surgical and Biomedical Sciences, Catania University, 95123 Catania, Italy
6. Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, 600077 Chennai, India
7. Multidisciplinary Department of Medical-Surgical and Odontostomatological Specialties, University of Campania "Luigi Vanvitelli", 80138 Naples, Italy

\* **Corresponding author:** Sunny Priyatham Tirupathi, Department of Pedodontics and Preventive Dentistry, Saveetha Dental College and Hospital, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Chennai, India; email: dr.priyatham@gmail.com

**Received:** Dec 6, 2024; **Accepted:** Dec 26, 2024; **Published:** Jan 20, 2025

## ABSTRACT

**PURPOSE:** The purpose of this study was to compare operative time, effect on the gingiva, glove penetration rate and post-operative complications of the Hybrid arch bar (HAB) and Erich arch bar (EAB).  
**MATERIALS AND METHODS:** Patients reporting to our institution, diagnosed with maxillomandibular fractures indicated for IMF were included in the study and randomized into two groups (Group I with Hybrid arch bars and Group II with Erich arch bars). Operative time in minutes, glove penetration rate were evaluated during the placement and removal of the arch bar. Gingival health was evaluated before the placement and after removal of the arch bar and different complications encountered were evaluated during every visit. Both of the groups were compared using t test and chi-square tes

**RESULTS:** Of the 80 cases studied, 40 were in the Hybrid arch bar group and 40 in the Erich arch bar group. The Hybrid group had a mean age of 30.10 years, while the Erich group had a mean age of 26.10 years, with a statistically significant age difference between the groups. The Hybrid group showed a lower gingival index post-IMF compared to the Erich group (0.99 vs. 2.07), and the Hybrid arch bar required significantly less time for placement (44 minutes vs. 74 minutes) and had no glove penetrations, unlike the Erich group, which had a 40% penetration rate. Post-operative complications were also lower in the Hybrid group, with fewer cases of loose screws.

**CONCLUSION:** The hybrid arch bar system can be used as an alternative to traditional Erich arch bars for maxillomandibular fixation in patients with maxillomandibular fractures with no major complications. It provides quicker placement of the arch bars improving the safety of the operator and preserving the gingival health of the patient.

**Keywords:** Fractures, Erich Arch bar, Arch bar, Intermaxillary fixation

## INTRODUCTION

Maxillofacial fractures constitute a common subset of injuries that may result in significant morbidity and disability. The administration of maxillofacial fractures constitutes a pivotal element of trauma care, necessitating the implementation of effective and efficient therapeutic modalities<sup>1</sup>. Maxillomandibular fixation, formerly referred to as intermaxillary fixation (IMF), is a technique employed to stabilize the maxilla and mandible in an optimal dental occlusion. The application of maxillomandibular fixation is fundamental in the management of patients who have sustained facial trauma, as well as those in need of reconstructive and orthognathic surgical interventions. It is an integral aspect of the treatment protocol for mandibular fractures, particularly in cases requiring closed reduction and the majority of open reduction and internal fixation (ORIF) procedures. The three primary objectives of maxillomandibular fixation encompass the establishment of occlusion, provision of stability, and immobilization of the jaw<sup>2</sup>.

Various forms of arch bars have been delineated in the literature, including Sauer's arch bars, Schuchardt's arch bars, Dautrey's arch bars, Jelenko arch bars, Krupps arch bars, and Erich arch bars (EAB). Currently, Erich arch bars (Fig 1) are the most frequently utilized apparatus for achieving intermaxillary fixation due to the stability they confer. Intermaxillary fixation utilizing EAB is considered the gold standard as it facilitates superior occlusal stability in comparison to alternative methodologies<sup>3</sup>.



Fig 1. Erich arch bars

EAB offers a proficient and adaptable approach to maxillomandibular fixation; however, its application is accompanied by certain adverse effects. Dental structures are exposed to therapeutic forces that may

induce mobility or even avulsion, while additional repercussions comprise potential damage to the gingiva and a heightened risk of penetrating injuries to the surgeon due to glove perforation by wires during the application and removal of the EAB.<sup>(4)</sup> The incidence of glove penetration has been estimated at 70%.<sup>5</sup> Another drawback is the extended duration required for the application and removal of the arch bar. Innovations in the design of maxillofacial hardware may address the limitations associated with EABs while preserving stability and versatility. This has culminated in the development of hybrid arch bars (HAB), which feature a modified design that is bone-supported and retained by screws affixed to the maxilla and mandible<sup>4</sup>.

The HAB is characterized as an arch bar equipped with eyelets that are anchored to the bone via self-drilling screws (Fig 2).

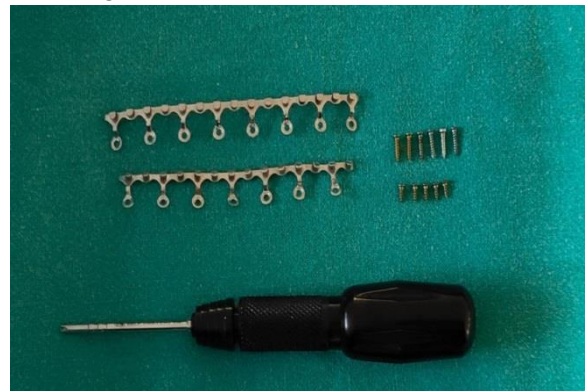


Fig 2. Hybrid arch bars

This arch bar amalgamates the benefits of bone-supported devices, such as expedited and straightforward application, alongside the advantages inherent to traditional arch bars. It has been engineered to optimize the benefits associated with arch bars, including its flexibility, capacity to function as a tension band, and the rapidity and ease of application akin to that afforded by IMF screws, while also encompassing all advantages of bone-supported maxillomandibular fixation, thereby reducing both operative time and glove penetration rates<sup>7</sup>. Numerous studies have been conducted, partially contrasting the efficacy of EAB and HAB; however, there exists a deficiency in the literature regarding various parameters. Consequently, this study is undertaken to address this gap through a comprehensive analysis and comparison of differing parameters.

The main aim of the study was to evaluate the efficacy between the use of Hybrid arch bar and Erich arch bar

in the management of maxillomandibular fractures. The purpose of this study was to compare operative time, effect on the gingiva, glove penetration rate and post-operative complications of the Hybrid arch bar and Erich arch bar.

### MATERIALS AND METHODS

To address the research purpose, a randomized clinical study was designed and implemented. The study population was composed of all the patients diagnosed with maxillomandibular fractures indicated for IMF from June 2022 through January 2024 at a single institution. To be included in the study sample, patients had to be between 18 to 65 years of age, free of any systemic diseases, indicated for IMF. Patients were excluded as study subjects if patients had comminuted mandibular fractures, completely edentulous patients, patients with absolute or relative contraindications to IMF, patients who need splint therapy for the stabilization of mobile teeth due to trauma. Patients were divided into two groups by randomisation.

In group I, patients underwent IMF using placement of Hybrid arch bars fitted with eyelets for self-drilling screw fixation to the maxilla and mandible (Fig 3).



Fig 3. Placement of Hybrid arch bars

In group II, patients underwent IMF using placement of Erich arch bars secured with circum-dental wires (Fig 4).



Fig 4. Placement of Erich bars

In group II, Erich arch bars were secured in place using 26-gauge round stainless steel circum-dental wires placed around the teeth.<sup>8</sup>

In group I, Hybrid arch bars were generally fixated using 5 2.0- and 6-mm-long self-drilling locking screws in the maxilla and 5 2.0- and 8-mm-long screws in the mandible. The number of screws placed was based on stability obtained.<sup>9,10</sup>

In both the groups, 26-gauge, round, stainless steel wires were used to achieve intraoperative IMF.<sup>(11)</sup> Pre-operatively patients were evaluated by using gingival index score by checking the health of marginal and interproximal tissues in the 1<sup>st</sup> visit (pre-op/diagnostic visit). Intra-operatively operative time in minutes, glove penetration rate were evaluated during the placement of the arch bar in the 2<sup>nd</sup> visit. In closed reduction, IMF was done for 4-6 weeks.<sup>12</sup> In open reduction cases, even though plating fixation reduces the requirement of postoperative IMF, temporary intra operative IMF was done to secure occlusion and post operatively IMF with elastics was given if required to prevent functioning problems.<sup>13,14</sup> Patients were recalled every week for 4 weeks (3, 4, 5 visits) for general check-up. At the end of the 4th week (6<sup>th</sup> visit), loose hardware (loosening of screws, wires), other complications were evaluated before the removal of the arch.<sup>15</sup> Post operatively patients were analysed for gingival index on removal of arch bar.<sup>15</sup> A departmental database was reviewed to identify patients who were potential candidates for the study. Patient charts were reviewed to confirm that patients met the inclusion and exclusion criteria, and then the predictor, sample, and outcome variables described were collected.

### Statistical analysis

The data analysis has been performed by the statistician. The data was assessed for normality using Kolmogorov-smirnov test, and it followed a normal distribution. Hence, parametric tests were applied. The descriptive statistics such as Mean ( $\mu$ ), Standard Deviation (SD), minimum and maximum values, frequency and percentages have been obtained. For the categorical data such as gender, glove penetration and loose hardware, chi square was applied. Paired t test was applied to assess the means at two time interval (before and after intervention with IMF) for the measurement of gingival index and operating time in the groups separately. Further,

Independent t test was applied to assess the means of two independent groups (Hybrid arch bars & Erich arch bars) before the treatment and after the treatment separately. A p value of <0.05 was considered as statistical significance.

**RESULTS**

Of the 80 cases included in the study, 40 each were in the Hybrid arch bar group and Erich arch bar group respectively. Mean (SD) age in years of the patients in the Hybrid arch bar group was 30.10 (4.73) with a range of 23-40 years. In the Erich arch bar group, the mean (SD) age in years was 26.10 (7.46) with a range of 18-42 years. There was a statistical significance between the age comparison of the 2 groups [ $X^2= 60.00$ ;  $df= 14$ ;  $p = <0.001$  (S)]. The total number of females in this study were 12 (15%) with 4 (10%) in Hybrid arch bar group and 8 (20.0%) in the Erich arch bar group. The total number of males in this study were 68 (85.0%) with 36 (90.0%) in Hybrid arch bar group and 32 (80.0%)

in the Erich arch bar group. The results did not any statistical significance with respect to the gender [ $X^2= 1.56$ ;  $df= 1$ ;  $p = 0.21$ (NS)] as illustrated in Table 1.

Post-Operative complications such as loose hardware were assessed between both groups. There were no glove penetrations (0%) with the use of Hybrid arch bar, however, with the use of Erich arch bar, there were 16 (40%) glove penetrations and this was statistically significant [ $X^2 = 20.00$ ;  $df = 01$ ;  $p = <0.001$  (S)] and has been illustrated in the Table 1. Table 1 also shows the results of any loose hardware. Only 4 (10.0%) loose screws were seen in the former group while the majority of the loose hardwares viz., loose screw 2 (5.0%), loose wire 10 (25.0%) and loose arch bar 2 (5.0%) were present in the latter group and this shows a statistical significance [ $X^2 = 14.28$ ;  $df = 03$ ;  $p = 0.003$  (S)]. Loe and Silness Gingival Index (GI) was measured pre and post operatively in both the groups using paired t test (Table2).

**Table 1. Frequency and percentage distribution of gender, glove penetration and loose hardware in Hybrid arch bar and Erich arch bar groups with chi square test**

	Groups		Total	Sig.
	Hybrid arch bars	Erich arch bars		
<b>Gender</b>				
Female	4 (10.0%)	8 (20.0%)	12 (15.0%)	$X^2= 1.56$ $df= 1$ $p = 0.21$ (NS)
Male	36 (90.0%)	32 (80.0%)	68 (85.0%)	
Total	40 (100%)	40 (100%)	80 (100.0%)	
<b>Glove penetration</b>				
No	40 (100%)	24 (60.0%)	64 (80.0%)	$X^2 = 20.00$ $df = 01$ $p = <0.001$ (S)
Yes	0 (0%)	16 (40.0%)	16 (20.0%)	
Total	40 (100%)	40 (100%)	80 (100.0%)	
<b>Loose hardware</b>				
None	36 (90.0%)	26 (65.0%)	62 (77.5%)	$X^2 = 14.28$ $df = 03$ $p = 0.003$ (S)
loose screw	4 (10.0%)	2 (5.0%)	6 (7.5%)	
Loose wire	0 (0.0%)	10 (25.0%)	10 (12.5%)	
Loose arch bar	0 (0.0%)	2 (5.0%)	2 (2.5%)	
Total	40 (100%)	40 (100%)	80 (100.0%)	

**Table 2. Comparison of the gingival index and operating time during and after the IMF placement in Hybrid arch bar and Erich arch bar groups using paired t test**

		Mean (SD)	SEM	95% CI		t value	Sig.
				LB	UB		
<b>Gingival index</b>							
Hybrid arch bars	PRE OP	1.09 (0.27)	0.04	-1.12679	-0.05321	-4.949	<0.001 (S)
	POST OP	0.99 (0.38)	0.06				
Erich arch bars	PRE OP	0.99 (0.38)	0.06	-1.20527	-0.95473	-17.438	<0.001 (S)
	POST OP	2.07 (0.60)	0.09				
<b>Operating time</b>							
Hybrid arch bars	APPLICATION	44.40 (4.05)	0.64	11.069	14.531	14.958	<0.001 (S)
	REMOVAL	31.60 (1.93)	0.30				
Erich arch bars	APPLICATION	74.20 (5.50)	0.87	41.029	45.171	42.092	<0.001 (S)
	REMOVAL	31.10 (2.91)	0.46				

In the Hybrid arch bar, the mean±SD of GI before the IMF was 1.09±0.27) and after the IMF was 0.99±0.38 and this was statistical significant (p = <0.001). In the Erich arch bar, the mean±SD of GI before the IMF was 0.99±0.38 and after the IMF was 2.07±0.60 and was statistical significant (p = <0.001). The GI was also measured before the application of the IMF in both the groups and there was no statistically significant difference between then Hybrid arch bars and the Erich arch bars [p =0.183 (NS)]. However, during the removal of the arch bars, the gingival index score was lower in the Hybrid arch bars when compared to the Erich arch bars and this was statistically significant [p = <0.001 (S)]. These have been illustrated in Table-3. The

operating time was measured in minutes during the application and the removal of the arch bars in both the groups (Table 2). The mean (SD) time taken to place and remove the Hybrid arch bars was 44.40 (4.05) and 31.60 (1.93) respectively and the results are statistically significant at p = <0.001. The mean (SD) time taken to place and remove the Erich arch bars was 74.20 (5.50) and 31.10 (2.91) respectively and the results are statistically significant at p = <0.001. The operating time was compared in both the groups during the application of the IMF using the independent t test. The application and removal time was lesser in the Hybrid arch bars when compared to the Erich arch bars and this was statistically significant [p = <0.001 (S)] as shown in Table-3.

**Table 3. Between-group comparison of the gingival index and operating time in Hybrid arch bar and Erich arch bar groups using independent t test**

		Mean (SD)	SEM	95% CI		t value	Sig.
				LB	UB		
<b>Gingival index</b>							
PRE OP	Hybrid arch bars	1.09 (0.27)	0.04	-0.04	0.24	1.34	0.183 (NS)
	Erich arch bars	0.99 (0.38)	0.06				
POST OP	Hybrid arch bars	1.18 (0.34)	0.05	-1.10	-0.67	-8.14	<0.001 (S)

	Erich arch bars	2.07 (0.60)	0.09				
<b>Operating time</b>							
APPLICATION	Hybrid arch bars	44.40 (4.05)	0.64	-31.95	-27.64	-27.55	<0.001 (S)
	Erich arch bars	74.20 (5.50)	0.87				
REMOVAL	Hybrid arch bars	31.60 (1.93)	0.30	-1.10	-0.67	-8.14	<0.001 (S)
	Erich arch bars	31.10 (2.91)	0.46				

**Discussion**

The purpose of this study was to compare operative time, effect on the gingiva, glove penetration rate and post-operative complications of the Hybrid arch bar and Erich arch bar in the treatment of maxillomandibular fractures. The specific aims of the study were to evaluate the following parameters

- 1) Operative time required for application and removal of the arch bar,
- 2) Gingival Index before the application and after the removal of the arch bar,
- 3) Glove penetration rate during the application and removal of the arch bar,
- 4) Loose hardware such as loose arch bar, wires and screws. Several techniques have been described for MMF which include direct interdental wiring, Indirect interdental wiring (eyelet or Ivy loop), Continuous or multiple-loop wiring, Embrasure wires, Ernst ligatures, Cap splints and Arch bars.<sup>16,17</sup>

These approaches typically involve placement of wires around teeth, which can cause mucosal or dental injuries and are limited in patients with poor dentition or who are partially edentulous. There is an added risk of needle stick injury due to the hardware involved. Technological advances in the design of maxillofacial hardware may overcome the drawbacks of using EABs while maintaining stability and versatility. This led to the development of hybrid arch bar (HAB) which consists of a modified arch bar that is bone supported and is retained by the screws in the maxilla and mandible. It combines features of arch bars and bone-supported devices, potentially yielding the advantages of both.<sup>2</sup> In the present study, the application time required for the

placement of the arch bar was significantly more in the group I when compared to the group II. In the present study there was statistically significant difference in the application time required for the placement of the arch bars similar to the studies of Chao et al,<sup>18</sup> . King et al.,<sup>19</sup> Hesham et al.<sup>20</sup> but the time required for the removal of the arch bar was similar in both groups with no statistically significant difference similar to the study of chao et al. The average time required for placement of arch bar in group I was 44 mins similar to study of Chao et al.<sup>18</sup> but was higher when compared to other studies. Increased requirement of time may also be caused due to the reason that stainless steel hybrid arch bars used in the present study when compared to titanium arch bars used in the other studies. Stainless steel has low malleability compared to titanium. Adjusting the eyelets position will be much easier when using titanium arch bars compared to stainless steel arch bars. Amount of time required for the placement and removal in either of the groups was high when compared to studies by Bouloux et al.<sup>21</sup> Hesham et al.<sup>20</sup> as the present study was an institutional study and was performed by training surgeons.

Statistically significant difference in the gingival index with lower score for group I was noted. The results coincide with the study of Hesham et al.<sup>20</sup> with higher gingival index in the Erich arch bar group probably due to the presence of wire around the tooth over the marginal and interdental gingiva which may inhibit the maintenance of the gingiva. Group II reported a 40% incidence of needle stick injuries and there were no glove penetrations in Hybrid arch bar group I. These findings are

consistent with previous studies by Hesham et al. (20) and King et al.<sup>19</sup> which also found a higher glove penetration rate with the Erich arch bar than the Hybrid arch bar.<sup>22-25</sup> The majority of reported wire-stick injuries occurred during wire placement, particularly during interproximal wire placement, where gloves could snag on exposed wires or improperly positioned wires in group II.<sup>25,26</sup>

The increased penetrations observed in the group II are attributed to the greater hardware used during its placement. Other arch bar specific complications such as mucosal over growth, root fracture of HAB and tooth mobility of EAB were also evaluated.

Our analysis revealed that anterior screws achieved mucosal coverage more rapidly and consistently than posterior screws (fig.5).



Fig 5. Mucosal over growth on Hybrid arch bar eyelets

We found that mucosal overgrowth may prolong the duration needed for arch bar removal, it does not lead to any undesirable clinical effects.<sup>27</sup> Proper utilization of the screw spacer instrument can mitigate the risk of mucosal migration over the screw. This instrument is positioned between the mucosa and the metal rim of the hole, lifting the metal rim away from the mucosa to prevent gingival compression and mucosal overgrowth.<sup>27</sup> Root fractures were assessed postoperatively using Orthopantomogram (OPG) in our study. While some patients showed root contact on OPG, (Fig 6) none exhibited symptoms of root injury or required endodontic treatment or extraction.



Fig 6. OPG showing fixation with Hybrid arch bars

No cases of tooth mobility were observed in this study in group II. This contrasts with findings from studies by Hamid et al.,<sup>27</sup> and Hesham et al.<sup>28</sup> where tooth mobility was reported as a complication associated with Erich arch bars. The potential for tooth mobility in those studies may be attributed to extrusive forces applied during wire twisting around the tooth. Additionally, pre-existing tooth mobility could exacerbate this issue.<sup>29,31</sup> It's worth noting that in our study, we excluded patients with mobile teeth due to trauma, which may have contributed to the absence of recorded tooth mobility cases.

The advantages of the study encompass randomization, a singular institutional experience, and the assessment of multiple parameters. The constraints of the study comprise a limited sample size and potential bias stemming from the involvement of various operating surgeons. The implementation of stainless steel hybrid arch bars necessitates a distinctly different technique that requires considerable time for proficiency.<sup>30,32</sup> It is plausible that as experience accumulates, the duration for the placement of the hybrid system may be further diminished, consequently reducing the associated complications. A pre-operative radiographic assessment is essential to ascertain the optimal placement of screws and to appropriately adjust the hybrid arch bar. Specialized instruments explicitly designed for hybrid arch bars, including a screw holder, screwdriver, and spacer, must be utilized to facilitate the application process of stainless-steel hybrid arch bars.<sup>33</sup> This investigation illustrated that the hybrid arch bar system may serve as a viable alternative to traditional Erich arch bars for maxillomandibular fixation, exhibiting no significant complications. The current study aligns with the findings and outcomes of prior research that employed titanium hybrid arch bars. It indicated reduced operative time, lower rates of glove penetration, and superior gingival health with fewer complications when utilized for intermaxillary fixation. Additional investigations are warranted regarding various designs of stainless steel hybrid arch bars, which may lessen the operator's exertion to manipulate the stainless steel arch bar, thereby minimizing the risk of root injury and potentially decreasing the application time for the placement of the arch bar and the incidence of complications.

### Conclusion

The hybrid arch bar system can be used as an alternative to traditional Erich arch bars for maxillomandibular fixation in patients with maxillomandibular fractures with no major

complications. It provides quicker placement of the arch bars improving the safety of the operator and preserving the gingival health of the patient.

## DECLARATIONS

### Ethics Approval and Consent to Participate

Not applicable.

### Funding

This research received no external funding.

### Conflict of Interest

The authors declare no conflict of interest

### Informed consent

Informed consent was obtained from all individual participants included in the study

## REFERENCES

1. Luciana L, Oggy BAR, Wiargitha IK, Irawan H. Management of Maxillofacial Fracture: Experience of Emergency and Trauma Acute Care Surgery Department of Sanglah General Hospital Denpasar Bali. *Open Access Maced J Med Sci.* 2019 Oct 8;7(19):3245–8.
2. Kendrick DE, Park CM, Fa JM, Barber JS, Indresano AT. Stryker SMARTLock Hybrid Maxillomandibular Fixation System. *Plast Reconstr Surg.* 2016 Jan;137(1):142e–50e.
3. Falci SG, Douglas-de-Oliveira DW, Stella PEM, Rocha-dos Santos CR. Is the Erich arch bar the best intermaxillary fixation method in maxillofacial fractures? A systematic review. *Med Oral Patol Oral Cir Bucal.* 2015;e494–9.
4. Shatat H, Kamel H, Elbokle N. Evaluation of bone supported Smart Lock Hybrid arch bar versus Erich arch bar for the treatment of mandibular fractures: A randomized clinical trial. *Egypt Dent J.* 2021 Jul 1;67(3):2091–100.
5. Hamid ST, Bede SY. The Use of Screw Retained Hybrid Arch Bar for Maxillomandibular Fixation in the Treatment of Mandibular Fractures. *Ann Maxillofac Surg.* 2021 Jul;11(2):247–52.
6. Jain A, Taneja S, Rai A. What is a better modality of maxillomandibular fixation: bone-supported arch bars or Erich arch bars? A systematic review and meta-analysis. *British Journal of Oral and Maxillofacial Surgery.* 2021 Oct;59(8):858–66.
7. Shatat H, Kamel H, Elbokle N. Evaluation of bone supported Smart Lock Hybrid arch bar versus Erich arch bar for the treatment of mandibular fractures: A randomized clinical trial. *Egypt Dent J.* 2021 Jul 1;67(3):2091–100.
8. King BJ, Christensen BJ. Hybrid Arch Bars Reduce Placement Time and Glove Perforations Compared With Erich Arch Bars During the Application of Intermaxillary Fixation: A Randomized Controlled Trial. *Journal of Oral and Maxillofacial Surgery.* 2019 Jun;77(6):1228.e1–1228.e8.
9. Schneider AM, David LR, DeFranzo AJ, Marks MW, Molnar JA, Argenta LC. Use of Specialized Bone Screws for Intermaxillary Fixation. *Ann Plast Surg.* 2000 Feb;44(2):154–7.
10. Cornelius CP, Ehrenfeld M. The Use of MMF Screws: Surgical Technique, Indications, Contraindications, and Common Problems in Review of the Literature. *Craniofac Trauma Reconstr.* 2010 Jun 1;3(2):55–80.
11. King BJ, Christensen BJ. Hybrid Arch Bars Reduce Placement Time and Glove Perforations Compared With Erich Arch Bars During the Application of Intermaxillary Fixation: A Randomized Controlled Trial. *Journal of Oral and Maxillofacial Surgery.* 2019 Jun;77(6):1228.e1–1228.e8.
12. Kim YG, Yoon SH, Oh JW, Kim DH, Lee KC. Comparison of intermaxillary fixation techniques for mandibular fractures with focus on patient experience. *Arch Craniofac Surg.* 2022 Feb 20;23(1):23–8.
13. Sahoo NK, Mohan R. IMF Screw: An Ideal Intermaxillary Fixation Device During Open Reduction of Mandibular Fracture. *J Maxillofac Oral Surg.* 2010 Jun 22;9(2):170–2.
14. Thapliyal G, Sinha R, Menon P, Chakranarayan A. Management of Mandibular Fractures. *Med J Armed Forces India.* 2008 Jul;64(3):218–20.
15. Shatat H, Kamel H, Elbokle N. Evaluation of bone supported Smart Lock Hybrid arch bar versus Erich arch bar for the treatment of mandibular fractures: A randomized clinical trial. *Egypt Dent J.* 2021 Jul 1;67(3):2091–100.
16. Singh V, Bhagol A, Kumar I. A new and easy technique for maxillomandibular fixation. *Natl J Maxillofac Surg.* 2010;1(1):24.
17. Verma A, Yadav S, Dhupar V. A New Simplified Technique for Intermaxillary Fixation by Loop-Designed Wire. *J Maxillofac Oral Surg.* 2015 Jun 11;14(2):499–500.
18. Chao AH, Hulslen J. Bone-Supported Arch Bars Are Associated With Comparable Outcomes to Erich Arch Bars in the Treatment of Mandibular Fractures With Intermaxillary Fixation. *Journal of Oral and Maxillofacial Surgery.* 2015 Feb;73(2):306–13.
19. King BJ, Christensen BJ. Hybrid Arch Bars Reduce Placement Time and Glove Perforations Compared With Erich Arch Bars During the Application of Intermaxillary Fixation: A Randomized Controlled Trial. *Journal of Oral and Maxillofacial Surgery.* 2019 Jun;77(6):1228.e1–

**Sree Harika Thatavarthi, Nagendra Srinivas Chunduri, Sri Surya Tejaswini et al. Comparative evaluation of hybrid arch bar and erich arch bar in the management of maxillomandibular fractures. *Bulletin of Stomatology and Maxillofacial Surgery.* 2025;21(2).56-64;doi:10.58240/1829006X-2025.2-56**

1228.e8.

20. Shatat H, Kamel H, Elbokle N. Evaluation of bone supported Smart Lock Hybrid arch bar versus Erich arch bar for the treatment of mandibular fractures: A randomized clinical trial. *Egypt Dent J.* 2021 Jul 1;67(3):2091–100.

21. Bouloux GF. Does the Use of Hybrid Arch Bars for the Treatment of Mandibular Fractures Reduce the Length of Surgery? *Journal of Oral and Maxillofacial Surgery.* 2018 Dec;76(12):2592–7.

22. Qureshi A, Reddy U, Warad N, Badal S, Jamadar A, Qurishi N. Intermaxillary fixation screws versus Erich arch bars in mandibular fractures: A comparative study and review of literature. *Ann Maxillofac Surg.* 2016;6(1):25.

23. Hashemi HM, Parhiz A. Complications Using Intermaxillary Fixation Screws. *Journal of Oral and Maxillofacial Surgery.* 2011 May;69(5):1411–4.

24. Ingole PD, Garg A, Sheno SR, Badjate SJ, Budhraj N. Comparison of Intermaxillary Fixation Screw Versus Eyelet Interdental Wiring for Intermaxillary Fixation in Minimally Displaced Mandibular Fracture: A Randomized Clinical Study. *Journal of Oral and Maxillofacial Surgery.* 2014 May;72(5):958.e1-958.e7.

25. Pathak P, Thomas S, Bhargava D, Beena S. A prospective comparative clinical study on modified screw retained arch bar (SRAB) and conventional Erich's arch bar (CEAB). *Oral Maxillofac Surg.* 2019 Sep 24;23(3):285–9.

26. Sankar H, Rai S, Jolly SS, Rattan V. Comparison of Efficacy and Safety of Hybrid Arch Bar with Erich Arch Bar in the Management of Mandibular Fractures: A Randomized Clinical Trial. *Craniomaxillofac Trauma Reconstr.* 2023 Jun 29;16(2):94–101.

27. Hamid ST, Bede SY. The Use of Screw Retained Hybrid Arch Bar for Maxillomandibular Fixation in the Treatment of Mandibular Fractures. *Ann Maxillofac Surg.* 2021 Jul;11(2):247–52.

28. Shatat H, Kamel H, Elbokle N. Evaluation of bone supported Smart Lock Hybrid arch bar versus Erich arch bar for the treatment of mandibular fractures: A randomized clinical trial. *Egypt Dent J.* 2021 Jul 1;67(3):2091–100.

29. Minervini G, Marrapodi MM, Cicciù M. Online Bruxism-related information: Can people understand what they read? A Cross-Sectional Study. *J Oral Rehabil.* 2023;50(11):1211-1216.

30. Almeida LE, Cicciù M, Doetzer A, Beck ML, Cervino G, Minervini G. Mandibular condylar hyperplasia and its correlation with vascular endothelial growth factor. *J Oral Rehabil.* 2023;50(9):845-851.

31. Langaliya A, Alam MK, Hegde U, Panakaje MS, Cervino G, Minervini G. Occurrence of Temporomandibular Disorders among patients undergoing treatment for Obstructive Sleep Apnoea Syndrome (OSAS) using Mandibular Advancement Device (MAD): A Systematic Review conducted according to PRISMA guidelines and the Cochrane handbook for systematic reviews of interventions. *J Oral Rehabil.* 2023;50(12):1554-1563.

32. Alshadidi AAF, Alshahrani AA, Aldosari LIN, Chaturvedi S, Saini RS, Hassan SAB, Cicciù M, Minervini G. Investigation on the Application of Artificial Intelligence in Prosthodontics. *Applied Sciences.* 2023; 13(8):5004.

33. Uzunçubuk H, Marrapodi MM, Meto A, Ronsivalle V, Cicciù M, Minervini G. Prevalence of temporomandibular disorders in clear aligner patients using orthodontic intermaxillary elastics assessed with diagnostic criteria for temporomandibular disorders (DC/TMD) axis II evaluation: A cross-sectional study. *J Oral Rehabil.* 2024;51(3):500-509