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Comparative Evaluation of Bone-Supported Arch Bar vs Tooth-Supported Arch Bar in Mandibular Fracture Treatment

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ABSTRACT

Background: Maxillofacial trauma, increasingly common due to road travel and socio-economic activities, frequently involves mandibular fractures. Effective treatment requires precise reduction and fixation to restore occlusion.

Aim: To compare the efficacy of bone-supported (Hybrid) vs tooth-supported (Conventional) arch bars in mandibular fracture management.

Materials and Methods: This study, conducted at Sri Aurobindo College of Dentistry, included 28 patients with isolated mandibular fractures, divided equally into two groups. Group A (Hybrid arch bar): 13 males, 1 female. Group B (Conventional arch bar): 12 males, 2 females. Parameters assessed included placement/removal time, oral hygiene, complications, and stability.

Results: Group A showed significantly faster placement and removal times. Average difference in removal time was 9 minutes and for placement is 30 minutes. Oral Hygiene Index (OHI) scores were better in Group A on the 28th postoperative day. Root perforation and mucosal coverage over screws were observed in Group A; glove perforations were more frequent in Group B.

Conclusion: Hybrid arch bars offer a viable alternative to conventional ones, with improved fixation time and hygiene outcomes, though with specific complications to consider.

Keywords: *Mandibular fracture ,Maxillomandibular fixation,Hybrid arch bar , Conventional arch bar*

1. INTRODUCTION

Trauma is a major cause of mortality in individuals under 40 [1]. In India, motor vehicle accidents account for up to 74% of trauma cases. The mandible, the only movable craniofacial bone, is particularly vulnerable and accounts for 36–65% of facial fractures [2,3] .Mandibular fractures often occur due to tension on the superior border and compression on the inferior border during trauma [4,5].

Management requires accurate reduction and fixation—open or closed—with restoration of occlusion. Recent studies compare traditional Erich arch bars with modified screw-retained (Hybrid) versions, focusing on placement time, safety, and oral hygiene[5,6].This study aims to assess the efficacy of both types in isolated dentate mandibular fractures.

Materials and Methods

A cross-sectional study was performed at Sri Aurobindo College of Dentistry and Institute of Medical Sciences from March 2023 to December 2024. Patients were randomly assigned to:

Group A (Hybrid Arch Bar): Bone-supported, using screws.

Group B (Conventional Arch Bar): Tooth-supported, using wires.

- **Inclusion Criteria**:
- Age 16–60
- Non-comminuted, dentate segment fractures
- Consent to participate
- **Exclusion Criteria**:
- Comminuted or edentulous segment fractures
- Infections or systemic illness
- Concomitant facial fractures

Sample Size: 14 patients per group (n=28), calculated using SPSS 24.

Procedure:
Under general anesthesia, arch bars were fixed:

Group A: Hybrid arch bar secured with 1.5 mm screws in both jaws; a minimum of five screws used.

Group B: Arch bar secured using 24/26 gauge wires.

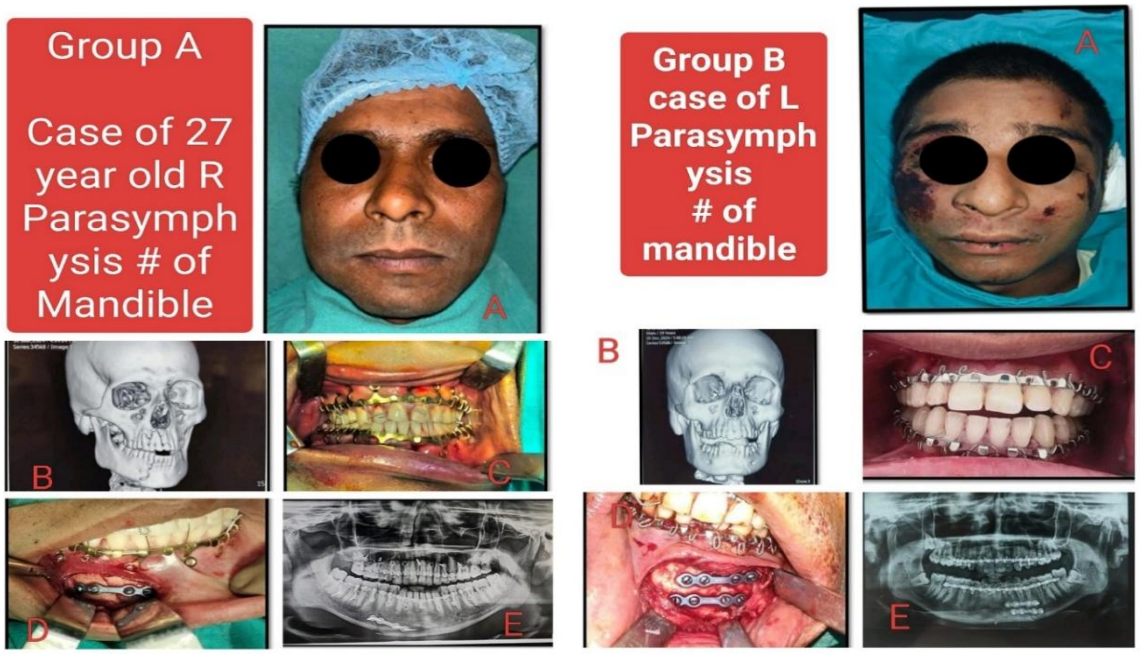

Fig.1- Group A and Group B patient
In Fig A- Preop , B-Preop X Ray ,C- After Arch Bar Placement, D-Intraoperative ,E-Post Op X Ray

In both groups, fracture sites were reduced and fixed with titanium miniplates. Postoperatively, patients received antibiotics, analgesics, antiseptics, and chlorhexidine mouthwash.

2. RESULTS

The mean age of the participants was 28.43 years for the hybrid arch bar group (Group A), while the conventional arch bar group (Group B) had an average age of 32.57 years.

In group A, the proportion of males was notably greater than that of females, with figures of 92.9% for males and 7.1% for females. Likewise, in group B, males were also predominant, making up 85.7% of the total sample size, while females accounted for 14.3%.

The Oral Hygiene of patients was assessed by using Oral Hygiene Index at various intervals across different groups, specifically preoperatively, on the 7th post-operative day and on the 28th post-operative day. Pre-operative Oral Hygiene Index (OHI) scores were similar in both groups. On the 7th post-operative day, there was a notable decrease in the Oral Hygiene Index scores compared to the pre-operative values.

On the 28th post-operative day, the Oral Hygiene Index scores increased in both groups. However, the increase was less pronounced in Group A, which had a score of 1.05 compared to Group B, which recorded a score of 1.23. Statistical analysis shows significant difference in the Oral Hygiene Index Scores for both group A and group B across various time intervals. In group A, the difference in scores was significant, with a p- value of 0.021, while group B exhibited a highly significant difference, indicated by a p- value of 0.001. These findings suggest that patients in group A maintain better oral hygiene compared to those in group B.

In Group A had an average placement time of 27 minutes whereas Group B recorded an average of 60 Statistical analysis showed a significant difference between the two groups ($p<0.001$), indicating that Group A required considerably less time for placement. The mean difference in placement time between the two groups was approximately 33 minutes.

For Group A recorded an average removal time of 20 minutes while Group B had an average of 28 minutes. Statistical analysis revealed a significant difference between the two groups ($p<0.01$), indicating that the hybrid arch bar was linked to a notably shorter removal time. The mean difference in removal time between the two groups was approximately 9 minutes for both maxilla and mandible.

Root perforation was observed following the placement of arch bars in the group A (hybrid arch bar group). During the intra-operative phase, the majority of screws perforated the roots while securing the hybrid arch bar, with a total of 140 screws utilized across 14 patients. Mucosal coverage is one of the most common complications found in the hybrid arch bar group (Group A). Half of the patient's (N- 7, 50 %) had mucosal coverage over the screws.

Iatrogenic injuries, such as gloves perforations and tears are predominantly observed in Group B. In Group B, iatrogenic injuries in nearly half of the patient's (57.1%), occurred during the process of securing the arch bar, whereas no injuries of this kind were reported in Group A during the same (P value>0.05)

Fig-2- Mucosal coverage over screw

3. DISCUSSION

An analytical cross-sectional study was conducted to compare the effectiveness of Conventional Arch Bars (CAB) and Hybrid Arch Bars (HAB) in treating isolated mandibular fractures involving the dentate segment. The primary objective was to ensure proper fracture reduction, stabilization, and occlusion restoration, while minimizing bloodborne infection risk, surgical duration, trauma, and anesthesia time.

Parameters	Group	N	Mean	Std. Deviation	Test	P value
Age (in yrs)	Group A	14	28.43	12.01	Independent T test	0.542
	Group B	14	32.57	9.26		
Oral Hygiene Index Score-Pre-op	Group A	14	1.38	0.31		0.845
	Group B	14	1.36	0.28		
Time Taken for securing arch bar in Maxilla (In Mins)	Group A	14	14.32	4.18		0.001
	Group B	14	29.64	6.62		
Time Taken for securing arch bar in Mandible (In Mins)	Group A	14	13.24	5.87		0.001
	Group B	14	32.21	8.07		
Oral Hygiene Index Score- On POD 7	Group A	14	1.03	0.36		0.593
	Group B	14	0.97	0.18		
Oral Hygiene Index Score-On POD 28	Group A	14	1.05	0.22		0.042
	Group B	14	1.23	0.23		
Time For Removal of Arch bar in Maxilla (In Mins)	Group A	14	11.06	4.96		0.001
	Group B	14	20.50	4.10		
Time For Removal of Arch bar in Mandible (In Mins)	Group A	14	9.58	3.55		0.001
	Group B	14	18.92	4.68		

The study included 28 patients aged 18–60, divided into Group A (HAB) and Group B (CAB)Consistent with Brett J. King (2019)[6] and V. Venugopalan (2020)[8], trauma was more common among young males. Group A had an average age of 28 years (92.1% male), and Group B, 32 years (85.2% male). Dr. Girish B. Giraddi (2023)[7] also reported a mean age of 29 years. Male dominance in trauma cases is attributed to high-risk behaviors, as noted by Singaram M et al. (2016)[1] and Vikas Sinha et al. (2021)[15].

Maintaining oral hygiene is difficult post-injury, especially with CAB. As observed by Shahid Hassan (2018)[9], Pankaj Pathak (2019)[10], and V. Venugopalan (2020)[8], HAB patients maintained better hygiene. Our study showed a significantly better oral hygiene index in Group A ($p < 0.001$), with reduced plaque due to easier brushing around screw-retained HAB, consistent

with Hariram Sankar et al. (2023)[12].

Regarding procedure duration, our findings matched Pankaj Pathak (2019)[10], showing shorter application times for HAB (27.56 minutes) than CAB (61.8 minutes), and faster removal (20 vs. 38 minutes). Brett J. King (2019)[6] and Hariram Sankar et al. (2023)[12] also reported reduced time due to screw fixation rather than circumdental wiring.

Iatrogenic injuries were significantly higher in the CAB group (57.1%), consistent with V. Venugopalan (2020)[8], Pankaj Pathak (2019)[10], and Hariram Sankar et al. (2023)[12], who observed more glove perforations in CAB users, increasing the risk of bloodborne disease transmission.While HAB has advantages, it may cause root perforation (28.8% in our study), as noted by Pankaj Pathak (2019)[10], though lower in Hariram Sankar et al. (2023)[12]. Soft tissue overgrowth over screw heads occurred in 15% of Group A, similar to Hariram Sankar et al. (2023)[12], while Tushar Manohar Rothe et al. (2018)[13] observed less in CAB.

In conclusion, the Hybrid Arch Bar offers better hygiene, quicker application, fewer operator injuries, and effective stabilization. Its design merges the benefits of conventional and bone-supported devices, making it a practical and efficient alternative for mandibular fracture treatment.

4. CONCLUSION

Hybrid arch bars offer a practical, efficient, and safer alternative to conventional tooth-supported arch bars for intermaxillary fixation in mandibular fractures. They reduce procedure time and improve oral hygiene, though they carry risks such as root perforation and mucosal overgrowth.Long-term follow-up is needed to assess root damage outcomes. Larger studies with extended observation periods are recommended to strengthen clinical decision-making.

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