Comparative clinical study evaluating the modified screw-retained arch bar (SRAB) versus the conventional Erich's arch bar (CEAB).

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ABSTRACT

Introduction: Intermaxillary fixation (IMF) is a widely used technique in the treatment of facial skeletal fractures. Traditional approaches, such as Erich's arch bar and Ivy eyelet wiring, are commonly utilized; however, they present certain limitations. A recent modification of the conventional Erich's arch bar (CEAB) involves creating perforations between the winglets and securing it with 1 mm screws. This modified screw-retained arch bar (SRAB) has been introduced as an intraoral method for managing mandibular fractures. The present study aimed to evaluate and compare the effectiveness, benefits, drawbacks, clinical indications, and possible complications of CEAB and modified SRAB in treating mandibular fractures.

Materials and Methods:

This prospective randomized study included 20 patients diagnosed with mandibular fractures. Participants were randomly divided into two groups: Group A was treated using the modified SRAB, while Group B received CEAB. The variables assessed included duration of arch bar placement, incidence of glove perforation, patient comfort and acceptance, oral hygiene status, iatrogenic dental trauma, and

occurrence of needle or wire stick injuries during IMF.

Results: The average time required for arch bar placement was significantly lower in the SRAB group (27.20 minutes) compared to the CEAB group (82.50 minutes). Glove perforations were more frequently observed in patients treated with CEAB. Additionally, 90% of patients in Group A demonstrated good oral hygiene, whereas all patients in Group B exhibited only fair oral hygiene.

Conclusion: Both techniques were effective in achieving stable IMF and satisfactory postoperative occlusion. However, the modified SRAB technique offers advantages such as reduced operative time and a lower risk of needle or wire stick injuries. Despite its ease of use, SRAB is not without limitations.

Keywords: Intermaxillary fixation (IMF), modified Erich's arch bar, malocclusion, jaw fixation techniques

Introduction

Maxillomandibular fixation (MMF) is a fundamental component in the treatment of patients with maxillofacial trauma. It plays a crucial role in reconstruction by providing a stable framework that facilitates the restoration of both facial structure and function. MMF helps re-establish proper occlusion, thereby supporting the reduction and stabilization of both simple and complex facial fractures.

Over time, numerous techniques have been introduced for achieving MMF. With the development of bone plating systems, the need for prolonged intermaxillary fixation (IMF) has significantly decreased. Commonly used methods for IMF include conventional Erich's arch bar (CEAB), IMF screws, Ivy eyelet wiring, bonded orthodontic brackets, cast metal or acrylic splints, S-shaped hooks, and various wiring approaches.[1] In modern practice, especially with the increasing use of open reduction and internal fixation, IMF is often employed primarily during surgery to assist in fracture reduction.[2]

Despite their widespread use, traditional techniques such as arch bars involve passing wires around the teeth, which can lead to complications including mucosal ischemia, tooth extrusion, and potential loss of tooth vitality.[3] These wires also interfere with maintaining proper gingival hygiene. Such limitations have prompted the development of alternative fixation methods, including

modified arch bars secured with screws, as introduced by S. B. F. de Queiroz in 2013.[8]

Existing literature indicates that the modified screw-retained arch bar (SRAB) may offer certain benefits compared to the conventional arch bar. However, there is a lack of sufficient comparative studies evaluating CEAB and modified SRAB in terms of their respective advantages and disadvantages.

Materials and Methods

This randomized prospective clinical study was conducted after obtaining approval from the institutional ethics committee. A total of 20 patients requiring intermaxillary fixation (IMF) following maxillofacial trauma were included and randomly assigned to two groups. Group A consisted of patients treated with the modified screw-retained arch bar (SRAB), while Group B included those managed with the conventional Erich's arch bar (CEAB). All procedures were performed by a single experienced operator to maintain consistency.

The study population comprised individuals aged between 18 and 60 years presenting with non-pathological mandibular fractures, including both favorable and unfavorable types, as well as maxillary fractures associated with disturbed occlusion requiring intraoperative IMF for definitive reduction. Patients with pathological fractures, edentulous ridge fractures, or comminuted maxillofacial fractures were excluded from the study.

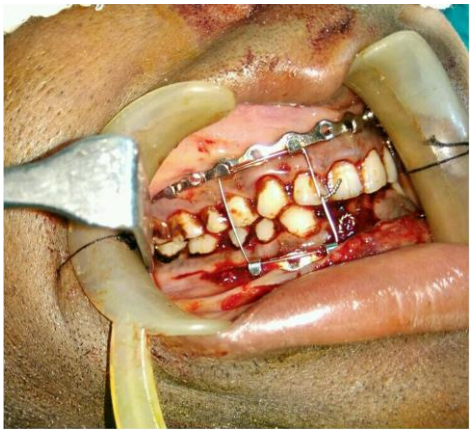

Fig .1 Intraoral clinical image showing a modified screw-retained arch bar (SRAB) in place, fixed using 1.5 × 8 mm screws inserted after creating pilot holes with a 1-mm drill bit in the interradicular region.

Fig. 2 Lateral mandibular radiograph showing the modified screw-retained arch bar (SRAB) in place during the postoperative period.

In Group A, the modified SRAB was fixed using 1.5 × 8 mm screws. These screws were inserted after preparing appropriately sized holes with a 1-mm drill bit in the interradicular spaces, placing two screws in the anterior region and two in the posterior region. IMF was then established using the Tru-Force latex elastic system (size 3/16″). The SRAB and IMF screws were removed after six weeks in the outpatient setting under local anesthesia.

In Group B, CEAB was applied using 26-gauge stainless steel wires following the conventional technique. The arch bar was similarly removed after six weeks postoperatively.

Results

The study included a total of 20 patients, with 10 individuals assigned to each group. The demographic characteristics of participants in both groups were similar. The duration required to complete the procedure was notably longer in Group B compared to Group A. The mean operating time for Group A was 27.20 ± 3.53 minutes, whereas for Group B it was 82.50 ± 18.85 minutes, showing a statistically significant difference ($p = 0.0001$).

Glove perforation was not observed in Group A (0%), while it occurred in 30% (n = 3) of cases in Group B; however, this difference was not statistically significant ($p = 0.2105$).

Regarding patient acceptance, 80% (n = 8) of individuals in Group A reported good acceptance and 20% (n = 2) reported fair acceptance. In contrast, Group B showed good acceptance in 20% (n = 2), fair acceptance in 70% (n = 7), and poor acceptance in 10% (n = 1) of patients, with the difference being statistically significant ($p = 0.025$).

At the sixth postoperative week, oral hygiene was rated as good in 40% (n = 4) and fair in 60% (n = 6) of patients in Group A. In Group B, 20% (n = 2) demonstrated good oral hygiene, while 80% (n = 8) were categorized as fair.

Stability of fixation was assessed at the first and sixth postoperative weeks. Adequate stability was observed in 90% (n = 9) of patients in Group A and in 80% (n = 8) of patients in Group B.

Root damage was noted in 10% (n = 1) of patients in Group A, whereas no cases were reported in Group B. This difference was not statistically significant (p = 0.305).

Bleeding during both placement and removal of the arch bar was also evaluated. Greater bleeding was observed during removal of the modified SRAB, particularly in four patients where screw heads were covered by overgrown mucosa. In contrast, patients in Group B exhibited minimal bleeding during both application and removal of the CEAB.

Discussion

Effective management of mandibular fractures primarily focuses on accurate reduction, adequate stabilization, and proper immobilization, along with restoration of normal occlusion. To achieve these objectives, it is important to adopt techniques that lower the risk of transmission of blood-borne infections, minimize injury to the periodontal tissues, and reduce both operative time and duration of anesthesia.

Previous studies have highlighted concerns regarding infection risks during maxillofacial procedures. Busch et al.[5] emphasized that wiring techniques used in fracture management may increase the likelihood of exposure to blood and saliva, thereby elevating the risk of cross-contamination. In their study, the use of self-tapping screws (STS) for intermaxillary fixation demonstrated reduced chances of accidental skin injury and transmission of infections. Additionally, STS provided better stability, required less intraoperative time, and showed improved patient compliance during removal compared to conventional Erich's arch bar (CEAB).

Similarly, Nandini et al.[6] conducted a clinical comparison between STS and CEAB in mandibular fracture management. Their findings indicated that placement of CEAB required significantly more time. They also reported a higher incidence of glove perforations in the CEAB group, whereas the STS group showed minimal occurrences. However, non-vital teeth and delayed responses were more frequently observed in the STS group. Patient acceptance was considerably higher with STS, while CEAB

showed lower satisfaction levels. In terms of stability, STS performed slightly better than CEAB. Furthermore, oral hygiene was found to be significantly improved in patients treated with STS.

The findings of the present study are largely consistent with these observations. However, an additional complication noted in the modified screw-retained arch bar (SRAB) group was mucosal overgrowth covering the screw heads in 20% of cases, which necessitated a minor incision under local anesthesia for removal.

Chandan et al.[9] introduced a modification of the conventional Erich's arch bar (CEAB) by attaching an orthodontic mesh to its posterior surface, which was then bonded to both the maxillary and mandibular arches. They compared this resin-bonded arch bar (RBAB) with CEAB and reported that RBAB performed better in maintaining oral hygiene, providing stability, reducing operative time, minimizing periodontal damage, and lowering the risk of percutaneous injury to the operator. In contrast, CEAB was associated with longer placement and removal times as well as greater mucosal trauma. Their findings suggested that RBAB is a cost-effective and safe alternative for achieving intermaxillary fixation (IMF) in mandibular fracture cases.

In another study, Ayoub et al.[4] evaluated the benefits of Dimac wire over CEAB in patients with minimally displaced mandibular fractures and complete dentition. The results showed that the average application time for Dimac wire was shorter (approximately 20 minutes) compared to CEAB (around 35 minutes). Additionally, the incidence of skin-penetrating injuries during IMF was lower with Dimac wire (8%) than with CEAB (27.2%). Periodontal tissue damage was assessed subjectively during removal, and the authors concluded that Dimac wire is less traumatic both during placement and removal.

Avery et al. [7]conducted a prospective study comparing small plate osteosynthesis (SPO) with interdental wiring, focusing on surgical glove perforations during mandibular fracture management. The study demonstrated a significant reduction in penetrating injuries to both the operating and assisting surgeons when SPO was used. It was concluded that SPO is preferable to interdental wiring in minimizing the risk of intraoperative cross-infection caused by such injuries.

Similarly, Rothe et al. [11] carried out a randomized clinical trial comparing CEAB, IMF screws, and modified arch bars (MAB) in patients with mandibular fractures. The findings indicated that CEAB required the longest placement time (approximately 110 minutes), followed by MAB (29 minutes) and IMF screws (16 minutes). Oral hygiene outcomes were best in the IMF screw group, followed by MAB and CEAB. In terms of stability, CEAB ranked highest, followed by MAB and IMF screws. Mucosal overgrowth was most frequently observed in the IMF screw group. When complications were analyzed, CEAB showed the highest incidence, followed by IMF screws, while MAB had the least. The authors concluded that MAB represents a reliable option for patients requiring prolonged IMF, offering reduced trauma to surrounding hard and soft tissues compared to CEAB and IMF screws.

Qureshi et al.[10] compared intermaxillary fixation (IMF) screws with the conventional Erich's arch bar (CEAB) and reported that both operative time and the incidence of glove perforation were significantly lower in the IMF screw group. They also found that patients treated with IMF screws demonstrated better acceptance and improved oral hygiene. However, no notable differences were observed between the two groups in terms of postoperative occlusion or stability of fixation. A higher incidence of root perforation, though, was associated with the use of IMF screws.

In the present study, patient discomfort was assessed using the visual analog scale (VAS). In Group A, discomfort was reported by 30% (n = 3) of patients during placement and 20% (n = 2) during removal of the appliance. In contrast, all patients in Group B (100%, n = 10) experienced discomfort during both placement and removal procedures.

The modified screw-retained arch bar (SRAB) offers several advantages over conventional techniques, despite the inherent risk of potential injury to the tooth roots. This risk can be minimized with thorough anatomical knowledge and careful surgical technique, particularly by recognizing tactile feedback while drilling—such as the sensation of the bur entering medullary bone versus encountering resistance near cortical bone or tooth roots.

The modified SRAB is particularly suitable for achieving IMF in cases of isolated mandibular fractures. However, its application may be limited in more complex

conditions, such as multiple facial fractures, comminuted mandibular fractures, and dentoalveolar injuries.

Conclusion

The findings of this study indicate that the modified Erich's arch bar offers effective and reliable intraoperative fixation. No cases of postoperative infection, injury to adjacent tissues, or nerve damage were observed. Additionally, patients demonstrated improved oral hygiene following surgery, supported by proper hygiene instructions, along with better compliance and ease of application. Therefore, the modified Erich's arch bar can be considered a suitable alternative to the conventional Erich's arch bar for temporary intermaxillary fixation.

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