



## COMPARISON OF CONVENTIONAL ARCH BARS WITH FIXATION SCREWS FOR INTERMAXILLARY FIXATION IN MANDIBULAR FRACTURES: A RANDOMIZED PROSPECTIVE CLINICAL STUDY.

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Conflicts of Interest: Nil

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DOI: <https://doi.org/10.32553/ijpba.v9i3.215>

### ABSTRACT

**Introduction:** Occlusion is the way in which one's maxillary and mandibular teeth relate to each other when the jaw is closed. When treating fractures of the mandible, the first and primary objective is to re-establish the patient's premorbid occlusion which is required for the mastication and also the other objective is to achieve esthetics. Inter-maxillary fixation (IMF) plays a vital role in management of fractures involving maxilla and mandible & helps in stabilizing the patient's occlusion and thus reduction in fracture segments. Many modalities for obtaining intermaxillary fixation like Arch bars, eyelets, interdental wiring, orthodontic braces and intermaxillary fixation screws have been considered. Every method used for intermaxillary fixation has its own merits and demerits.

**Materials and Method:** A prospective randomized clinical study was conducted between 2015 to 2017 in Patients who reported with mandibular fractures to the department of Oral & Maxillofacial Surgery at Vydehi Institute of Dental Sciences and Research Centre. A total of 50 patients with mandibular fractures requiring internal fixation were divided into two groups. Group A consisted of patients in whom Erich's arch bars were placed for IMF and Group B consisted of patients in whom IMFS were placed for IMF. Patients included were those who required IMF, Subjects in good health i.e; ASA I,II and III. Patients excluded were completely edentulous, ASA IV subjects, Comminuted fractures, Pediatric patients, Panfacial fractures.

**Results:** Use of arch bars as seen in our results has a few disadvantages over IMF screws like time consumed in application and removal is more, Increased pain scores, Increased number of needle stick injuries and difficulty in maintaining oral hygiene, however it has its own advantages like it can be used in the treatment of dentoalveolar fractures, multiple teeth bearing fractured fragments can be reduced into an arch form.

Use of IMF screws provide better oral hygiene status as well as same occlusal results as of arch bars. Decreased number of needle stick injuries and takes lesser time to apply and remove. IMF screws are useful in mandibular fractures which are not grossly displaced or comminuted.

**Conclusion:** Use of both the techniques in achieving IMF is efficacious with both the techniques having merits and demerits over each other. Although both the techniques offer good temporary intermaxillary fixation, the benefits and risks of both the techniques should be weighed depending on the type of fracture we are dealing with.

**Keywords:** IMF

## Introduction

Mandibular fractures were first described in 1650 BC, when Papyrus, an Egyptian described the examination, diagnosis, and treatment of mandible fractures. Hippocrates was the first to describe re-approximation and immobilization through the use of circum-dental wires and external bandage. The importance of establishing proper occlusion was first described in a textbook written by Salerno, Italy, in 1180. Maxillo-mandibular fixation was first mentioned in 1492, in a book Cirurgia in Lyons. Chopart and Desault used dental prosthetic devices to immobilize fracture segments.<sup>1,2</sup> In 19th century Gilmer reformed the treatment of fractures by fixated full arch bars on the mandible and the maxilla.<sup>1</sup>

Occlusion is the way in which one's maxillary and mandibular teeth relate to each other when the jaw is closed. When treating fractures of the mandible, the first and primary objective is to re-establish the patient's premorbid occlusion.

Inter-maxillary fixation (IMF) plays a vital role in management of fractures involving maxilla and mandible & helps in stabilizing the patient's occlusion and thus reduction in fracture segments. Many modalities for obtaining IMF like Arch bars, eyelets, interdental wiring, orthodontic braces and IMF screws have been considered. Every method used for IMF has its own merits and demerits. The traditional wiring techniques reported in published studies for achieving intermaxillary fixation (IMF) have been eyelet interdental wiring by Robert H. Ivy in 1922, Erich's arch bar, Gilmer's wiring and Stout wiring.<sup>3,4</sup> These are time-tested and inexpensive, but they have various inherent drawbacks. Most of these techniques will require wires to be tightened around the teeth, which can cause ischemic necrosis of the marginal gingiva and trauma to the adjoining mucosa. These techniques have been time-consuming and carry a risk of needle stick injury and patient acceptability has been low owing to the discomfort and difficulty in the maintenance of oral hygiene, leading to deterioration in periodontal health. The constant traction applied on the engaged teeth can also

cause the teeth to extrude. Additionally, these techniques cannot be used in patients with partially edentulous dentition or patients with extensive periodontal disease. They are also not suitable for dentition with extensive crown and bridgework.

Erich arch bar provides better stable immobilization of fracture fragments during fixation. This method is useful for treating both alveolar fractures, subluxated teeth, simple dentoalveolar fractures and where multiple tooth bearing fragments in either jaw require reduction into an arch form before intermaxillary fixation is applied.

Although arch bar has been extensively used for achieving IMF, the use of intermaxillary fixation screws (IMFS) is gaining popularity. Compared with arch bars, IMF screws are quick and easy to place, have relatively low costs & are ideal for use when the teeth have been periodontally compromised, heavily restored and are insufficient in number to place an arch bar. IMF screws provide stabilization with an added advantage of ease of placement and removal with reduced risk of needle stick injury. They reduce trauma to dental papillae, furthermore gingival health is easier to maintain.

The purpose of this randomised prospective controlled clinical study is to compare the efficacy of IMF screws with Erich arch bars in achieving intermaxillary fixation for treatment of mandibular fractures. Various parameters for comparison include: occlusal stability during fixation, pain, time taken for each procedure during placement & removal, intra & post operative complications.

## Materials and method

A prospective randomized prospective clinical study was conducted between 2015 to 2017. Patients who reported to the department of Oral & Maxillofacial Surgery with mandibular fractures at Vydehi Institute of Dental Sciences and Research Centre. A total of 50 patients who reported with mandibular fractures and required internal fixation were divided into two groups.

Group A consisted of patients in whom Erich's arch bars were placed for intermaxillary fixation and Group B consisted of patients in whom Intermaxillary fixation screws were placed for intermaxillary fixation. Patients included were those who required intermaxillary fixation, Subjects in good health i.e; ASA I,II and III. Patients excluded were completely edentulous, ASA IV subjects, Comminuted fractures, Pediatric patients, Panfacial fractures.

#### Clinical Parameters:

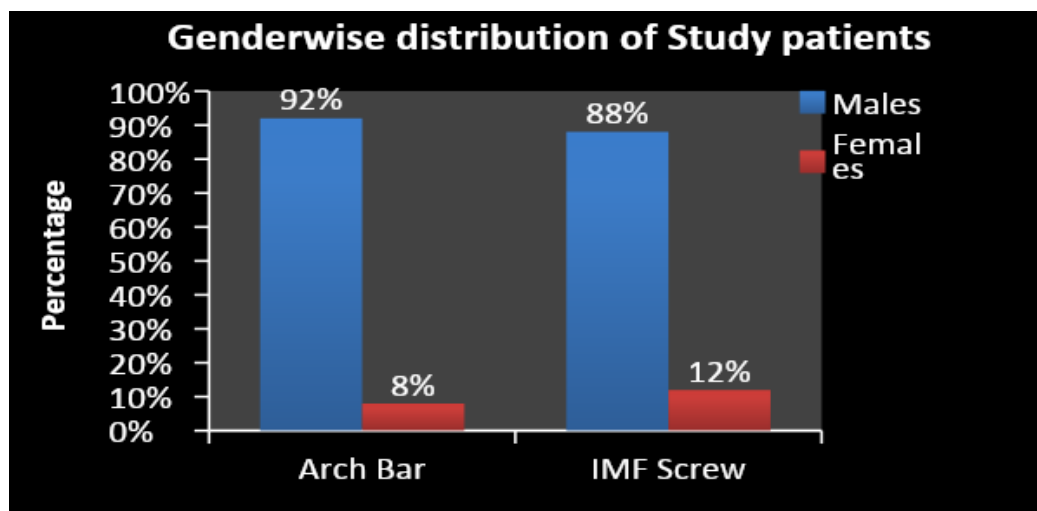
- Pain experienced by the patient during application and removal was recorded on VAS (visual analogue scale).
- Application time.
- Removal time.
- Intra-operative complications

- Needle stick injury
- Screw fracture
- Screw loosening
- Damage to the surrounding structures

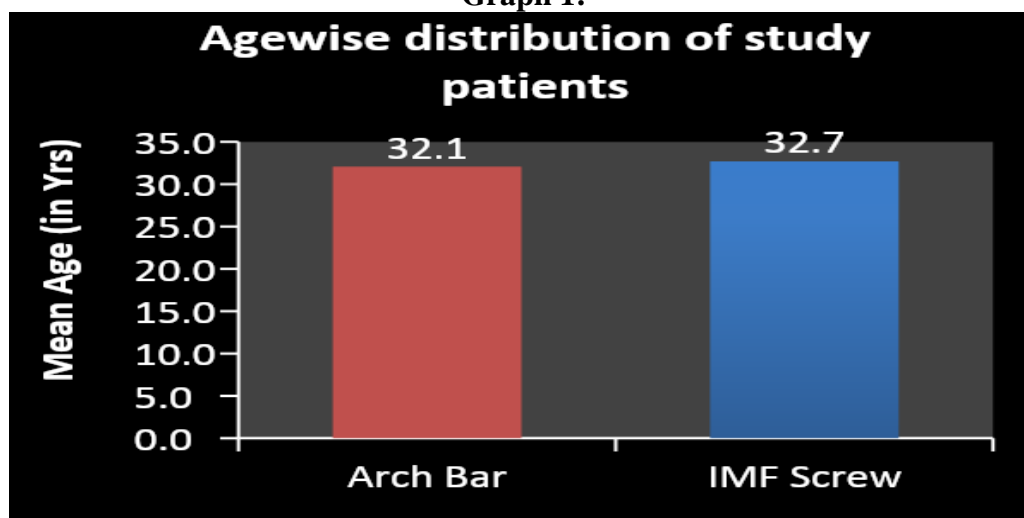
Stability of occlusion during fracture reduction

#### Results:

The comparison of conventional arch bars with fixation screws for intermaxillary fixation in mandibular fractures was done in 50 patients. The age of the patients ranged from 17 – 60 years in the arch bars group with 23 patients (92%) being males and 02 patients (8%) being females and 17 – 56 years in the IMF screw group with 22 patients (88%) being males and 03 patients (12%) being females. (**Graph 1, Graph 2**)



Graph 1:

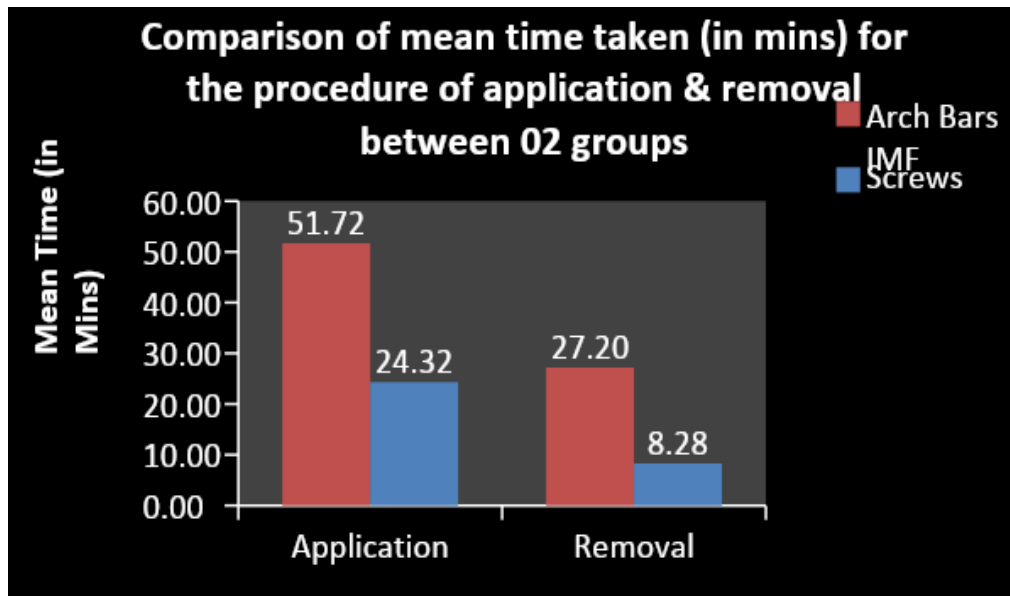


Graph 2:

### Time

Time taken was assessed in both the procedures individually from the start of application to the completion as well as from the start of removal to the completion of removal. The time was noted by the operator. In the arch bars group,

the mean time taken for application was 51.72 minutes and for removal 27.20 minutes. The mean time taken for application of IMF screws was 24.32 minutes and 8.28 minutes for removal. **(Graph 3)**

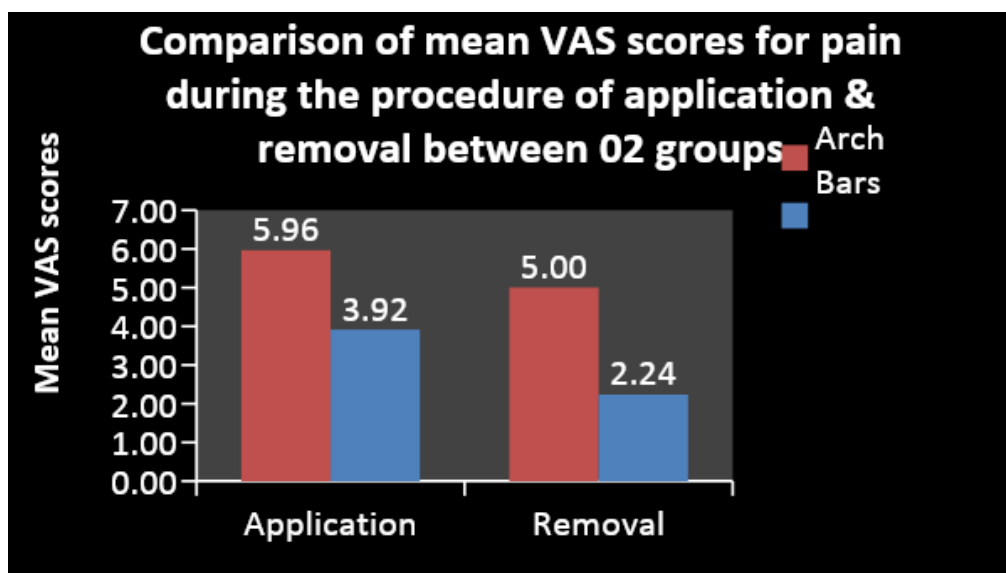


**Graph 3:**

### Pain

Pain was assessed by the patient during the application and removal of the intermaxillary fixation techniques. It was evaluated using a visual analogue scale ranging from 0-10, 0 being no pain and 10 being the worst possible

pain. In the arch bars group, the mean pain score recorded on application was 5.96 and 5.00 on removal while in the IMF screw group it was 3.92 on application and 2.24 on removal. **(Graph 4)**

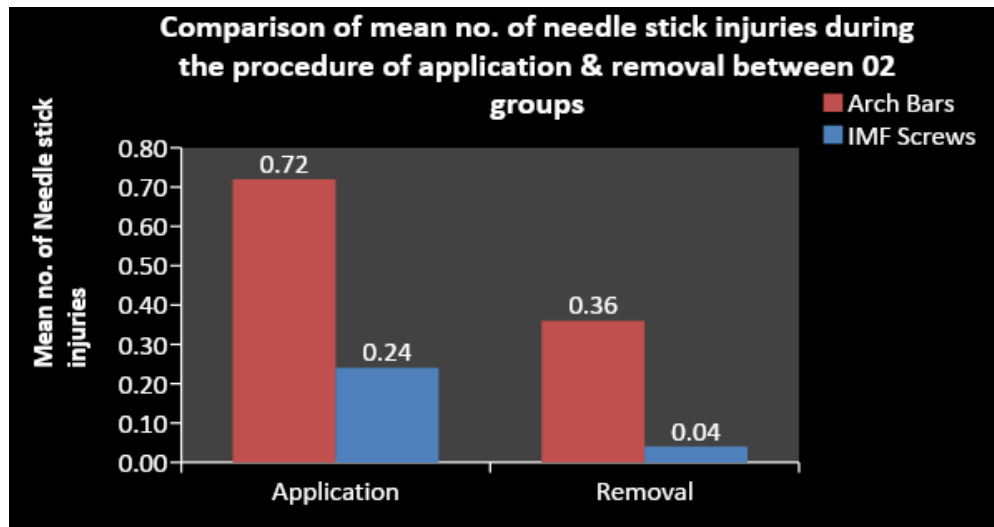


**Graph 4:**

### Needle stick injury

Comparison of mean no. of needle stick injuries during the procedure of application & removal between 02 groups wherein 18 episodes were noted during the application and 09 episodes

during the removal of arch bars. 06 episodes of needlestick injury were recorded during the application and 01 during the removal of IMF screws (**Graph 5**)



**Graph 5:**

### Occlusion

In this study Intermaxillary fixation stability was found equally satisfactory in both the groups, however in a few cases of IMF screws, IMF stability was found inadequate which is attributed to loosening of the screws.

### Limitations of IMF screws (Graph 6)

#### Screw loosening

A total of 05 IMF screws were found to be loose in all 25 patients which can be attributed to improper tightening of the screws or an improperly drilled bur hole.

### Screw Fracture

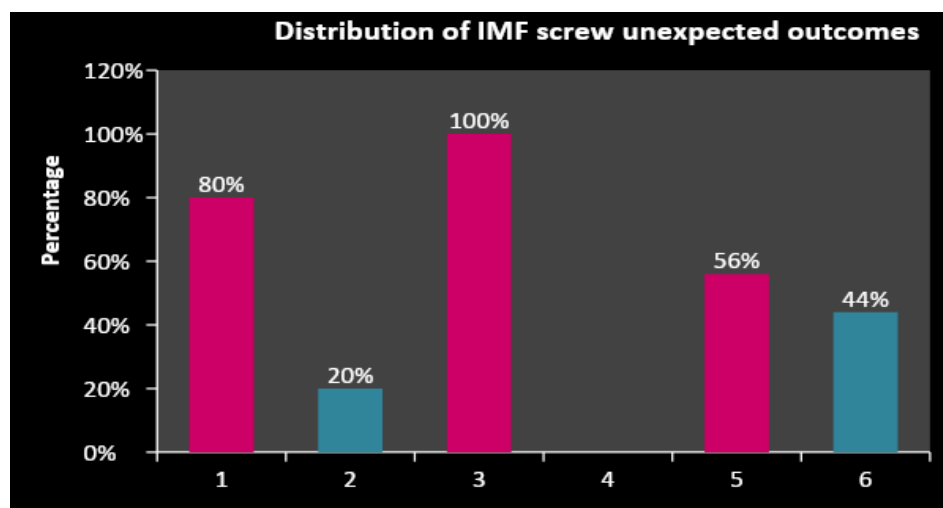
No screw fractures were encountered during the entire study.

### Root hits/injury

A total of 17 root hits were reported in 11 patients during the entire study.

### Mucosal coverage

04 screws were found to be covered with the mucosa which is attributed to either placement of the screw too far apically or screws left over for a longer time.



**Graph 8:**

## Discussion

The arch bar has been the mainstay for the management of maxillomandibular bone injuries since world war I. The originators of this method, Sauer in Germany and Gilmer in US used an ordinary round bar flattened on one side that was ligated to the teeth with brass ligature wires. Blair and Ivy's modification was a flattened on one side that was about 2 mm in width to conform better to the teeth and provide greater stability. Erich Arch bars are currently the most common methods of achieving intermaxillary fixation, although other methods are described. The arch bars themselves provide a semi rigid bar scaffold to which each dental arch is wired. Despite being effective and versatile for intermaxillary fixation, their use is not without consequences.

The placement of arch bar is time consuming and uncomfortable to the patient. Among the disadvantages of using arch bar include movement of teeth in lateral and extrusive direction, constant traction applied to the wire can distract the fracture parts and possibly cause additional complications, difficulty to secure arch bar in isolated posterior teeth, periodontal tissue injury, needle stick type of injuries to the operator, difficulty in maintaining good oral hygiene and it is not suitable for dentition that carry extensive crown and bridge work. Danger of avulsion of teeth if force is too great. On the other hand if the wires are not sufficiently tightened, they may further loosen and require retightening during the procedure. Besides being unpleasant to the patient, retightening carries the risk of wire breakage and possibly a need for further anaesthesia to replace the wire and further increasing the chances of glove puncture. In the modern days, quality of life has been given increased attention. Internet and other sources keep the patients updated about different treatment modalities and physical impact of them on daily life. However, the introduction of self drilling screws has eliminated the above mentioned issues with arch bars. The self tapping intermaxillary screws were first introduced by Arthur and Berardo in 1989 and later modified by Carl Jones with a Capstan shaped head design.<sup>4</sup> He suggested the use of threaded titanium screws

of 2 mm diameter and 10–16 mm length. The authors suggested that screws with capstan style head are important as it allows the wires and elastics to be held away from the gingival tissue. The gingival health is easy to maintain when compared to other methods of IMF. These screws are quick to insert and have fewer risks of needle stick injury than conventional methods. The IMF screw is suitable for dentition that carries out extensive crown and bridge work. The operating time is also reduced from 1 hour to around 15 minutes. Self tapping intermaxillary fixation screws are not indicated for severely comminuted fractures, extensive alveolar bone fractures and missile injuries to the jaws. The other disadvantages include damage to the roots of the teeth, perforation into vital structures like Inferior alveolar canal and maxillary sinus, fracture of the screw during insertion or IMF, loosening of the screws and mucosal coverage of the screws post insertion.

The main aim of this study was to identify a better method of intermaxillary fixation when comparing IMF screws and Erich arch bars. Intermaxillary fixation with screws is quick and easy as the mean time taken to place or remove the screws is significantly less when compared to that of arch bars as shown in studies conducted by Bergh B. VD et al.<sup>5</sup>, Qureshi et al<sup>6</sup>.

The incidence of needle stick injuries and perforation of gloves and subsequently risk of transmission of blood borne disease are much higher in cases of arch bar fixation as compared to IMF screws. In our study, needle stick injuries were higher in number in case of arch bars and lesser in IMF screws. Similar results were reported by Qureshi et al<sup>6</sup> and Nandini et al<sup>7</sup> for eyelets vs arch bars.

The post-operative occlusion was reported satisfactory in both IMFs and arch bar groups by Qureshi et al<sup>6</sup> which is in accordance with those reported by Roccia et al.<sup>8</sup> In this study also IMF stability was found equally satisfactory in both the groups, however in a few cases of IMF screws, IMF stability was found inadequate which is attributed to loosening of the screws.



Coburn *et al*<sup>9</sup> reported a case of screw fracture. Whereas no episode of screw fracture encountered in our study in any of the cases.

In this study, a few screws (n=05) were found to be loose, which can be attributed to improper screw tightening or improperly drilled bur hole similar to that of Coletti *et al*<sup>10</sup>, Ingole PD *et al*<sup>4</sup> and Qureshi *et al.*<sup>6</sup>

Mucosal coverage was noted in 8 cases where IMF screws were placed, the reason being either placement of the screw too far apically or screws left over for a longer time. In such cases, the screws were carefully exposed either by a stab incision or through the opening present over the musosa. Hashemi HM *et al*<sup>11</sup> reported 21 out of 373 screws, Qureshi *et al*<sup>6</sup> 4 cases out of 30 as reported by Bins *et al*<sup>12</sup> in their literature review.

Iatrogenic injury to the dental roots has been reported in the studies conducted by Col NK Sahoo *et al*<sup>13</sup> and Nandini *et al*<sup>7</sup>. In our study, a total of 17 roots were hit in 11 patients and the patients did not have any symptoms postoperatively as seen in other studies too.

Pain scores measured during placement and removal of screws and arch bars was lower in the IMF screw group Similar reports have been put forward in terms of pain by Ingole *et al*<sup>4</sup>.

Maintenance of oral hygiene posed to be an issue as far as arch bars were concerned, Increased food lodgment was noted in arch bars group in comparison to IMF screw group. Nandini GD *et al*<sup>7</sup> reported similar results where in maintenance of arch bars was difficult.

Hashemi HM and Parhiz A<sup>11</sup> reported incidences where screws entered the maxillary sinus and inferior dental canal. In our study 2 screws entered the inferior dental canal with no neurosensory deficits noted in these patients and screws were removed uneventfully.

In this study “Comparison of conventional arch bars with fixation screws for intermaxillary fixation in mandibular fractures: A Randomised prospective clinical study.” We conclude that the use of both the techniques in achieving intermaxillary fixation is efficacious with both

the techniques having merits and demerits over each other.

Although both the techniques offer good temporary intermaxillary fixation, the benefits and risks of both the techniques should be weighed depending on the type of fracture we are dealing with.

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