

## Original Article

### IMF Screws – A Simplified Method of Intermaxillary Fixation – A Clinical Study

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#### ABSTRACT:

**Background and objectives:** Numerous methods have been described for the achievement of Intermaxillary fixation (IMF) in the treatment of fractures of facial skeleton. Conventional methods like arch bars and eyelet wires are currently most common methods for achieving IMF, but they have their own disadvantages. During last 10 years, IMF using intraoral self tapping IMF screws has been introduced for the treatment of mandibular fractures. The aim of this work was to evaluate efficacy of self tapping IMF screws, minimize the associated complications and their potential advantages in the management of mandibular fractures. **Methods:** Thirty patients with mandibular fractures, who reported to Department of Oral and Maxillofacial Surgery, Jaipur Dental College, Jaipur were evaluated. To evaluate the efficacy of this method, different parameters were considered such as postoperative occlusion, pain, oral hygiene, soft tissue covering, possible iatrogenic dental injuries, incidence of needle stick injuries and time taken for the intermaxillary fixation with self tapping IMF screws. **Results:** The most important complication was iatrogenic damage to dental roots seen in 1 case (3.33%), needle stick injuries were encountered in 1(3.33%) case and time taken for intermaxillary fixation was in the range of 12 – 21 (Mean 15.6 Min.) minutes. Postoperative malocclusion was observed in 1(3.33%) case. **Interpretation and Conclusion:** Use of self tapping IMF screws for intermaxillary fixation is a valid alternative to conventional methods in the treatment of mandibular fractures. Iatrogenic injury to dental roots is the most important problem of this procedure, but can be minimized by careful evaluation and treatment planning.

**Key words:** Intermaxillary fixation; self tapping IMF screws; mandibular fractures.

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#### INTRODUCTION:

Primate evolution has made the human head and face very vulnerable to frontal impacts. Maxillofacial trauma, which may result from accidental or assault injuries to the craniofacial complex represents 42% of all injuries. In these 70% are mandibular fractures and 30% are maxillary fractures. Among the mandibular fractures, 43% were caused by road traffic accident, 30% by assaults and 7% were work related, 4% were sports related and the remainder had miscellaneous causes<sup>1</sup>. The treatment of mandibular fractures dated back as early as 17<sup>th</sup> century. Between 25 BC and 11<sup>th</sup> century AD, surgeons and writers such as Sushruta (India), Celsus (Rome) and Avicenna (Middle East) described conservative means of treating jaw fractures. The aim of mandibular fracture treatment is the

restoration of anatomic form and function, with particular care to re-establish the occlusion. Traditionally this has been achieved by immobilizing the mandible by linking it temporarily to the opposing jaw by some form of IMF using teeth. Intermaxillary fixation was achieved by eyelets, arch bars, bonded brackets, cast metal splints, vacuum formed splints, pearl steel wires etc. The introduction of bone plating systems has reduced or eliminated the prolonged periods of IMF. However, there is often a need for temporary intermaxillary fixation intraoperatively to assist in reduction of fractures with the teeth in correct occlusion and occasionally post operatively to correct minor occlusal discrepancies. Successful treatment of mandibular fractures depends on reduction and fixation using a closed or open technique, and on restoration of normal occlusion.

Before fracture reduction, temporary intermaxillary fixation with correct registration of occlusion is usually necessary<sup>3</sup>. IMF screws has been introduced. Intermaxillary fixation (IMF) screws are quick and easy to use and greatly shorten the operating time to achieve maxillomandibular fixation. They are relatively inexpensive and reduce the risk of needle stick-type-injuries associated with using wires. There is also no trauma to gingival margins and gingival health is easier to maintain compared with when arch bars or eyelets are used<sup>4</sup>.

This study is designed to evaluate the efficacy of self tapping IMF screws, minimize the associated complications and their potential advantages in the management of mandibular fractures.

1. To evaluate the efficacy of IMF screws as a means of Intermaxillary fixation.
2. To eliminate or minimize the complications associated with IMF screws.
3. To evaluate the potential advantages and disadvantages of IMF screws.

To evaluate the indications and contraindications of IMF screws.

#### **MATERIALS METHODS:**

30 patients were randomly selected for the study to evaluate the efficacy of IMF screws as a mean of intermaxillary fixation in the treatment of mandibular fractures. The selected cases were treated by open reduction and internal fixation under GA. In these cases IMF screws was used as a method of intermaxillary fixation intraoperatively.

Intermaxillary fixation was achieved with 26 gauge stainless steel wire. IMF screws used were of 2mm diameter, 8 to 10 mm length. The screw has a pointed tip and its head having a slot where the wire can be passed for intermaxillary fixation.

#### **INCLUSION CRITERIA**

**Patients fulfilling the following criteria were included in the study:**

1. Fractures of the dentulous mandible
2. Undisplaced fractures of the mandible
3. Minimally and moderately displaced fractures of the mandible
4. Patients with fracture mandible in age group of 18 – 60 years

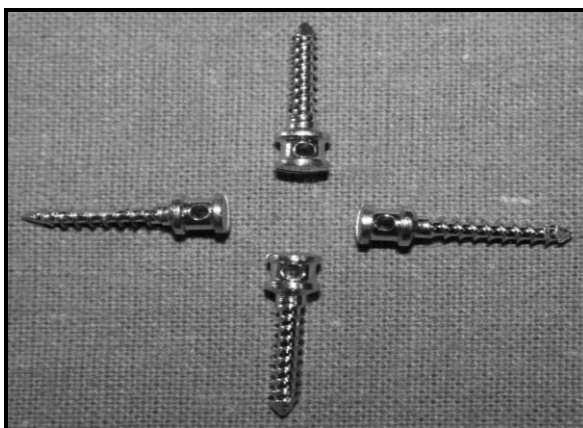
#### **EXCLUSION CRITERIA**

**Patients were excluded from the study if they had any of the following:**

1. Comminuted fractures of mandible
2. Severely displaced fractures
3. Children with erupting teeth
4. Fracture of edentulous mandible

**MATERIALS USED:** Self tapping IMF screws, Screw driver, 26 gauge wire.

**Procedure:** Screws were inserted, at least one in each quadrant, under general anesthesia. The sites of placement of screws in maxilla in between canines and first premolar. In the mandible care is taken not to place the screw too far inferiorly as it may endanger the inferior dental nerve and vessels. Care is taken that the bur enters the alveolar bone at right angles so as to avoid injuries to roots. The screw is secured in a screw holder and inserted into previously drilled hole in a clockwise direction. The screw is passed through the buccal cortex and inserted until the flat surface of the head fits snugly against the buccal mucosa and IMF is achieved with the help of 26 gauge wire. Care is taken that the screw does not penetrate the palatal or lingual mucosa where it could cause soft tissue irritation.



**Fig.1 - IMF Screws**



**Fig.2- Armamentarium**



**Fig. 4 - IMF Screws In Place**



**Fig. 5 - Intermaxillary Fixation With IMF Screws case**

**CLINICAL PARAMETERS**

The clinical parameters that were assessed included :

- 1) Time in minutes required for application of IMF Screws.
  - 2) Pain status
  - 3) Oral hygiene
  - 4) Occlusion
  - 5) Incidence of needle stick injuries
  - 6) Iatrogenic injuries to teeth
  - 7) Soft tissue covering
- Loss, breakage and loosening of screws were also assessed.

**Pain:** A scale of 0-10 was used to assess the intensity of pain 0 means no pain and 10 being the most pain possible.

**Oral hygiene:** Assessed with the help of OHI – S Index.

**Interpretation of OHI-S**

Good	0.0 to 1.2
Fair	1.3 to 3.0
Poor	3.1 to 6.0

**Occlusion**

**Occlusion is assessed as :**

- Normal
- Minimally deranged
- Moderately deranged
- Severely deranged

**Time Taken For IMF**

Time is noted from the moment the pilot holes are drilled till the intermaxillary fixation is achieved with the help of 26 gauge stainless steel wire.

**Iatrogenic Injury To Teeth**

It is assessed with the help of post operative OPG & IOPA radiographs to check for any injury to the roots of the teeth adjacent to the site of screw insertion.

**Incidence Of Needle Stick Injuries**

Needle stick injury is assessed during intraoperative procedure as – Present, Absent

**Soft tissue covering**

Clinically assessed on 1<sup>st</sup>, 3<sup>rd</sup>, 5<sup>th</sup>, 7<sup>th</sup> post-operative follow up days as: Present, Absent Loss, breakage and loosening of screw were also recorded when they were present.

**RESULTS:**

Out of 30 cases, 28 (93.33%) male and 2 (6.67%) female. 3 (10%) patients were below 20 years, 15 (50%) were between 20- 30 years, 8 (26.67%) were between 30-40 years and 4 (13.33%) were above 40 years.

Out of 30 cases, 18 (60%) had fracture of parasymphysis, 4 (13.33%) had parasymphysis and angle fracture, 3 (10%) had angle fracture, 3 (10%) had body fracture, 1 (3.33%) case reported with body and angle, 1 (3.33%) case had parasymphysis and subcondylar fracture, (table no1)

**Table No. 1:** Distribution of Mandibular Fractures according to Age & Sex

Age group (In yrs)	Sex		Total
	Male	Female	
< 20	3 (10.00)	0 (0.00)	3 (10.00)
20-30	14 (46.67)	1 (3.33)	15 (50.00)
30-40	7 (23.33)	1 (3.33)	8 (26.67)
> 40	4 (13.33)	0 (0.00)	4 (13.33)
Total	28 (93.33)	2 (6.67)	30 (100.00)

Among these, 20 (66.67%) were minimally displaced, 4 (13.33%) were moderately displaced and 6 (20%) were undisplaced. (**Table No. 2**)

**Table No. 2:** Distribution of Mandibular Fractures according to Type of Fracture

Type of fracture	No.	%
Undisplaced	6	20.00
Minimally displaced	20	66.67
Moderately displaced	4	13.33
Total	30	100.00

**Occlusion:** In 3 (10%) cases, there was minimal derangement of occlusion on first and third postoperative days. On fifth postoperative day there was minimal occlusal discrepancy in 2 (6.67%) cases. At the end of 7th postoperative day 29 (96.67%) cases had normal occlusion, 1 (3.33%) case had minimal occlusal discrepancy. All the cases with mild occlusal discrepancy showed statically significant improvement over a period of one week and only 1 (3.33%) case had postoperative malocclusion.

**Pain:** On first postoperative day out of 30 patients, 5 (16.67%) had no stress while 25 (83.33%) were annoyed. On third post operative day 5 (16.67%) patients had no pain, 24 (80%) had no stress and 1(3.33%) was annoyed. On fifth postoperative day, number of patients who had no pain raised to 26 (86.67%), and 4 (13.33%) patients had no stress; while none was annoyed. On 7th postoperative day none of the patients was annoyed, only 1 (3.33%) patient had non stressing pain and 29 (96.67%) patients reported with no pain.

**Oral hygiene:** On seventh postoperative day, out of 30 patients, 24 (80%) had fair oral hygiene while 6 (20%) had good oral hygiene status.

**Soft tissue** covering over the screws was analysed over a period of 7 days. On 1<sup>st</sup> and 3<sup>rd</sup> postoperative days no soft tissue covering was observed, while on 5<sup>th</sup> postoperative day soft tissue covering was seen in 1 (3.33%) case and on 7<sup>th</sup> postoperative day it was seen in 4(13.33%) cases.

Out of thirty cases time taken for **the intermaxillary fixation** with the help of IMF screws was less than 15 minutes in 18 (60%) cases while in remaining 12 (40%) cases time taken was more than or equal to 15 minutes with range of 12 – 21 minutes (mean 15.6 min).

#### DISCUSSION:

Introduction of bone plating system has reduced prolonged periods of intermaxillary fixation or sometimes not required in patients with fractures of the mandible.<sup>6</sup>

Although rigid internal fixation has now become the method of choice for most maxillofacial surgeons, maxillomandibular fixation (MMF) can still be necessary to achieve good occlusion and stability for osteosynthesis<sup>7</sup>.

Various methods have been used for IMF in the management of mandibular fractures. The most common

technique is to use arch bars or eyelet wires. The disadvantage of eyelet wiring is that, as the eyelet is drawn into the interdental space and the wire is tightened, it proves difficult to insert other wires through the eyelet<sup>9</sup>.

The self tapping intermaxillary screws were first introduced by **Arthur and Berardo**<sup>10</sup> in 1989 and later modified by **Carl Jones**<sup>11</sup> with a Capstan shaped head design.

He suggested the use of threaded titanium screws of 2mm diameter and 10 to 16 mm in length. According to him, screws with capstan style head are important as it allows the wires and elastics to be held away from the gingival tissue. The operating time is reduced from one hour to 15 minutes. The most suitable fractures are those that are undisplaced<sup>11</sup>.

If the screws are left in place postoperatively this overheating can cause thermal necrosis of bone around the screw and lead to loosening. Self tapping intermaxillary fixation screws may shear at bone level during insertion<sup>12</sup>.

We used the technique described by Arthur and Berardo (1989)<sup>13</sup>, utilizing four self-tapping screws inserted transmucosally, one for each quadrant. The screws, 10mm long and 2mm in diameter, are inserted at the junction of the attached and mobile mucosa between the canines and first premolars. The wire used for IMF was 26 gauge diameter.

#### Screw Fracture:

Coburn DG<sup>14</sup> reported three cases of screw fracture and recommended a careful drilling of bur hole, with slow bur speed and copious irrigation with sterile saline.

In present study we have taken all the necessary precautions to avoid this complication. The bur holes were drilled with slow speed along with copious irrigation. The screws were inserted at an even speed following the technique of two forward turns followed by one backward turn and without forcing the screws when resistance was encountered.

#### Iatrogenic injury to teeth:

Another complication encountered during the usage of self tapping screws is the injury to the roots of the teeth adjacent to the site of screw fixation.

Mujumdar<sup>15</sup> also reported one case of root damage using self tapping screws. He mentioned that his system include easy placement and removal with minimal hardware, significant reduction in operating time from 45 minutes to 10 minutes and equal ease of application in dentate and non dentate patients. The above mentioned advantages were similar to our study. To avoid iatrogenic injury to teeth, in

the present study we have done a thorough clinical and radiographic assessment of teeth adjacent to the site for screw placement. We had taken not only preoperative panoramic radiograph, but also IOPA radiographs of each quadrant in relation to the site of screw fixation. Taking all these precautions, we encountered only one case (3.33%) of iatrogenic injury in the present study.

#### **Time taken for IMF:**

Time plays a vital role in any surgical procedure.

In the present study, The average time taken for IMF with the self tapping IMF screw was found to be in the range of 12-21 minutes (mean 15.6 min.) in the present study.

#### **Needle stick injuries:**

Avoiding penetrating injuries remains a vital aspect of protecting the surgeon against the exposure to blood borne disease. As the number of wires used for IMF is higher in arch bar and eyelet wiring, so incidence of needle stick injury is also very high. While in case of IMF screws the number of wires is limited, so there are less chance of needle stick injuries.

Pigadas N<sup>16</sup> undertook a randomized control multiunit trial in order to assess the glove perforation and percutaneous injury rate while using rapid intermaxillary fixation/traditional wiring technique (eyelet). It was found that number of glove perforations /operation were 0.56 for rapid IMF and 1.45 for wiring. We encountered only 1 case (3.33%) needle stick injury in the present study. With references from the other studies, it was inferred that incidence of needle stick injuries is much higher in cases of arch bar and eyelet fixation when compared to self tapping IMF screws<sup>36,46,58</sup>.

#### **Soft tissue covering:**

R. Fabio<sup>3</sup> performed a retrospective study to evaluate the effectiveness of IMF screws as well as its postoperative complications. He found that out of 265 screws used, 13 screws had been covered by oral mucosa in the post operative period. These were removed under LA. It is suggested that screws should not be placed very close to mucogingival junction to avoid their embedment in the soft tissue. One of the main objective while treating the mandibular fracture is to restore a normal (pretrauma) occlusion.

Roccia F, Amedeo T and Alessandro D<sup>3</sup> used IMF screws in 62 patients and suggested that these screws are not indicated where the function of tension band and postoperative directional traction are required, as in multiple comminuted mandibular fractures and gunshot fractures. Contraindication to screws also includes pediatric patients with unerupted teeth, In our study, minor post-operative occlusal discrepancy was noted in one case. In such conditions where postoperative elastic traction is necessary self tapping IMF screws may not be the ideal method of intermaxillary fixation.

**Loosening of the screw:** In our study we did not come across any case of screw loosening.

IMF screws are a safe and facile means of stabilizing the maxillomandibular complex in selected cases

#### **CONCLUSION:**

Self tapping IMF screws offer good temporary fixation intra-operatively to check occlusion and postoperatively for intermaxillary fixation. Self tapping IMF screws are useful in fractures of mandible which are not grossly displaced or comminuted or having a dentoalveolar fracture. It reduces the operating time, the risk of needle stick injuries and damage to the periodontal tissues. This study reveals a low percentage (3.33%) of iatrogenic injuries to teeth and percentage of postoperative malocclusion (3.33%) similar to that reported in the literature. Considering the results it would be advantageous to use self tapping IMF screws for treatment of mandibular fractures and extending it to the treatment of other facial fractures i.e. fractures of middle third of face. Complications associated with self tapping IMF screws can be eliminated or minimized by following proper protocol.

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