Treatment Outcomes for Isolated Maxillary Complex Fractures with Maxillomandibular Screws

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Abstract

Intermaxillary fixation (IMF) is a basic and fundamental principle in the management of patients with fractures of the maxillomandibular complex. There are several shortcomings related to the conventionally recommended tooth-mounted devices that are used to achieve IMF. To circumvent these, the use of bone-borne screws has been advocated. We present a series of maxillary fractures treated with IMF screws. Over a 12-month period, 15 cases of maxillary fracture were managed with open reduction and bone plate fixation. IMF screws were used to achieve IMF intraoperatively and for a short duration postoperatively. Eight cortical titanium screws were inserted trans-mucosally, two for each quadrant at the junction of the attached and mobile mucosa. Satisfactory occlusion was achieved in all the patients with few complications. IMF screw fixation was observed to be a safe and quick method for open reduction of maxillary fractures. Tooth-borne devices are associated with problems such as poor oral hygiene and periodontal health, extrusion of teeth, loss of tooth vitality, traumatic ulcers of buccal and labial mucosa, and needle stick injury to the operator. These procedures are also time consuming. The use of cortical bone screws is a quicker and safe alternative for achieving satisfactory IMF.

Keywords

- intermaxillary fixation
- maxillary fractures
- screw fixation

Successful treatment of maxillary fractures depends on reduction and fixation using open or closed techniques and restoration of normal occlusion. Before fracture reduction, intermaxillary fixation (IMF) with correct registration of occlusion is necessary. IMF can be achieved by various techniques; the most common is by the placement of arch bars on the maxillary and mandibular teeth using interdental wires. This technique is time consuming, which takes ~approximately 45 minutes to 1 hour¹ to carry out and may not produce satisfactory results for patients who may be partially or totally edentulous. Trauma to the periodontium and compromised oral hygiene are other shortcomings of this method. In addition, this procedure poses a significant risk to the operating team, given the high possibility of glove and skin penetration by the ends of the wires and arch bars.

In pursuit of better alternatives, several variations of IMF have been recommended including the use of S-shaped hooks,² AO miniscrews,^{3,4} and 2.7-mm self-tapping screws,⁵ where wires or elastics can be used between hooks or screws. Of these variations, screws have several advantages, including ease of use, shortened operating time, and reduced risk of needle stick-type injuries associated with the use of arch bars. In addition, there is no trauma to the gingival margin and gingival health is easier to maintain.⁶

Material and Methods

Patients aged between 18 and 60 years with maxillary fractures requiring IMF to stabilize the occlusion prior to fracture fixation were recruited for the study. Those with dentoalveolar,

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panfacial, and comminuted fractures of the mandible were excluded, along with patients with comorbid medical conditions such as rheumatoid arthritis and bronchial asthma. Informed consent was obtained from all patients. We followed a technique similar to that described by Karlis and Glickman⁶ utilizing a titanium 2.0-mm non-self-tapping screw manufactured by KLS MARTIN. Instruments used for the procedure included a surgical drill bit, IMF screws (2.0-mm diameter, 10-mm-long titanium screws), screw driver, and power-driven micromotor. The procedure was performed under general anesthesia. No incision was made. A hole was drilled transmucosally in the alveolar bone using a drill bit loaded on the micromotor. Holes were drilled in the interproximal spaces between the premolars at the mucogingival junction. Based on preoperative clinical and radiographic information, the screws were placed in locations that provided appropriate vector to reestablish occlusion at the preinjury level and to provide a safe distance from the root prominences and mental foramina. The drill holes were oriented at 90 degrees from the roots of the adjacent teeth (►Fig. 1). The IMF screws loaded on the self-holding screwdriver were threaded and tightened in place. Prestretched stainless steel wires (26 gauge) were tightened around the heads of the IMF screws in both upper and lower jaws and IMF was attained (►Fig. 2). Postoperative orthopantomographs were used to evaluate screw placement (►Fig. 3). All patients were managed according to standard protocol; they remained in IMF postoperatively with elastic bands for 2 weeks. Follow-up examinations were performed weekly or biweekly, until the fracture healing was complete during which patients were examined for dental occlusion, orodental hygiene, position and alignment of screws, mucosal overgrowth, root damage, and mental nerve sensory loss.

Results

A total of 15 patients were recruited, all were males, with a mean age of 26 years. All fractures were a result of road traffic accidents and majority had suffered LeFort II variety of fracture (►Table 1). The average operative time for screw placement was 15 minutes. During the procedure, there were no glove perforations or screw breakage. During follow-up, the most

Fig. 2 Intermaxillary fixation screw insertion with steel wires.

Fig. 3 Postoperative orthopantomogram showing intermaxillary fixation screws.

common complication observed was the coverage of the screw head with mucosa (three patients; ►Table 2). Retrieval of these covered screws required a small stab incision under local anesthesia for three patients. No occlusal disturbances were observed; no damage to teeth, screw loosening, or postoperative bleeding was noticed. One patient had left side mental nerve paraesthesia following screw removal which gradually and spontaneously improved. Orodental hygiene was satisfactory in all patients and no postoperative discomfort was reported. In conclusion, a better oral hygiene can be maintained, thereby reducing the chances of intraoral wound infections, dehiscence, and uncomfortable postoperative

Fig. 1 Drilling hole for intermaxillary fixation screw insertion.

Fig. 4 Ideal site for placement of intermaxillary fixation screws at the junction of mobile and fixed mucosa, avoiding dental roots.

Table 1 Type of maxillary fracture

Fracture type	No. of patients (%)
Le Forts I	3 (20)
Le Forts II	7 (46.7)
Le Forts III	5 (33.3)

sequelae. We have not attempted screw fixation, for cases with mandibular fractures in this small study population.

Discussion

The use of cortical bone screws is a quick and safe alternative to traditional methods of maxillary fixation. The placement of screws was as suggested by Thota and Mitchell⁷ who opined that the best position for IMF screw placement is between the canine and first premolar. The position of the screws should be in proximity to mucogingival junction (→Fig. 4). However, this position can be modified, especially in patients with a history of periodontal disease and bone loss. We have used titanium 2.0-mm non-self-tapping screws. Ideally, self-tapping and self-drilling screws are preferred over non-self-tapping screws. When applying these latter screws, it is necessary to use the drill, and this increases the risk of damaging the roots. The tactile feel to the operator while using self-drilling screws acts as guiding force and reduces risk of dental root injury. All 15 patients in our study tolerated the screw IMF well and did not report major discomfort. They remained in IMF with elastic bands postoperatively for 2 weeks. However, nowadays, state of the art is to remove screw IMF postoperatively. A study by Coburn et al⁸ reported 4% complications (total 122 patients studied), including iatrogenic injury to the root leading to tooth loss following the use of screws; however, this complication was not observed in our study possibly because of careful selection of the site for screw placement, avoiding the dental roots. Three patients got mucosal overgrowth covering screw heads which can be attributed probably to screw placement away from mucogingival junction. The advantages of IMF screws that were observed included the ease of placement and removal, the minimal use of hardware, a significant

reduction in operating time from 45 minutes for arch bars to 15 minutes for IMF screws, equal efficacy in the dentate and edentulous patient, better patient comfort, better quality of life,⁹ better tolerance, and very importantly, reduced risk of infections to the surgeons via skin and glove puncture. In two studies by van den Bergh et al,^{9,10} the use of IMF screws is proven to be a superior and more efficacious method¹¹ when compared with arch bars. Furthermore, the quality of life is much higher in patients treated with IMF screws. The mean time of application of arch bars was 69 minutes compared with 17 minutes of applying IMF screws (this latter figure is comparable to the results of our study). There were no needle stick injuries in our study, similar to the study by van den Bergh et al.¹⁰ These benefits justify the relatively high cost of the screws.¹² Conditions which are relative contraindications to IMF screw fixation are comminuted and alveolar fractures of the maxilla and mandible, which can be safely managed with arch bars. The drawback of our study is that the number of included patients is small and this report is rather descriptive. Further innovations and improvisations in techniques, in a bigger study group, can help us provide greater benefits to our patients.

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Table 2 Complications related to intermaxillary fixation screws

	Description	Number of patients (%)
1.	Coverage by oral mucosa	3 (20)
2.	Screw breakage/drill bit breakage	0 (0)
3.	Damage to dental roots	0 (0)
4.	Wire/Screw loosening	0 (0)
5.	Malocclusion	0 (0)
6.	Mental nerve paraesthesia	1 (6.7)