

## A Drill-free Bone Screw For Intermaxillary Fixation In Military Casualties

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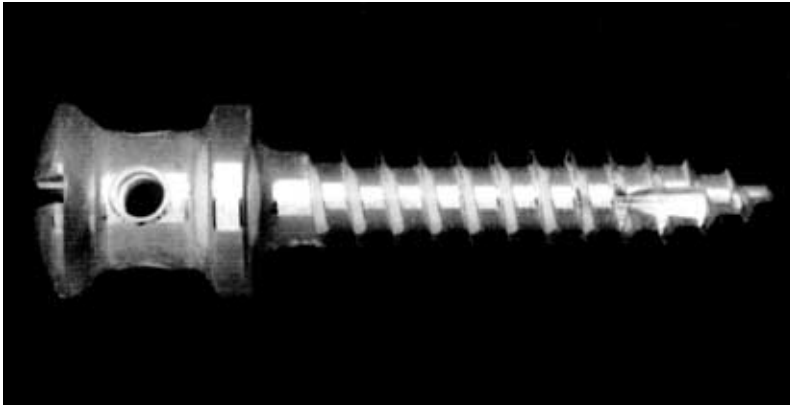


Fig 1. A drill-free intermaxillary fixation screw.

### ABSTRACT

**Drill-free bone screws are a simple and quick method of establishing intermaxillary fixation requiring a minimum amount of specialist training or equipment. These screws offer significant advantages over other methods of intermaxillary fixation and are well suited for use in military casualties.**

### Introduction

For the majority of the twentieth century intermaxillary fixation (IMF) was the established method of treating most fractures of the middle and lower thirds of the face. By wiring the teeth together in their correct occlusion, reduction and fixation of nearly all fractures of the tooth bearing segments of the mandible and maxilla can be achieved. Over the past two decades direct fixation of facial fractures with miniplates has become the conventional method of treatment. However, for military casualties IMF remains a simple method of immobilising facial fractures to relieve pain and discomfort. Casualties can then be evacuated for definitive treatment where time and resources allow.

In military conflicts, circum dental wiring techniques for IMF have been the mainstay of facial fracture management (1). These include islet wiring, Leonard's buttons and arch bars (2). Historically, silver cap splints have been used but these are cumbersome to make, fit and remove. Vacuum-formed thermoplastic foil splints are easier to use but their manufacture still requires laboratory support (3). Orthodontic brackets directly bonded onto teeth are effective (4) but their use is technique sensitive and they can

extrude teeth. Each of these methods of IMF can be difficult and time-consuming to perform. Furthermore, some knowledge of dental materials and anatomy is necessary.

As an alternative to attaching IMF appliances to teeth, pre-drilled bone screws have been developed (5,6,7). These screws are quick to place, reduce the chance of needlestick injury from wires and can be used with heavily restored teeth (5). When drilling the screw holes, saline irrigation assists bone debris removal and cooling of tissues (8). However, there is a risk of the drill damaging the roots of adjacent teeth, especially in inexperienced hands (9,10,11).

To overcome these disadvantages drill free IMF bone screws have recently been introduced. They are particularly suitable for military purposes and we present their use.

### Technique

The drill-free IMF screw (STRATEC Medical Ltd, Welwyn Garden City, AL7 1HG, UK) has a specially formed pointed tip (Figure 1).

This enables it to act like a corkscrew and to be pulled into the bone on rotation. The flutes, close to the tip, chisel off bone particles and clear bone swarf away from the pitch of the screw. Hence, the risk of the screw binding and the screw head shearing off during placement is reduced (12,13). The screw is made of threaded 316L extra hard stainless steel, has a diameter of 2mm, and is available in lengths of 8mm or 12mm. The head of the screw is cruciform with a groove beneath it around which wire or elastic IMF may be applied. To obtain more secure IMF two holes penetrate the screw head at right angles through which the IMF fixation may be threaded.

If the patient is awake, adequate anaesthesia of the alveolus, using lignocaine and adrenaline local anaesthetic, must be obtained before inserting the screws. However, this is not necessary if the procedure is performed under general anaesthetic. The IMF screws are placed bicortically, in one step, at the junction of the attached and non-attached gingivae with a cruciform blade screwdriver (Figures 2 and 3). The screws are initially positioned at right angles to the bone surface but as they are advanced they are tilted a few degrees towards the occlusal plane. Hence,

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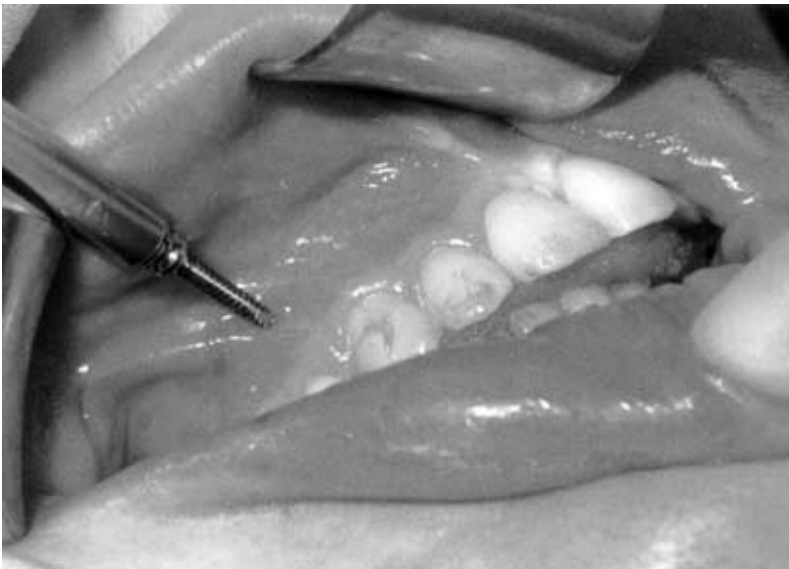


Fig 2. Screw on cruciform screwdriver at level of free and attached mucosa.



Fig 3. Screw in place between premolars and canine.



Fig 4. IMF established with wire.

when fully seated the screws are slightly divergent from each other, preventing any IMF wrapped around the screw heads from slipping off. A little pressure is required to engage the outer cortical plate and some resistance is again felt on engaging the inner plate. Care must be taken to support the bone whilst placing the screw, especially with comminuted fractures. If a root is encountered the operator will feel the tip bind. The screw can then be removed and re-sited without significantly damaging the tooth root. Screws can be placed anywhere along the arch but the best position is between the canine and first premolar. Usually one screw per quadrant is sufficient but more can be placed if needed. IMF is preferably established with power chain to reduce the risk of needle stick injury (14) but wire can be used (Figure 4). Once the fractures have healed, the screws can be removed in the outpatient clinic without the need for local anaesthetic.

The screws may be used as temporary IMF to support the fracture during definitive plating. At the end of the operation the IMF is released, the occlusion checked and the screws removed. If post-operative elastic traction is required, for example in mandibular condylar fractures, the screws may be left in place and removed at a later date.

In all cases where screws are left in place, it is very important to check that the sharp tip of the screw has not penetrated through the lingual or palatal alveolar mucosa as this can traumatise the patient's tongue.

The drill-free screw IMF equipment consists of a screwdriver and screws. Hence, its inclusion in the current British Military IMF kit-pack would be a minimal addition.

## Discussion

16% of battlefield injuries involve the head and neck region and between 3 and 8% of all casualties have middle and lower third, facial fractures (15). Providing the airway is secure the evacuation of casualties with facial fractures may not be a priority. However, stabilisation of the fracture to relieve pain and reduce the risk of infection should be performed as soon as possible (16).

The definitive treatment of facial fractures with plating techniques has many benefits. Direct anatomical reduction of the fracture is achieved, mandibular function is restored and the airway remains patent (17). Nevertheless, the use of plates requires specific equipment, theatre time and surgeons trained in the appropriate techniques. On arrival at a field hospital limited resources may preclude early plating of casualties' facial fractures. Therefore, as a simple method of fracture stabilisation, IMF is frequently used.

Drill-free screws offer significant

advantages over other forms of IMF when treating simple fractures. The screws are quick and easy to insert and can be used by non-specialist surgeons with minimal training. Their use saves operating time, reduces gingival trauma and the risk of needlestick injury. No complex equipment is required and they can be used even when teeth are heavily restored or damaged. Screws may be placed under local anaesthetic, especially if the reduction of the fracture is straightforward. Moreover, as no drill is used it is difficult to damage teeth.

Drill free screws may be used in comminuted fractures. However, if the number of fracture sites make placement of screws difficult and if multiple screws are required, then conventional eyelet wiring or arch bar techniques should be considered.

In the initial treatment of many facial fractures, drill free bone screws offer a simple quick and easy method of establishing IMF. Hence, they are well suited for use in military casualties.

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