CASE REPORT

Use of Power Screwdrivers and Power Driven Wire Twisters in Maxillofacial Trauma Management for Screw Placement and Intermaxillary Fixation – An Innovative Technique

Batchu Pavan Kumar, Vuyyuru Vidya Devi, Lt. Gen. Tapas Kumar Bandyopadhyay
Department of Oral and Maxillofacial Surgery, Kamineni Institute of Dental Sciences, Nalgonda, Telangana, India

Email for correspondences: vidya.devi.vuyyuru@gmail.com

ABSTRACT

Intermaxillary fixation, usually done with Erich's arch bars, secured with 26 gauge stainless steel wires, in indication in maxillofacial trauma as a conservative management and as an adjunct to open reduction and internal fixation. Additional open reduction and internal fixation are done most commonly with mini plates stabilized by screws. Both wire placement and screw fixation are conventionally done manually and involve high incidence of operator fatigue. As such power-driven low-speed torque, controlled tools are an unexplored resource in the management of maxillofacial trauma and fixation. They provide improved speed and consistency of force and have multiple potential applications. Here, we present a case report portraying the use of a power-driven wire twister and screwdriver in a case of symphysis fracture.

Key words: Fixation, Power driven, screw driver, wire twister, wiring

INTRODUCTION

The use of rotary motors in the management of maxillofacial trauma has been limited so far to the placement of drill holes by micromotor handpieces. Other areas where rotary force is applicable are the placement of screws and the application of intermaxillary fixation, both while securing the Eric's arch bar with circumdental wiring and placement of wire intermaxillary fixation. Both wire twisting and screw fixation are procedures that are done manually, resulting in various issues arising due to the application of irregular forces and a high incidence of operator fatigue. This area presents a vast, unexplored scope for the application of power driven rotary instruments for improved speed, accuracy, consistency, and operator ease.[1,2]

Multiple studies are present in orthopedics in citing the use of Engineering/Hardware Drills as a substitute for orthopedic drills in resource poor areas as a financially viable alternatives.[1,2] In this paper, we are presenting two novel techniques with the use of low-speed, low-torque power driven drivers adapted for the placement of miniplate screws and the application of wires in intermaxillary fixation.

Quick Response Code

Article Info:

doi: 10.5866/2023.13.10070

Received: 21-04-2023
Revised: 14-05-2023
Accepted: 29-05-2023
Available Online: 02-07-2023, (www.nacd.in)

CASE REPORT

A case of a symphysis fracture in a 23-year-old male patient was managed using the novel power driven cordless rotary driver for IMF and screw fixation. The power driven wire twister was used

to place the circumdental wiring during the arch bar placement in the second and third quadrants [Figure 1], whereas manual twisting was done in the first and fourth quadrants. With the usage of the power driven wire twister, the wire was found to achieve optimal tightness at which point the wire automatically disengaged by breaking at the end held by the twister head. The twisting of each wire took 20–25 s from the feeding of the wire to the completion of the tightening process and removal of the twisted wire fragment from the twister-head. All the wires placed with the power driven wire twister were found to provide acceptable stability to the arch bar and there were no issues with the loosening of the wires later on.

During the placement of the IMF wires, the wire loops with the pre-twisted ends were loaded into the twister-head and activated. The placement of each wire took approximately 15–18 s from loading to completion of the twisting and provided adequate immobilization without the need for additional tightening.

After the placement of IMF, fixation was achieved with a two 2 mm 4 hole with gap straight plate secured with 2 × 8 mm Ti screws which were all tightened with the power driven screwdriver. The chordless power driven screwdriver used in this case rotates at 360 rpm has an adjustable torque of 1–5 Nm and can be pressure activated or button activated. The torque controlled screwdriver with a torque detection system prevents the application of excess forces beyond the preset torque.

A 2 mm driver head was placed in the bit holder on the power driven screw driver. The pilot drill holes were placed and the screw was positioned with an orthopedic self-holding screwdriver and engaged for 3 turns [Figure 2]. The screwdriver was then replaced with the power driven screwdriver and the stabilization of the screw was completed. For the mandibular region, the torque was set at 1 Nm [Figure 3]. A lower torque precision p screwdriver with a torque of 0.25–0.35 Nm can be used for the fixation of Midface fractures.

The tightening of each screw took <2 s and the total plating time was 11 min. After fixation with the power driven screwdriver, each screw was checked for optimal tightness with a torque tester [Figure 4]. All screws were found to be adequately tight with the power driven screw driver with end torque of about 0.34 Nm whereas the screws tightened manually showed high end torque variation from 0.23 to 0.41 Nm.

Figure 1: Power driven wire twister

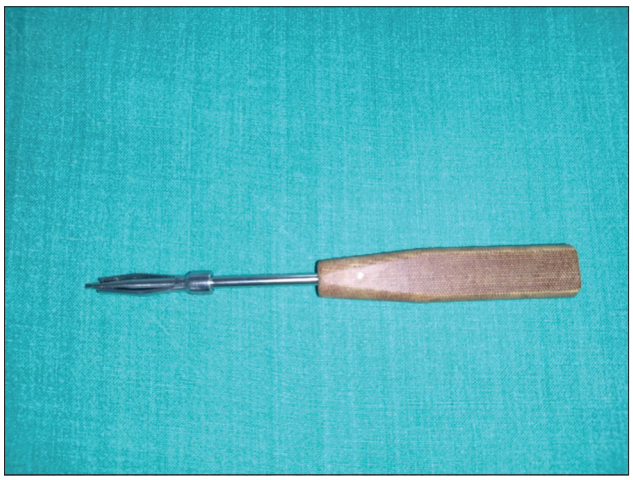

Figure 2: Orthopedic screw holder

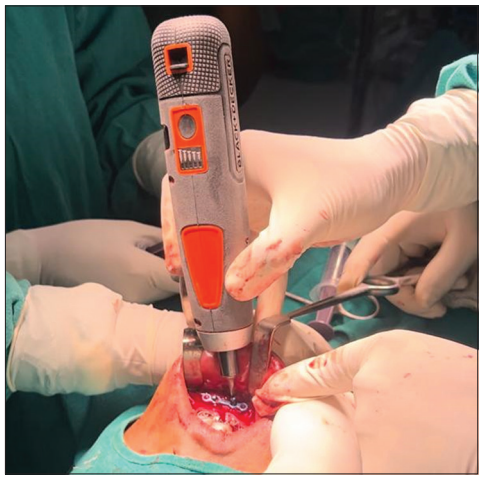

Figure 3: Power Driven screw driver used in placement of screws in fixation of parasymphysis fractures

Figure 4: Torque testing screw driver

DISCUSSION

Maxillofacial trauma is a widespread problem, caused due to road traffic accidents and assaults, especially in developing countries. In the regional population of Nalgonda, 61.7% of all cases presenting with maxillofacial trauma presented with hard-tissue injuries of which 31.69% were cases in which arch bar fixation and IMF were indicated and 42.62% of cases were the type of cases indicated for open reduction and internal fixation.[3] The extent of intervention required in maxillofacial trauma makes it one of the most common cases encountered and managed by a maxillofacial surgeon. Maxillofacial trauma can be managed by conservative techniques involving placement of intermaxillary fixation or with open reduction and internal fixation with or without including intermaxillary fixation. As such innovative approaches, addressing the discomfort and drawbacks present in these procedures has an extensive impact.

Intermaxillary fixation with Erich's arch bar and IMF wiring are standard practice in maxillofacial trauma management. While there have been newer alternatives for achieving intermaxillary fixation, Eric's arch bar remains the most widely used and versatile option. The disadvantage of this technique, however, lies mainly in the fact that it is secured by wires placed around each individual tooth. The wiring technique is conventionally done with manual instruments and involves severe operator fatigue and failure of the wire due to the uneven and improper force application. Both of these factors result in increase in the operative time and increased discomfort for the patient. The operator skill effecting the forces applied may also result in loosening of the wire and thus instability of the arch bar which may eventually result in improper reduction of the fracture fragment and undesirable occlusion.[4]

With the use of power driven wire-twister, the force applied is consistent and the wire tightens adequately. As the point of application of force is near the twister head once the force exceeds the desired tightness, the wire snaps adjacent to it leaving adequate length of twisted wire to cut and tuck as required. In addition, as the force applied with the power driven twister is rotational rather than the pull and twist motion used in the manual twisting the power driven twister was seen to result in less pain and greater comfort to the patient.

Fixation in maxillofacial surgery is achieved with miniplates secured with screws. When inserting screws, friction is generated between screw threads and the host bone to produce a shear force and counteract the linear motion of the screw. This friction enables stabilization and compression of bones and their fragments during locomotion to resist muscle and joint forces. For non-locking screws, the force applied for tightening is subjectively chosen and controlled by the surgeon. If the torsional force applied to a screw exceeds the shear limit of the surrounding bone, the screw "strips" the bone, reducing the resistance to pullout force by more than 80%.[5] Thus, torque plays a significant role in the fixation and stability of the screw and the amount of torque required is influences by thickness of the cortical bone in which the screw is being placed.[6]

The use of power driven screwdriver decreases the operating time and operator fatigue. In addition, a consistent preset force can be applied to the screws thus decreasing the risk of abnormal force application and therefore stripping damage to the adjacent bone. In this case, stability of each screw was found to be adequate without any accidental loosening. The usage of the screw driver was comfortable and ergonomic with quick and efficient completion of the task.

CONCLUSION

Low torque low speed motor rotatory devices like the power driven screwdriver and power driven wire twister have multiple applications in maxillofacial fixation systems that are so far

unexplored. They provide advantages in terms of surgical time, operator ease, and application of controlled and consistent forces.

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