

Editorial

Editorial: Intramedullary headless screw fixation of metacarpal fractures, a paradigm shift in metacarpal fracture management

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It is well-accepted that most metacarpal fractures can be treated non operatively. However, metacarpal fractures that are displaced or angulated beyond acceptable limits are considered indications for surgical fixation. Established techniques for surgical fixation include plate and screw fixation, inter-metacarpal pin fixation, and intramedullary pin fixation. None of these techniques have addressed the co-

nundrum that is posed by displaced subcapital fractures of the metacarpal, either as an isolated injury or as part of multiple displaced metacarpal fractures.

It was not until 2010 that a newer technique was introduced to address displaced subcapital fractures. I introduced the technique of retrograde intramedullary headless screw fixation for such fractures in 2010.¹ Since then, more than 70 papers have been published on the application of this technique to metacarpal fractures, as well as outcomes of the same technique and its pearls, as well as pitfalls.^{2,3}

So, what is it about this technique that has appealed to a large number of surgeons? The simplicity of this technique, as well as its ability to confer stability on an unstable fracture in an expeditious manner, reducing operating room time while at the same time allowing rapid rehabilitation and return to function, are among the two most important advantages of this technique. In most circumstances, total active motion in the digit is more than 240°, and complication rates are comparable to the other techniques at 2.5 to 3.5%.^{2,4,5}

There are several criticisms of such a technique. First and foremost, is the fact that this technique relies on trans-articular placement of the screw through the metacarpal head. This trans-articular screw placement was largely considered an anathema at the time that this technique was introduced. It was suggested that such a placement of the screw would inevitably lead to arthritic change at the joint due to articular cartilage disruption while at the same time causing compression and shortening of the fracture and that such devices did not offer adequate rotary control of the fracture site. None of these criticisms have thus far been borne out in published literature. Interestingly, surgeons who were critical of such a technique largely disregarded the fact that the head of the metacarpal was either similar in size or larger than the scaphoid, which was and is still routinely fixed with the help of headless screws placed either retrograde or antegrade through articular cartilage.

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Furthermore, chondral insertion of headless screws is performed routinely in several other locations, including the radial head, the capitellum, the femoral head, as well as numerous other articular fractures.

When faced with such criticism it is vital to do due diligence and examine such criticism with carefully controlled studies. Our study on the quantitative 3-dimensional CT scan analysis of such fixation revealed that the 3mm headless compression screw occupied only 8% and 4% of the mated surface area of the metacarpal head in coronal and sagittal planes. Moreover, the mean subchondral volume occupied by the countersunk portion of the screw head was only 4%.⁶ These findings were especially reassuring since the portion of the metacarpal head occupied by the screw, which is the dorsal third, is not considered critical for functional tasks, as most metacarpophalangeal joints exhibit up to 30° of hyperextension, which is almost never functionally relevant. Bachoura et al. also reported findings similar to ours.⁷

Another criticism was the injury to the extensor mechanism in the act of insertion of such a screw. My original technique emphasized the placement of an incision and a longitudinal split of the extensor mechanism to access the metacarpal head. However, subsequent studies have reported percutaneous placement of these screws. In a cadaver study, Gaston and colleagues reported on their experience with percutaneous insertion of different screws, and they found that when normalized to total tendon width, the defect in the extensor mechanism was less than 28% of the total tendon width with an average of 20% for all fingers and screw types.⁸

In 2001, in the British Medical Journal, a paper entitled “Scott’s parabola: the rise and fall of a surgical technique,” a British gynecologist, J.W. Scott, commented on procedures or interventions that show great potential when introduced but eventually fall into disuse as the number of unfavorable or negative reports increase over time.⁹ In an editorial entitled “Scott’s parabola and the rise of the medical-industrial complex,” Jupiter and Burke commented that “While innovation and technology, necessities of the surgeon’s armamentarium, produce most of the substantial advances in surgery, it is reality that most of the surgical device technology originates in industry research and development sections rather than from grant-supported research in academic, clinical and basic science labs”.¹⁰

The intramedullary headless screw technique was neither developed by industry nor from a clinical or basic science lab. However, it was born out of necessity when I was faced with a displaced subcapital fracture of the metacarpal. I realized that fixing such a fracture with a plate and screws was incompatible with adequate extensor function and that wire fixation would not allow me expeditious rehabilitation of my patient with multiple dis-

placed metacarpal fractures. Thus, I opted to use an intramedullary headless screw which led to an excellent outcome for that patient. When I last saw her nine years after the index procedure, she exhibited a well-maintained range of motion over 240°, and radiographs showed no evidence of degenerative change.

As I emphasized in my technique report, pre-operative templating remains the cornerstone of using this technique. There is abundant data to acquaint the user with metacarpal medullary canal sizes as well as how to decide on the size and choice of implant.¹¹⁻¹³

I did not take into account when I published my original technique report that such a report would lead to the spawning of multiple intramedullary headless devices for metacarpal fractures. Each of these devices touts its unique design and purported advantages over other designs. None of these supposed advantages and design features have been shown to have any meaningful effect on the outcomes in published literature. Therefore, it begs the question: Is the design of the intramedullary device critical, or is it possible that the intramedullary headless screw merely functions as an internal splint with subchondral purchase in the head as well as purchase in the proximal shaft? Biomechanical studies have shown that this technique offers excellent stability in most fracture configurations, but caution is advised in long oblique fracture patterns.¹⁴⁻¹⁶

Furthermore, indications for metacarpal fracture fixation have been extended by various authors to include mid-shaft fractures as well as basal fractures, and excellent outcomes have also been reported when the screw is inserted in an antegrade fashion through the metacarpal base. In the 15 years since I first published this technique, based on published results in more than 70 papers as well as applications of this methodology to phalangeal fractures, nonunions, and malunion corrections, it may be safe to say the evidence is overwhelmingly in favor of the durability and expanded use of this technique. It remains to be seen if, indeed, as suggested by J.W. Scott, this technique might fall into disuse due to an increasing number of negative reports over time.

At this time, it appears that this technique has led to a paradigm shift in the management of metacarpal fractures, allowing surgeons to fix displaced metacarpal fractures safely, effectively, and consistently, as well as reproducibly leading to expeditious rehabilitation, reduced recovery time and superior patient outcomes.

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