Quantifying extensor tendon and articular surface involvement during phalangeal intramedullary fixation

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INTRODUCTION: Phalangeal fractures of the hand are the second most common upper extremity fracture in the United States. Many studies highlight the efficacy of intramedullary (IM) hand nail fixation of the phalanges. However, screw insertion involves penetrating the articular cartilage and extensor mechanism. This study quantifies the percentage of extensor tendon and articular cartilage involvement created by antegrade and retrograde intramedullary fixation of proximal and middle phalangeal fractures with 3.0 mm and 3.5 mm IM threaded hand nails.

METHODS: 50 fresh-frozen fingers were studied from ten cadaveric hands. Four techniques for screw placement were utilized; 1) antegrade through a flexed proximal interphalangeal joint (PIPJ) into the middle phalanx of the index, middle, ring, and small fingers and 2) retrograde through the interphalangeal joint (IPJ) into the proximal phalanx of the thumb. Clinical photographs were taken for each specimen then uploaded into Image J to quantify extensor tendon and articular surface involvement.

RESULTS: The surface areas of the extensor mechanism and articular cartilage affected by screw insertion of all fingers were quantified. The mean extensor tendon involvement after intramedullary hand nail insertion was less than 9% (range 7.8% - 10.1%) while average cartilage defect was less than 5% (range 3.7% - 5.9%). In all instances, the assessed articular surface area was greater with the 3.5 mm than the 3.0 mm screws.

DISCUSSION AND CONCLUSION: Our results indicate that hand nails inserted antegrade into the middle phalanx through the PIP joint of the index, middle, ring, and small fingers, as well as retrograde into the proximal phalanx of the thumb impact the extensor tendons and articular surface about 9% and 5% respectively. Fracture fixation with intramedullary hand nails is beneficial in providing a stable construct to allow immediate motion with no soft tissue tethering and acceptable joint cartilage involvement.