

Distal Interphalangeal Joint Bony Dimensions Related to Headless Compression Screw Sizes

Dominic Mintalucci, MD, Kevin F. Lutsky, MD, Jonas L. Matzon, MD, Michael Rivlin, MD, Genghis Niver, MD, Pedro K. Beredjiklian, MD

Purpose To determine the radiographic dimensions of the distal interphalangeal (DIP) joint and to compare these measurements with commonly used headless compression screws.

Methods Using standard posteroanterior and lateral radiographs of the hand, we measured the dimensions of the distal and middle phalanges in 60 index, middle, ring, and little fingers. We then compared these measurements with the diameters and lengths of 16 commercially available headless compression screws commonly used to perform DIP joint arthrodesis. Percent compatibility and risk factors for incompatibility were determined.

Results In general, commercially available screw diameters were too large given the anatomic dimensions of the DIP joint. The distal phalanx shaft as measured on the lateral view was the narrowest determinant of fit. When the dimensions of all fixation devices were combined, screws were oversized relative to the bony anatomy in 66% of index fingers, 53% of middle fingers, 49% of ring fingers, and 72% of little fingers. This mismatch was greater in women than in men. Only 1 of the compression screw types demonstrated a compatibility rate greater than 90% for the index and little fingers, respectively. A multivariate analysis of independent risk factors showed the likelihood of a compatible fit to vary directly with patient height and to be less likely in the little and index fingers. Interobserver reliability analysis revealed excellent x-ray measurement correlation between observers.

Conclusions A size mismatch existed between the anatomic dimensions of the DIP joint and commercially available headless compression screws. Caution must be used when considering these screws for DIP joint arthrodesis, to avoid problems related to screw prominence in the narrow aspects of the distal and middle phalanges.

Clinical relevance Headless compression screws are frequently oversized for use in DIP arthrodesis. (*J Hand Surg Am.* 2014;39(6):1068–1074. Copyright © 2014 by the American Society for Surgery of the Hand. All rights reserved.)

Key words Arthrodesis, complications, distal interphalangeal joint, headless compression screws, phalanges.



From the Department of Orthopaedics, Jefferson Medical College, and the Division of Hand Surgery, Rothman Institute, Philadelphia, PA.

The authors acknowledge Nayoung Kim for help with the statistics.

Received for publication September 12, 2013; accepted in revised form February 11, 2014.

No benefits in any form have been received or will be received related directly or indirectly to the subject of this article.

Corresponding author: Dominic Mintalucci, MD, Santa Rosa Orthopaedics, 1405 Montgomery Drive, Santa Rosa, CA 95405; e-mail: dminta3@gmail.com.

0363-5023/14/3906-0005\$36.00/0
<http://dx.doi.org/10.1016/j.jhssa.2014.02.007>

ARTHRODESIS IS A WELL-ESTABLISHED procedure to treat deformity, pain, and/or instability of the distal interphalangeal (DIP) joint.¹ When indicated, DIP joint arthrodesis can be achieved using various techniques, including axial K-wires, crossed K-wire wires, intraosseous wiring, tension band wiring, lag screws, intramedullary compression screws, and lateral miniplates.^{2–8} However, all of these surgical techniques can have complications, such as pin track infection, hardware prominence,

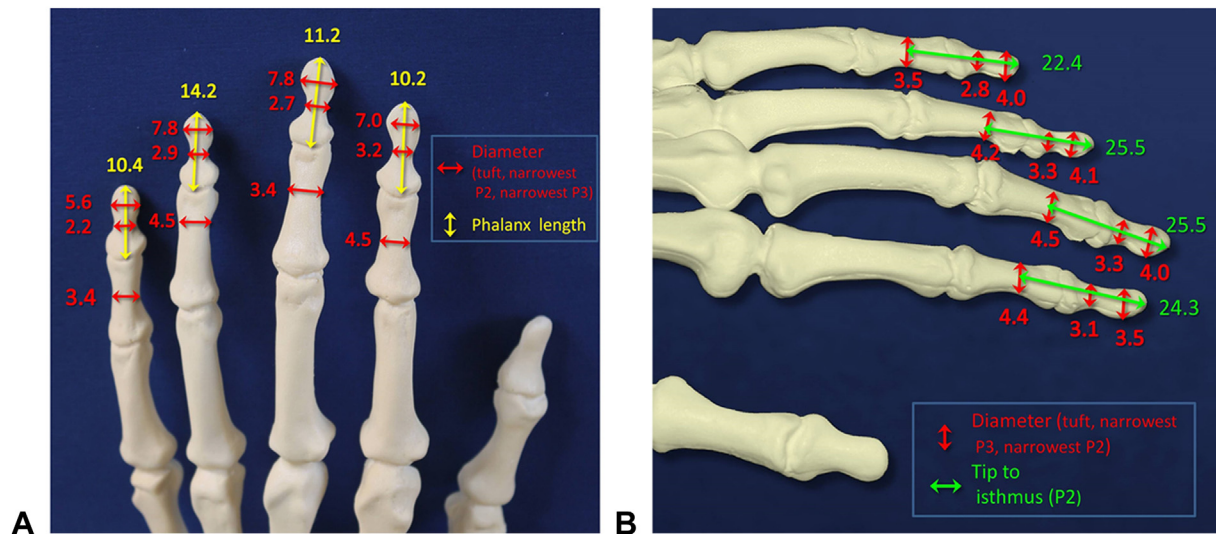


FIGURE 1: Diagrammatic depiction of bony measurements expressed as averages in millimeters. **A** Measurements made on PA radiographs. **B** Measurements made on lateral radiographs.

hardware loosening, dorsal skin necrosis, stiffness, and nonunion.⁹

Early fixation techniques using K-wires and/or intraosseous wiring were limited by minimal compression across the arthrodesis site and exposed hardware.⁸ Recently, the use of headless compression screws has gained in popularity in an attempt to avoid these limitations. These implants can achieve excellent compression across the DIP joint by the variable pitch of the screw threads.¹⁰ To prevent soft tissue complications such as nailbed or germinal matrix injury and bony complications such as iatrogenic fracture and/or loss of fixation, the screws must fit entirely within the distal and middle phalanges. However, the bony anatomy and size constraints of the joint can make this challenging. Specifically, the small size of the bones and the narrow soft tissue envelope increases the possibility of screw-related complications.

Little information exists regarding the sizes of the distal and middle phalanges as they apply to the clinical use of compression screw fixation. The purposes of this study were to measure the bony dimensions about the DIP joint and to compare these measurements with several commercially available headless compression screw devices. Our hypothesis was that these screws are oversized relative to the bony proportions of the DIP joint.

MATERIALS AND METHODS

Standard posteroanterior (PA) and lateral radiographs of the hand were obtained in adult patients who

presented for evaluation in the authors' hand surgery clinics. Radiopaque markers of known size were placed at the level of each digit to correct for errors in magnification. All patients who had x-rays were considered for inclusion, or were excluded from the analysis if they had a history of fracture or inflammatory arthritis. Subsequently, all imperfect or rotated radiographs were excluded. Patient sex and height were recorded.

Using Phillips iSite (Phillips, Andover, MD) digital imaging software, the following measurements were obtained on both PA and lateral radiographs: the widest cortical diameter (outer cortex to outer cortex) of the distal phalangeal (P3) tuft, the narrowest cortical diameter of the P3 shaft, and the narrowest cortical diameter of the middle phalanx (P2). In addition, we measured P3 length from its tip to the articular surface, the distance from the tip of P3 to the narrowest portion of the P3 shaft, and the distance from the tip of P3 to the narrowest margin of P2 (Fig. 1). Five observers (2 fellowship-trained hand surgeons, 2 hand fellows, and 1 orthopedic chief resident) performed the measurements independently.

We then compared the bony measurements with the manufacturers' specifications for the diameters and lengths of 16 headless compression screw systems commonly used to perform DIP joint arthrodesis (Table 1). The largest outer diameter of the screw varied in location (leading thread, trailing thread, and screw shaft) based on design and manufacturer. Determination of screw fit compatibility was based on several factors. First, the trailing thread diameter was compared with the P3 tuft. Second, the outer

Download English Version:

<https://daneshyari.com/en/article/4067954>

Download Persian Version:

<https://daneshyari.com/article/4067954>

[Daneshyari.com](https://daneshyari.com)