Ideal Position for Thumb Interphalangeal Arthrodesis in the Era of Smartphones and Text Communication

Jeffrey Yao, MD; Min Jung Park, MD, MMSc; Drew Davis, MD; James Chang, MD

Abstract: The hypothesis of this study was that arthrodesis of the thumb interphalangeal joint at a degree of flexion greater than the recommended 0° to 15° in the era of widespread use of handheld devices would potentially be more beneficial for the use of these devices. For patients who rely heavily on a smartphone or handheld device and require dominant thumb arthrodesis, thumb interphalangeal arthrodesis at an angle of 10° or 30° will neither improve nor impede their use of the device.

Hand surgeons treat many patients who suffer from the sequelae of osteoarthritis, inflammatory arthritis, and joint trauma. Conservative treatment with nonsteroidal anti-inflammatory drugs, steroid injections, splinting, and hand therapy may help relieve symptoms temporarily. However, once these options fail, patients may require more invasive treatment for their symptoms.1 Treatment options, including arthroscopy, arthroplasty, and arthrodesis, are tailored to the needs and expectations of each patient. Arthrodesis continues to be a realistic option in the treatment of pain, deformity, and instability of the carpometacarpal, metacarpophalangeal, and interphalangeal joints of the thumb.1

Few data exist regarding the epidemiology of arthrosis of the interphalangeal joint. It is less common than disorders of the carpometacarpal joint. Although treatment of basilar thumb (carpometacarpal) arthritis and instability is usually some form of interposition arthroplasty, arthrodesis is often the treatment of choice for symptomatic metacarpophalangeal and interphalangeal joints.2

In 1969, Carroll and Hill3 identified the ideal position for thumb interphalangeal arthrodesis to be 0° to 15° of flexion. This position was shown to allow for maximum function of the thumb. However, the authors stated that the recommendations “may be amended to fit the patient’s needs in specialized situations.”3 Currently, a new, specialized situation exists. The advent of text communication and the use of smartphones and handheld devices has become ubiquitous, and this technology is designed with a thumb–device interface. Gartner, Inc, a leading information technology research and advisory company, reported that 32.2 million smartphones were sold worldwide in the second quarter of 2008, increasing from 27.9 million in the second quarter of 2007.4 The United States is responsible for approximately one-third of total sales.4

When using these devices, it is common to hold the thumb in a flexed position of up to 90° at the interphalangeal joint (Figure 1). The purpose of the current study was to provide the ideal angle of arthrodesis of the thumb interphalangeal joint in patients who may have arthrosis of the interphalangeal joint refractory to conserva-
tive measures yet rely heavily on smartphones or handheld devices. The authors hypothesized that arthrodesis at a greater degree of flexion than the recommended 0° to 15° in an era of handheld devices would be beneficial for the use of these devices.

**Materials and Methods**

Approval of the scientific design was obtained from the institutional review board. Twenty-five healthy participants with no hand or thumb pathology were recruited for the study. All participants were familiar with smartphones and text messaging, as well as a standard keypad. The Palm Treo smartphone (Palm, Inc, Sunnyvale, California) was chosen because of its qwerty-style keypad (each letter of the alphabet is assigned to 1 button) and the absence of an autocorrect feature. This was done to eliminate variability that could be encountered in a text messaging interface such as T9, where multiple letters are assigned to 1 button and autocorrect features will complete commonly used words.

Three unique sentences were developed that (1) represented the length of an average text message, (2) contained an equal number of keystrokes (combined letters and spaces), and (3) used every letter of the alphabet. The sentences were designed this way to standardize them to one another and to help eliminate the possibility that one sentence would be easier to type than another if the keys were grouped in a certain way (ie, close together on the keyboard). The sentences were (1) The quick brown fox jumps over a lazy dog, (2) The five boxing wizards jump very quickly, and (3) Pack my boxes with five dozen liquor jugs.

The participants were asked to type each of the sentences in series, untimed, on the smartphone as they normally would using both thumbs. This allowed the participants to become familiar with the smartphone and its interface. Participants were also shown how to erase and correct typographical errors. They were then asked to type each sentence again in series, and accurate completion of the sentences was confirmed. The time needed to complete each sentence was recorded with a digital stopwatch.

The exercise was then repeated with each participant’s dominant thumb splinted, first to 10° and then again to 30° of interphalangeal flexion. The splints were aluminum and hook-and-loop, placed on the dorsal surface of the thumb with the thumb pad free, and calibrated with a goniometer (Figures 2, 3).

Mean time to type each sentence from the first keystroke to accurate completion of the sentence was recorded for each participant unsplinted, splinted to 10°, and splinted to 30°. The data were analyzed for significance between the unsplinted and splinted times with analysis of variance. A P value of .05 was considered significant.

**Results**

Eleven participants were women and 14 were men. Average age was 29.8 years (range, 28-36 years). The participants reported no significant difficulty in typing the sentences while unsplinted or splinted. Mean times to type the 3 sentences with the dominant thumb interphalangeal joint unsplinted, splinted to 10°, and splinted to 30° are listed in the Table.
Mean time for all participants to type the test sentences unsplinted was 23.4 ± 5.4 seconds. Mean time was 23.7 ± 5.3 seconds when the thumb interphalangeal joint was splinted to 10° and 21.5 ± 4.4 seconds when the thumb was splinted to 30°. The unsplinted and splinted means were compared with analysis of variance, and \( P = .19 \). The data indicated no significant difference in the mean time it took participants to type the sentences unsplinted vs splinted to 10° or 30° of thumb interphalangeal flexion.

**DISCUSSION**

Hand surgeons must tailor treatment plans for different pathologic processes to individual patient needs and circumstances. Treatment of carpometacarpal arthritis is an example of this concept, where a less active patient may be offered an arthroplasty and a younger manual laborer may be recommended an arthrodesis.5,6

Recently, patients have become more dependent on their handheld devices and smartphones. In the past, specific patient populations, such as laborers and musicians, have been cared for by hand surgeons. The hypothesis of this study was that smartphone users would represent another such patient population.

Smartphones and handheld devices dominate the world of personalized technology and are used for both business and personal communication.4 Casual observation of someone who is texting or typing on his or her smartphone reveals that both thumbs are usually held up to a 90° angle at the interphalangeal joint. This led the current authors us to investigate the importance of thumb interphalangeal joint position in avid smartphone users.

Treatment of the thumb carpometacarpal joint is common. Although thumb interphalangeal joint arthritis is less common, it may be an equally disabling problem for patients. Arthrodesis is a well-documented and reliable option for the treatment of interphalangeal joint pain, deformity, or instability that is refractory to conservative measures such as activity modification, splinting, nonsteroidal anti-inflammatory drugs, and corticosteroid injections.3 The current study aims to help physicians better counsel patients who may have significant thumb interphalangeal arthritis, are avid smartphone users, and are concerned about the impact thumb interphalangeal arthrodesis may have on their ability to use the devices.

This study’s data suggests that arthrodesis of the thumb interphalangeal joint at 10° or 30° of flexion does not significantly influence the speed at which a patient types or texts on a smartphone. Mean times to complete the sentences were neither prolonged nor reduced with splinting at either degree of flexion. This is likely because the hand is innately dexterous, and the overall posture of the hand and the carpometacarpal joint likely compensates for the loss of interphalangeal motion. Further study is needed to identify the effect of immobilizing the carpometacarpal and metacarpophalangeal joints of the thumb on the use of these devices.

**CONCLUSION**

The authors recommend that if a patient uses a smartphone and requires thumb interphalangeal joint arthrodesis, the traditional position of 0° to 15° remains appropriate and will likely result in no impairment of smartphone use. This will also keep the thumb in a position that will best suit the patient for other activities of daily living.

**REFERENCES**


