Palmar Abduction: Reliability of 6 Measurement Methods in Healthy Adults

M. de Kraker, MD, R. W. Selles, PhD, T. A. R. Schreuders, PhD, H. J. Stam, MD, PhD, S. E. R. Hovius, MD, PhD

Purpose The aim of the current study was to assess reliability of 6 palmar thumb abduction measurement methods: conventional goniometry, the Inter Metacarpal Distance, the method described by the American Medical Association, the method described by the American Society of Hand Therapists, and 2 new methods: the Pollexograph-thumb and the Pollexograph-metacarpal.

Methods An experienced hand therapist and a less-experienced examiner (trainee in plastic surgery) measured the right hands of 25 healthy subjects. Palmar abduction was measured both passively and actively. Means and ranges for palmar abduction were calculated, and intrarater and interrater reliability was expressed in intraclass correlation coefficients, standard errors of measurement, and smallest detectable differences.

Results Mean active and passive angles measured with goniometry resembled values measured with the Pollexograph-thumb method (approximately 60°). Mean angles found with the Pollexograph-metacarpal method were approximately 48°. Mean active and passive distances for the Inter Metacarpal Distance were 64 mm. Mean active and passive distances found with the American Society of Hand Therapists method were 97 to 101 mm, and mean distances found with the American Medical Association method were 67 to 70 mm for active and passive measurements. Intraclass correlation coefficients for the Pollexograph-thumb, Pollexograph-metacarpal, and the Inter Metacarpal Distance indicated good and significantly higher intrarater agreement for active and passive measurements than intraclass correlation coefficients of conventional goniometry, the American Society of Hand Therapists method, and the American Medical Association method, which showed only moderate agreement. For interrater reliability, the same measurement methods were found to be most reliable: the Pollexograph-thumb, Pollexograph-metacarpal, and the Inter Metacarpal Distance.

Conclusions We found that the Pollexograph-thumb, Pollexograph-metacarpal, and the Inter Metacarpal Distance are the most reliable measurement methods for palmar abduction. *(J Hand Surg 2009;34A:523–530. © 2009 Published by Elsevier Inc. on behalf of the American Society for Surgery of the Hand.)*

Key words Assessment, goniometry, hand, palmar abduction, reliability.

FOR PALMAR ABDUCTION, many different definitions have been reported in the literature.[1–5] One often-used definition is "the movement in which the thumb metacarpal moves away from the index metacarpal, perpendicular to the plane of the palm."[2] Another frequently used definition is "the angle between the first and second metacarpals with the thumb maximally abducted."[1,3,4]

As there is no consensus on the definition, there is also no consensus on the optimal measurement method

From the Department of Plastic and Reconstructive Surgery, and the Department of Rehabilitation Medicine, Erasmus MC – University Medical Center Rotterdam, Rotterdam, The Netherlands.

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Corresponding author: M. de Kraker, MD, Department of Plastic and Reconstructive Surgery, Erasmus MC – University Medical Center Rotterdam, Dr. Molewaterplein 40, 3015 GD, Rotterdam, The Netherlands; e-mail: m.dekraker@erasmusmc.nl.

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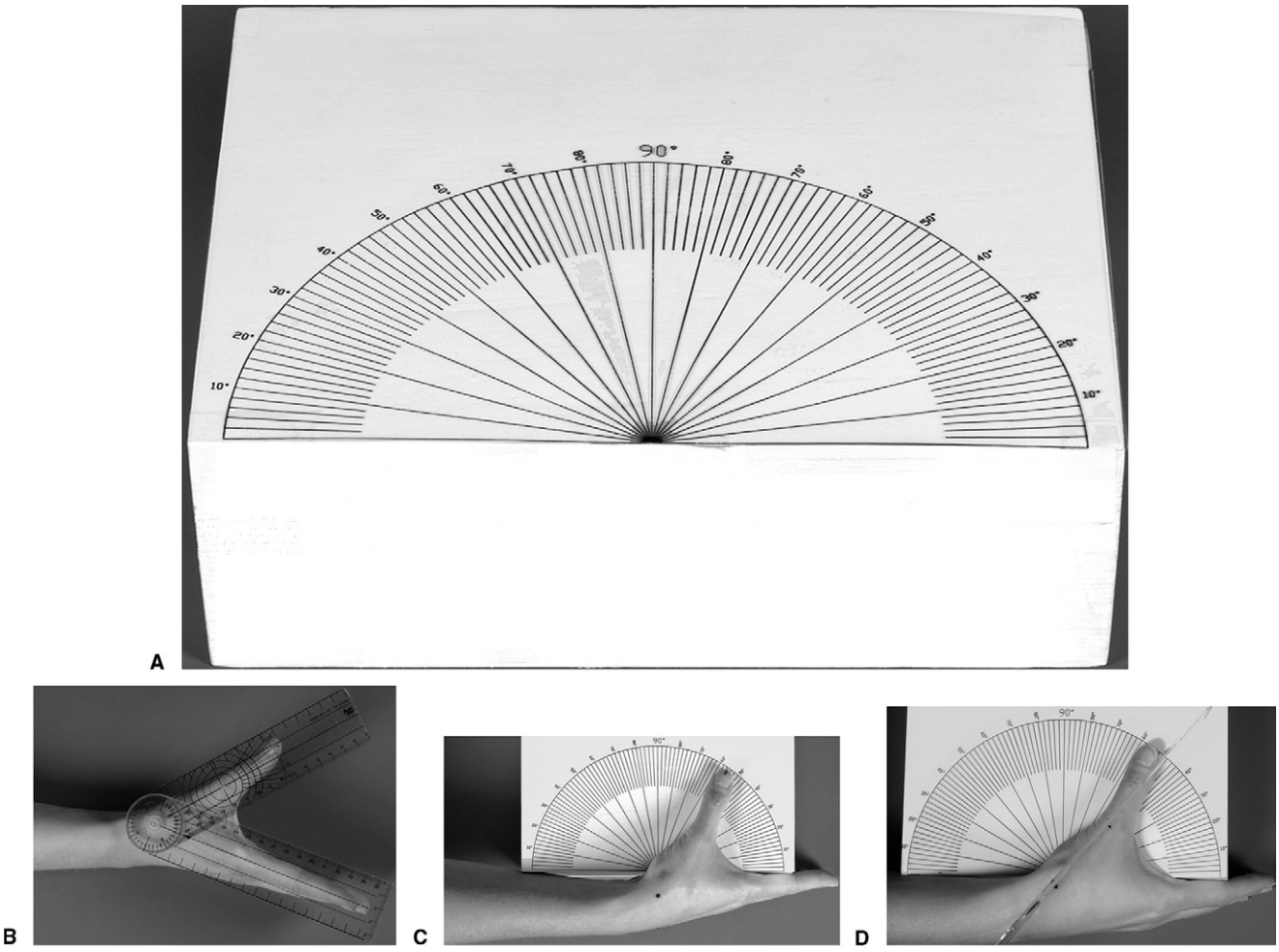

FIGURE 1: A The Pollexograph with protractor on top. **B** An active measurement with a conventional goniometer. The goniometer is placed over the first and second metacarpals. **C** Position of hand and forearm on the Pollexograph during a Pollexograph-thumb measurement. Two landmarks are visible: the CMC joint marking and the nail marking that facilitates angle readings. **D** A Pollexograph-metacarpal measurement; the ruler is placed over the first metacarpal. Possible laxity in the metacarpophalangeal and IP joints is left out of the measured angle.

for palmar thumb abduction.[1,5–9] Several authors have measured palmar abduction angles,[1-4,9] whereas others used distances between anatomic reference points.[5,8,10] For these measurements, different devices have been used, such as goniometers,[8] calipers,[8] triangular pieces of wood with known angles,[6] torque-controlled devices,[9] and 3-dimensional video camera systems.[11–14] All these existing methods have disadvantages that complicate daily clinical use, such as low reliability (eg, conventional goniometry)[8] or measurement complexity (eg, 3-dimensional video camera systems).[11–14] We therefore designed the Pollexograph (Fig. 1A) to allow reliable and easy palmar thumb abduction measurements in daily clinical care.

The Pollexograph design is based on the concept that hand position should be standardized to obtain repetitive and reliable measurements. Because palmar abduction is a motion in 1 plane, it should be assessed in this plane along a smooth surface.

Thus, the Pollexograph measures the movement in which the thumb metacarpal moves away from the index metacarpal, perpendicular to the plane of the palm. A box shape was chosen so that the thumb would be forced to move in the plane perpendicular to the hand. A protractor on top is divided in steps of 2° to conform to the scale of many conventional goniometers. The protractor runs from 0 to 90° from the left to the middle and from the right to the middle, making the Pollexograph applicable for left and right hands. To optimally align the hand and to read the palmar abduction angle on the Pollexograph, the examiner marks a number of anatomic points on the hand. First, to allow the thumb to move freely in the right plane, it is important to place the thenar crease exactly on the edge of