



ELSEVIER

Contents lists available at ScienceDirect

Journal of Hand Therapy

journal homepage: www.jhandtherapy.org

JHT READ FOR CREDIT ARTICLE #427.

Scientific/Clinical Article

The inter-rater reliability of the modified finger goniometer for measuring forearm rotation



Mike Szekeres PhD(c), OT Reg (Ont), CHT^{a,b,*}, Joy C. MacDermid PT, PhD^{b,c}, Trevor Birmingham PT, PhD^a, Ruby Grewal MD, FRCSC^{b,d}

^aHealth and Rehabilitation Sciences, Western University, London, Ontario, Canada^bThe Roth McFarlane Hand and Upper Limb Centre, London, Ontario, Canada^cSchool of Rehabilitation Science, McMaster University, Hamilton, Ontario, Canada^dDepartment of Surgery, Western University, London, Ontario, Canada

ARTICLE INFO

Article history:

Received 13 August 2015

Received in revised form

20 January 2016

Accepted 5 February 2016

Available online 4 March 2016

Keywords:

Forearm rotation

Measurement

Goniometry

Distal radius fracture

ABSTRACT

Study Design: Prospective cohort study.*Purpose of the Study:* To compare the inter-rater reliability of using a modified finger goniometer (MFG) for the measurement of isolated forearm rotation for patients with distal radius fractures to the currently accepted technique for isolated forearm measurement.*Introduction:* The currently accepted method of forearm measurement requires the assessor to visually estimate vertical for the stationary arm and placement of the moveable arm while placing a straight edge along a curved surface. Inter-rater reliability may be limited as assessors may estimate the placement of the goniometer arms differently depending on their experience, posture, and even their positioning relative to the patient. Rather than continue to place a straight edge on a round surface, we evaluate a new technique using an MFG for measuring isolated forearm rotation.*Methods:* Patients with clinically healed distal radius fractures were enrolled in the study. Measurement of active forearm pronation and supination was recorded using 2 separate measurement techniques. These measurements were taken by 2 separate hand therapists with more than 10 years of clinical experience in a tertiary care setting at the beginning and end of hand therapy sessions for 3 consecutive weekly visits. Intraclass correlation coefficients (ICCs), standard error of measurement, and minimal detectable change were calculated for each technique.*Results:* The point estimates for the MFG method demonstrated a slightly higher ICC than the standard method for pronation (0.86 vs 0.82). For supination, both measurement techniques displayed equally high pooled ICCs (0.95). The standard error of measurements for the MFG were 2.1 for pronation and 1.2 for supination compared with 2.9 (pronation) and 1.2 (supination) for the standard technique. These translate into 90% minimal detectable changes of 5° and 3° for the MFG pronation/supination compared with 7° (pronation) and 3° (supination) for the standard technique, respectively.*Discussion:* Although the point estimates for the ICCs of the MFG method are equal or higher than the standard method, the confidence intervals for the ICCs overlap, indicating that the MFG is at least equivalent to the standard method in terms of inter-rater reliability.*Level of evidence:* 2b.

© 2016 Hanley & Belfus, an imprint of Elsevier Inc. All rights reserved.

Institutional review board approval received for this study on August 20, 2010 from the Lawson Health Research Institute, Research Ethics Board #16696E.

* Corresponding author. Hand and Upper Limb Centre, Clinical Research Lab, St. Joseph's Health Care, London, Ontario N6A 4V6, Canada. Tel.: 1-855-709-4263; fax: 1-866-359-0432.

E-mail address: Mike.szekeres@gmail.com (M. Szekeres).

Introduction

Limitations in forearm pronation and supination commonly occur after fractures and soft tissue injury to the wrist, forearm, and elbow.^{1–3} Distal radius fracture (DRF) is the most common fracture in the upper extremity,⁴ and the incidence of DRF has been shown to be as high as 4 in 1000.⁵ DRF is a common diagnosis seen by hand therapists and is likely one of the most common causes for

limitation in forearm motion. During rehabilitation, hand therapists use goniometric measurement as one of the cornerstones of assessment when limitations in range of motion (ROM) are present.

Reliability of ROM measurement is important for accurately assessing joint limitations and for documenting change over time. ROM measurements are commonly shared between health care professionals and are a valuable component of the overall status of the patient, provided that the information obtained from the goniometric assessment is the same regardless of the assessor. Computerized tools and inclinometers have been described in the literature for measuring forearm rotation, but the standard goniometer is the most common tool used in the clinical setting.

Rotation of the forearm may be measured with a standard goniometer using 2 different approaches. The first approach is often termed functional rotation as it includes measurement of a combination of forearm and intercarpal rotation, effectively measuring the hand's position in space. One method for this type of measurement, using a handheld cylinder and plumb line, was initially proposed by Flowers et al.⁶ The plumb line offers an advantage to reproducibility, as finding vertical orientation is taken care of by gravity rather than the assessor's eyes. This method has shown excellent reliability, but this study was small ($n = 31$), was a single session, included a variety of orthopedic conditions, and measured passive forearm motion only. McRae⁷ first measured functional forearm rotation by using a pencil held in the hand. McGarry et al.⁸ later studied this technique and found upper limits of the 95% confidence intervals to be 10° for both pronation and supination in healthy and middle-aged volunteers. Karagiannopoulos et al.⁹ compared the pencil technique to the plumb line method and found similar reliability to this method, but it only included 20 injured subjects in addition to 20 healthy volunteers. The injured subjects had a mix of both elbow and wrist injuries that required a period of immobilization sufficient to cause limitations in ROM.

The second approach for measuring forearm rotation is to measure motion occurring directly at the distal radioulnar joint (DRUJ). This method does not include accessory intercarpal and metacarpal motions. A standard goniometer is used with the stationary arm held perpendicular to the floor, the axis along the ulnar side of the wrist, and the moveable arm along the volar wrist for supination measurement (Fig. 1), and along the dorsal wrist for pronation. This method of measurement, initially proposed by Norkin and White,¹⁰ is supported by the American Society of Hand Therapists and standard ROM textbooks^{11,12} and will be referred to as the standard method in this article.

Both approaches to the measurement of the forearm have shown excellent test–retest reliability for both healthy volunteers and for patients with demonstrated forearm ROM limitations.^{8,9,13} Measures of inter-rater reliability, however, have been more variable. In the largest study to date ($n = 38$), Armstrong et al.¹³ investigated the reliability of ROM measurements of isolated forearm rotation using the standard method. Intraclass correlation coefficients (ICCs) were 0.83 for pronation and 0.90 for supination. They concluded that ROM must change greater than 10° for both pronation and supination to be considered meaningful when comparing measurements between testers. This large value for minimal detectable change (MDC) suggests a lack of precision in measurement but could have been because of a relatively small number of subjects. This lack of precision may be technique related as the current method of measuring true forearm rotation involves placing a flat goniometer along the curved surface of the flexion/extension creases of the wrist just distal to the ulnar styloid.

Recently, a new technique for measuring isolated forearm rotation (Fig. 2) was introduced, using a modified finger goniometer (MFG).¹⁴ The authors state that this new method potentially reduces visual estimation of goniometer placement and vertical



Fig. 1. The currently accepted standard technique for measuring isolated forearm rotation.

orientation by using bony landmarks for placement and including a plumb line on the tool to mark vertical orientation. The purpose of this study was to compare the inter-rater reliability of using the MFG for the measurement of isolated forearm rotation for patients with DRF to the currently accepted technique for isolated forearm measurement.

Materials and methods

Subjects

The data for this prospective cohort study were collected as part of a 3-year study of patients who had sustained a DRF and were treated at the Roth McFarlane Hand & Upper Limb Centre. Patients were included in the study if they were older than 18 years, had been cleared by a hand surgeon to begin ROM exercises for the wrist and forearm, and lived close enough to allow for weekly follow-up visits. Exclusion criteria included concurrent diagnosis of complex regional pain syndrome or gross swelling of the hand that precluded the use of superficial heat during therapy. The reason for this is because superficial heat was used as a washout period between measurement sessions and likely changed the forearm ROM slightly during each hand therapy session. Informed consent was

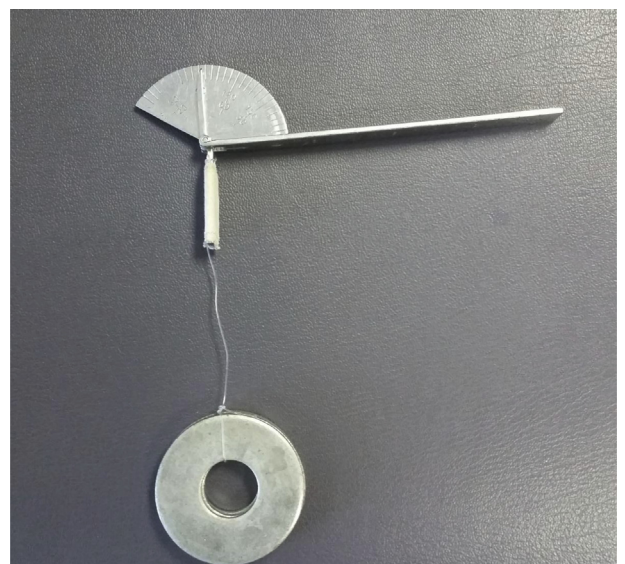


Fig. 2. The modified finger goniometer.

Download English Version:

<https://daneshyari.com/en/article/2694792>

Download Persian Version:

<https://daneshyari.com/article/2694792>

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