# Test-Retest Reliability of Handgrip Strength Measurement Using a Hydraulic Hand Dynamometer in Patients With Cervical Radiculopathy

Christos Savva, MSc,[a] Giannis Giakas, PhD,[b] Michalis Efstathiou, MSc,[a] and Christos Karagiannis, MSc[a]

## Abstract

**Objective:** The purpose of this study was to evaluate the test-retest reliability of handgrip strength measurement using a hydraulic hand dynamometer in patients with cervical radiculopathy (CR).

**Methods:** A convenience sample of 19 participants (14 men and 5 women; mean ± SD age, 50.5 ± 12 years) with CR was measured using a Jamar hydraulic hand dynamometer by the same rater on 2 different testing sessions with an interval of 7 days between sessions. Data collection procedures followed standardized grip strength testing guidelines established by the American Society of Hand Therapists. During the repeated measures, patients were advised to rest their upper limb in the standardized arm position and encouraged to exert 3 maximum gripping efforts. The mean value of the 3 efforts (measured in kilogram force [Kgf]) was used for data analysis. The intraclass correlation coefficient, SEM, and the Bland-Altman plot were used to estimate test-retest reliability and measurement precision.

**Results:** Grip strength measurement in CR demonstrated an intraclass correlation coefficient of 0.976, suggesting excellent test-retest reliability. The small SEM in both testing sessions ($SEM_1$, 2.41 Kgf; $SEM_2$, 2.51 Kgf) as well as the narrow width of the 95% limits of agreements (95% limits of agreement, −4.9 to 4.4 Kgf) in the Bland-Altman plot reflected precise measurements of grip strength in both occasions.

**Conclusions:** Excellent test-retest reliability for grip strength measurement was measured in patients with CR, demonstrating that a hydraulic hand dynamometer could be used as an outcome measure for these patients.

(J Manipulative Physiol Ther 2014;37:206-210)

**Key Indexing Terms:** *Reliability; Hand Strength; Muscle Strength Dynamometer; Cervical Radiculopathy*

Cervical radiculopathy (CR) is a pathological condition of the cervical nerve roots that often causes chronic pain and sensory and motor impairments such as numbness, paresthesia, muscle weakness, and possible loss of active movement.[1,2] A limited number of epidemiologic studies have revealed an annual incidence rate of 83 per 100 000 persons in the population with a clear increased prevalence of CR in the fourth to sixth decades of life.[3-5]

Muscle weakness and rapid atrophy are 2 common symptoms that are often presented in patients with CR.[6-8] Based on the kinetic chain principles that the upper limb is a system of linked segments working together to perform daily activities, the produced muscle atrophy contributes to a generalized muscle weakness in the affected limb and consequently reduce the strength of gripping activities.[9-12] Grip strength measurement (GSM) using a dynamometer is therefore advocated as an outcome measure in patients with CR owing to its ability to detect and quantitatively determine the degree of weak grip strength (GS).[1,13-16] The measure is often applied before and after treatment, to facilitate assessment of the intervention outcome.[17,18]

Grip strength measurement used as an outcome measure must yield similar and stable results of GS when applied by the same rater across separate measures.[19,20] Test-retest reliability of GSM is one of its most essential measurement properties because as an outcome measure, it is used to evaluate change in a patient's GS on repeated trials.[1,15,17,18,21] Excellent test-retest reliability for GSM has been identified in healthy participants,[11,22,23] but there is a gap in the literature for this type of reliability in patients with CR. To our best knowledge, only one reliability study has been conducted on this topic, raising several methodological questions because of the

[a] Clinical Trainer, Department of Health Science, Diogenous 6, Engomi, European University, Nicosia, Cyprus.

[b] Senior Lecturer in Biomechanics, Department of Physical Education and Sport Science, University of Thessaly, Volos, Greece.

Submit requests for reprint to Christos Savva, MSc, Clinical Trainer, Argolidos 25 Panthea, Limassol, Cyprus. (e-mail: *savva.christos@hotmail.com*).

Paper submitted November 11, 2013; in revised form December 30, 2013; accepted January 9, 2014.

0161-4754/$36.00

Copyright © 2014 by National University of Health Sciences.

http://dx.doi.org/10.1016/j.jmpt.2014.02.001

limited number of participants (n = 13) and the lack of estimation of measurement error, thus preventing the generalization of its findings in clinical practice.[11]

Although GSM has been advocated as an outcome measure in CR in order to identify the degree of weak GS, little attention has been given in respect to its test-retest reliability. Therefore, the purpose of the present study was to evaluate the test-retest reliability of GSM using a hydraulic hand dynamometer in patients with CR.

## Methods

### Design and Rater

A prospective, observational, nonexperimental design was used. This study was approved by the Cyprus National Bioethics Committee. The patients' GS was measured by the same rater on 2 different occasions with an interval of 7 days between the testing sessions, to prevent potential learning or fatigue effects.[19,24,25] A blinded rater measured and recorded the patients' scores. The rater was a qualified physiotherapist with 6 years of postqualification experience in the field of neuromusculoskeletal physiotherapy, and during data collection, he was not aware of the purpose and nature of the study design to address potential recorder bias.[26,27]

### Patients

Nineteen volunteer patients (14 men and 5 women; mean ± SD age, 50.5 ± 12 years) experiencing CR were enrolled from the physiotherapy department of Nicosia General Hospital, to detect a difference in reliability of 0.9 and 0.7 at 80% power and a 5% level of significance using 2 ratings.[28,29] Specifically, based on 2 repetitions, an $\alpha$ value of .05, and a power of 0.80, a minimal sample size of 19 patients was needed. All enrolled participants (n = 19) were blinded to the GS scores to address potential expectation bias, which could influence the GS performance during the gripping trials.[27] Patients were included if they had been diagnosed (by orthopedic doctors) as having unilateral CR using magnetic resonance imaging or computed tomographic scans and reported unilateral sensory and motor deficits including sharp pain, muscle weakness, pins and needles, and numbness in the upper limb, aggravated or eased by certain neck movements.[30,31] In addition, participants were included if 3 of 4 special test results of clinical prediction rule were positive; Spurling test, Distraction test, Upper Limb Tension test, and ipsilateral cervical rotation of less than 60°.[14,32] Patients were not considered for this study if they had a current history of cervical myelopathy or signs of upper motor neuron disease, bilateral CR, and other musculoskeletal conditions in the affected limb including tendinopathy, carpal tunnel syndrome, and so on.[1,14] In addition, participants were excluded if they had been receiving any medication or physiotherapy during the current period to remain the patients' GS unchanged over time. Before participating in the study, patients signed an informed consent form approved by the Cyprus National Bioethics Committee. A participant information sheet detailed the aim and the procedures of the study and informed patients of their right of privacy, anonymity, and confidentially as well as their right to withdraw from the study at any time without giving a reason.[25]

### Equipment

The Jamar dynamometer, an isometric, hydraulic hand dynamometer developed by Betchol was used to measure the patient's GS (Seahan Corporation, Masan, Korea).[33] According to the American Society of Hand Therapists, the particular instrument can provide the most stable results during repeated gripping trials.[23,34,35] Its excellent test-retest reliability has been confirmed in many studies, with an obtained intraclass correlation coefficient ($ICC_{2,1}$) values ranging between 0.81 and 0.98.[11,13,36,37]

### Procedure

Data collection was conducted between September 2012 and January 2013. Patients were asked to attend for 2 testing sessions occurred in a safe, quiet, temperature-controlled laboratory located in the outpatient physiotherapy department of Nicosia General Hospital. Time of testing has been found to influence test-retest reliability of GSM. In order to standardized the time of day, patients were advised to attend in the morning between 9:00 AM to 11:00 AM.[11,35]

The procedure for GS data collection was executed as recommended by the American Society of Hand Therapists.[38] At the beginning of each session, patients were sat in a straight back chair with their feet flat on the floor, their shoulder maintained at 0° of flexion, abduction and rotation, elbow flexed to 90°, forearm rested in a neutral position, with their wrist in ulnar deviation and extension, positioned between 0° and 30° and 0° and 15°, respectively.[36,38,39] Once the standardized arm position was achieved, the Jamar dynamometer set at the second handle space was given to participants to encourage familiarization with the task. Then, patients were advised to exert 3 maximum gripping efforts for 5 seconds, and between each trial, there was a 15-second rest period to prevent fatigue effects.[38] During each trial, instructions were given by the rater to each patient as follow: "squeeze the handle as hard as possible." No encouragement was given during GSMs. After each trial, the blinded rater measured and recorded the patients' scores. The mean value of the 3 efforts (measured in kilogram force [Kgf]) was used for the analysis of GS data. The procedure of data collection was followed by all participants in both occasions. The same dynamometer was used for all testing.

Download English Version:

https://daneshyari.com/en/article/5864022

Download Persian Version:

https://daneshyari.com/article/5864022

Daneshyari.com