

RELIABILITY OF ANKLE-FOOT MORPHOLOGY, MOBILITY, STRENGTH, AND MOTOR PERFORMANCE MEASURES

John J. Fraser, PT, PhD, OCS¹
Rachel M. Koldenhoven, MEd, ATC¹
Susan A. Saliba, PT, PhD, ATC¹
Jay Hertel, PhD, ATC¹

ABSTRACT

Background: Assessment of foot posture, morphology, intersegmental mobility, strength and motor control of the ankle-foot complex are commonly used clinically, but measurement properties of many assessments are unclear.

Purpose: To determine test-retest and inter-rater reliability, standard error of measurement, and minimal detectable change of morphology, joint excursion and play, strength, and motor control of the ankle-foot complex.

Design: Reliability study.

Methods: 24 healthy, recreationally-active young adults without history of ankle-foot injury were assessed by two clinicians on two occasions, three to ten days apart. Measurement properties were assessed for foot morphology (foot posture index, total and truncated length, width, arch height), joint excursion (weight-bearing dorsiflexion, rearfoot and hallux goniometry, forefoot inclinometry, 1st metatarsal displacement) and joint play, strength (handheld dynamometry), and motor control rating during intrinsic foot muscle (IFM) exercises. Clinician order was randomized using a Latin Square. The clinicians performed independent examinations and did not confer on the findings for the duration of the study. Test-retest and inter-tester reliability and agreement was assessed using intraclass correlation coefficients ($ICC_{2,k}$) and weighted kappa (K_w).

Results: Test-retest reliability ICC were as follows: morphology: .80-1.00, joint excursion: .58-.97, joint play: -.67-.84, strength: .67-.92, IFM motor rating: K_w -.01-.71. Inter-rater reliability ICC were as follows: morphology: .81-1.00, joint excursion: .32-.97, joint play: -1.06-1.00, strength: .53-.90, and IFM motor rating: K_w .02-.56.

Conclusion: Measures of ankle-foot posture, morphology, joint excursion, and strength demonstrated fair to excellent test-retest and inter-rater reliability. Test-retest reliability for rating of perceived difficulty and motor performance was good to excellent for short-foot, toe-spread-out, and hallux exercises and poor to fair for lesser toe extension. Joint play measures had poor to fair reliability overall. The findings of this study should be considered when choosing methods of clinical assessment and outcome measures in practice and research.

Level of evidence: 3

Key Words: Assessment, examination, intrinsic foot muscles, manual therapy, repeatability

¹ Department of Kinesiology, University of Virginia, 210 Emmet Street South, Charlottesville, VA 22904-4407, USA

Conflicts of Interest: None

Disclosures: The views expressed in this article are those of the author(s) and do not necessarily reflect the official policy or position of the Department of the Navy, Department of Defense, or the United States Government. Lieutenant Commander John J. Fraser is a military service member and this work was prepared as part of his official duties. Title 17, USC, §105 provides that 'Copyright protection under this title is not available for any work of the U.S. Government.' Title 17, USC, §101 defines a U.S. Government work as a work prepared by a military service member or employee of the U.S. Government as part of that person's official duties.

Presented in part at the American Physical Therapy Association, Combined Sections Meeting, February 18, 2017, San Antonio, TX and is archived at [10.7490/f1000research.1114545.1](https://doi.org/10.7490/f1000research.1114545.1)

CORRESPONDING AUTHOR

John J. Fraser,
Warfighter Performance Department, Naval
Health Research Center, 140 Sylvester Road
San Diego, CA 92106
Phone: 757-438-0390
E-mail: john.j.fraser8.mil@mail.mil