Measuring Functional Range of Motion in Patients with Ankle Arthritis

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Category: Ankle Arthritis

Keywords: Ankle arthritis
Total ankle replacement
Ankle fusion
Ankle arthrodesis

Introduction/Purpose: Measurement of range of motion is an important outcome measure following ankle surgery. However, there is wide variation in its measurement: from clinical evaluation, to radiographic metrics, and gait analysis.
The purpose of this study was to present and validate a simple, standardized technique for measurement of function total range of motion between the tibia and the floor using a digital goniometer.

Methods: Institutional review board approval was obtained. Forty-five ankles from 33 participants were recruited into two groups.
Group 1 (Healthy controls), comprised 20 ankles from 10 participants. None had any musculoskeletal or neurological pathology.
Group 2 (Ankle osteoarthritis), comprised 25 ankles from 23 patients. Ankle pathology had been treated with ankle arthrodesis (n=5), total ankle replacement (n=6), and non-operative treatment (n=14).
Measurement was performed by two testers according to a standardized protocol developed for the Pivotal Total Ankle Replacement Versus Arthrodesis (TARVA) RCT. Intra- and inter-rater reliability was calculated using intra-class correlation coefficients.

Results: Group 1 (Healthy controls). The median difference for all measurements within an observer was 1.5 (IQR 0.7-2.5) degrees. The ICC for inter-rater total ankle range of motion was excellent 0.95 (0.91-0.97, 95% confidence interval, $p < 0.001$). The ICC for intra-rater total ankle range of motion was excellent 0.942 (0.859-0.977, 95% CI, $p < 0.001$).
Group 2 (Ankle osteoarthritis). The median difference for all measurements within an observer was 0.6 (IQR 0.2-1.3) degrees. The intra-class coefficient (ICC) for inter-rater total ankle range of motion was excellent 0.99 (0.97-1.0), 95% CI, $p < 0.001$). The ICC for intra-rater total ankle range of motion was 0.99 (0.96-1.0), 95% CI $p < 0.001$).

Conclusion: This technique provides a reliable, standardized method for measurement of total functional range of motion between the tibia and the floor. The technique requires no specialist equipment or training, and provides a valid functional assessment for patients with and without ankle osteoarthritis and also following treatment even with an ankle arthrodesis.

(a) The fibula line (centre of fibula head – lateral malleolus – floor) is marked on the limb. A second, parallel line is marked 2cm posterior, indicating the posterior border of goniometer (not required if a transparent goniometer is used).
(b) The subject is stood facing a wall with the knee straight. The goniometer is placed flat on the floor, with the vertical limb rested against the outer surface of the calf and the 5th metatarsal head, along the fibula line.
(c) Maximal tibia to floor dorsiflexion is measured in the lunge position.
(d) Maximal tibia to floor plantar flexion is measured from a seated position.

Foot & Ankle Orthopaedics, 1(1)
DOI: 10.1177/ 2473011416S00033