

## **Exploring a Modified Goniometric Measure of Hip Flexor Length Accounting for Pelvic Tilt**

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**PURPOSE:** The purpose of this study was to determine if pelvic tilt could be accounted for during the modified Thomas test (MTT) by comparing computer postural analysis software and an altered goniometric method to yield a more accurate measurement to utilize in the clinical setting.

**SUBJECTS:** A convenience sample of college and graduate students were recruited from two universities in Abilene, TX.

**METHODS:** Subjects received a verbal explanation of test procedures and then completed a PAR-Q, a photo release, and informed consent form. Subjects were led through a 10-minute lower body warmup. Markers 2.5 centimeters in diameter were placed over the greater trochanter, ASIS, PSIS, and lateral condyle of the femur. After a demonstration, subjects performed the MTT twice and were photographed during each trial. They were independently measured by two different investigators. To account for pelvic tilt, goniometric measurement was performed by placing the stationary arm on the intracristal line (halfway between the ASIS and PSIS) and the moving arm in line with the lateral femoral condyle. The measured angle was then validated by utilizing the Postural Analysis Software System (PASS) to compare a trigonometry-based calculation of the "true" hip-extension angle to the data that was collected by the investigators. Intraclass correlation coefficients (ICC) were calculated using SPSS Version 25 to establish the degree of agreement between the goniometric measurements acquired from each investigator and the "true" hip extension values analyzed using PASS.

**RESULTS:** Fifty-three subjects (M=17, F=36, age=  $22.32 \pm 2.08$  years) completed the investigation. Based on the 95% confidence interval of the ICC estimate, the single measure agreement between the altered goniometric measurement and computerized postural analysis was ICC=0.779-0.875. These results indicate that the two methods had excellent agreement.

**CONCLUSIONS:** Our findings suggest that the altered goniometric method accounting for pelvic tilt is a valid measure for quantifying true hip extension in the MTT position when compared the postural analysis software. Further research would be beneficial in exploring variables affecting the reliability of goniometric measurements. This would include comparing subjects of varying hip/thigh circumferences, increasing the number of raters, and testing a larger sample size.

**CLINICAL RELEVANCE:** Evidence suggests that the modified Thomas test is not a valid measure for hip extensibility unless one accounts for pelvic tilt. Therefore, the altered goniometric method provides a new, valid measure that can be reproduced in the clinic. Further research is needed to establish the parameters that constitute a hip flexion contracture based on passive range of motion.