

# Measurement Reliability of Anterior Translation of the Knee Using a Digitally Instrumented Arthrometer

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## Introduction

- Measurement reliability is important when new sports-medicine devices or techniques are developed.
- To assess anteroposterior knee joint motion and laxity, the Blue Bay Knee Arthrometer, equipped with a touchscreen electronic interface, reproduces the measurement capability of the KT-1000 and KT-2000 devices (Medmetric Corporation, San Diego, CA).
- Objective and reliable assessment data of normal anterior knee translation is critical before comparison with an injured ACL knee can be made.

## Purpose of Study

To determine the reliability of anterior translation measurements obtained from an instrumented knee arthrometer.

## Methodology

- Both right and left knees of 20 participants (12 men, 8 women; age  $22.5 \pm 2.6$  years; mass  $81.6 \pm 24.3$  kg; height  $173.1 \pm 12.4$  cm) with no history of ACL injury were tested.
- Testing was conducted using the Blue Bay Knee Arthrometer (Blue Bay Medical, Navarre FL) that detects motion between two sensor pads, one in contact with the patella and the other in contact with the tibia approximately 10 cm distal to the joint line.
- With the subject lying supine, the examiner used a thigh support to position both knees in 20 to 25 degrees of knee flexion with the feet secured in a support.



- With a force-sensing handle, the examiner applied an anterior load and an audible “beep” sounded when a 67-N (15 lb.) and 89-N (20 lb.) force was applied through the force handle. A manual maximum test was performed and measured total anterior displacement.
- The touchscreen electronic interface allowed the examiner to visualize and record the applied loads and resultant translations.



- The test-retest procedure involved the examiner positioning the arthrometer, measuring and recording knee anterior translation, removing the instrument, and repeating the measurements. Three measurements were recorded for each test-retest trial and the greatest amount of translation achieved was used in the statistical analysis.

## Main Outcome Measures

- Intraclass correlation coefficients (ICC 2,1) determined intratester reliability for the instrumented measurement of anterior translation (millimeters) at 67-N, 89-N, and manual maximum loads.
- The standard error of measurement (SEM) was calculated to provide an estimate of measurement precision.

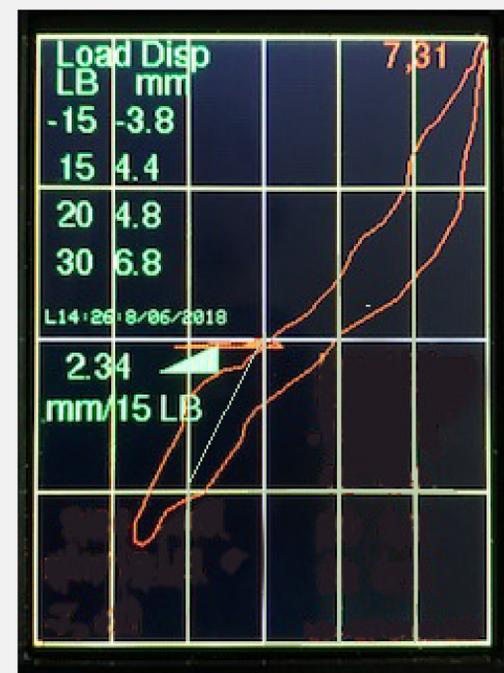


Figure : Load-Displacement Curve

## Results

- Excellent Intraclass Correlations of intratester reliability and high precision of anterior knee translation (SEM) were observed ( $n = 40$ ).

Load	ICC (2,1)	95% CI	SEM
67-N (15 lb.)	.933	.877 - .964	.37 mm
89-N (30 lb.)	.935	.880 - .965	.41 mm
Manual Maximum	.922	.858 - .958	.38 mm

- Trial Means ( $\pm$  SD) and 95% confidence interval limits for anterior translation of the knee ( $n = 40$ ).

Load	Trial 1	Trial 2	95% CI
67-N (15 lb.)	4.88 $\pm$ 2.0 mm	4.87 $\pm$ 1.9 mm	4.43 – 5.31 mm
89-N (30 lb.)	6.16 $\pm$ 2.2 mm	6.20 $\pm$ 2.2 mm	5.69 – 6.67 mm
Manual Maximum	8.04 $\pm$ 2.0 mm	8.13 $\pm$ 1.8 mm	7.77 – 8.50 mm

## Conclusions

- The results are clinically useful in providing information about reliability and objective measures at different force loads for reproducible anterior knee-translation measurement using the Knee Arthrometer.
- We believe a clinician and/or researcher can use the Blue Bay Knee Arthrometer to obtain objective and reliable measurements.