INTRODUCTION:
Clinical assessment after injury to the knee is dependent on the experience of the examiner. Instrumentation can help to eliminate inexperience. The use of instrumentation for the Lachman test has proven to be reliable (KT-1000 knee arthrometer®), MEDmetric corporation, San Diego, CA; Rolimeter™, Aircast, Summit, NJ1 and useful in evaluating knee biomechanics, however, no instrumented test is available to aid in the assessment of rotational knee laxity. The objective of this study was to evaluate the reliability of a new device for the non-invasive assessment of rotational stability of the knee.

METHODS:
Rotational Knee Laxity Measurement Device
The rotational knee laxity measurement device consists of an Aircast Foam Walker™ (Aircast, Summit, NJ) instrumented with a 6-degree of freedom (DOF) universal force moment sensor (UFS-Model 4015; JR3 INC, Woodland, CA) mounted to the sole, and a handle bar that allows the clinician to apply moments through the UFS. A level bubble attached to the handle bar provided feedback to the examiner during initial registration. A magnetic tracking system, Nest of Birds (NOB, Ascension Technologies, Inc, Burlington, VT) was used to record the motion of the tibia with respect to the femur Figure 1. NOB simultaneously tracks the position and orientation of two sensors, providing high speed, accurate tracking data. The sensors can record six DOF (position and orientation) of motion with an accuracy of <1.8 mm RMS for position and <0.5º RMS for orientation (www.ascension-tech.com). One sensor was mounted to the femur and one to the tibia to record their relative kinematics. The kinematic data was sent to a PC where a custom program displayed and recorded the positions, loads, and moments during experimental testing (Matlab, The MathWorks, Natick, MA).

RESULTS:
Internal and external rotation of the tibia with respect to the femur (Figure 1). NOB simultaneously tracks the position and orientation of two sensors, providing high speed, accurate tracking data. The sensors can record six DOF (position and orientation) of motion with an accuracy of <1.8 mm RMS for position and <0.5º RMS for orientation (www.ascension-tech.com). One sensor was mounted to the femur and one to the tibia to record their relative kinematics. The kinematic data was sent to a PC where a custom program displayed and recorded the positions, loads, and moments during experimental testing (Matlab, The MathWorks, Natick, MA).

DISCUSSION:
This study introduced a new device for the measurement of rotational knee laxity. Using highly accurate technology of UFS and NOB, this study successfully showed high intra and inter-observer reliability as measured by intra-class correlation coefficients over five cycles of motion utilizing the new measurement device. Furthermore, this study reported an average range of rotational motion that correlates with the literature1. Limitations of this study include the small number of specimens tested and old age of specimens. We could obtain more accurate measurements of rotation if moments were applied directly to the tibia, but our goal was to assess the reliability of a noninvasive device. Future studies will include further cadaveric studies to assess the ability of the device in detecting differences between ACL competent and deficient knees as well as differences between single bundle and double bundle ACL reconstructions in rotational laxity. A human trial is planned to assess reliability in vivo and then to evaluate rotational stability in patients with cruciate ligament injuries and reconstructions.

REFERENCES:

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