Development Of Lachman-O-Meter To Detect Anterior Cruciate Ligament Injury

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INTRODUCTION:

The Lachman test is a widely used clinical examination for diagnosing anterior cruciate ligament (ACL) injuries, though its accuracy depends on examiner expertise [1]. This study evaluates the diagnostic effectiveness of a newly developed arthrometer prototype, the Lachman-O-Meter, in assessing ACL injuries.

METHODS:

An experimental study used a synthetic knee model with rubber bands (Figure 1) simulating an intact ACL and varying degrees of injury (mild, moderate, and complete tears). The Lachman-O-Meter's interrater reliability was compared with manual examination, while its diagnostic accuracy was assessed based on sensitivity, specificity, and overall accuracy [2].

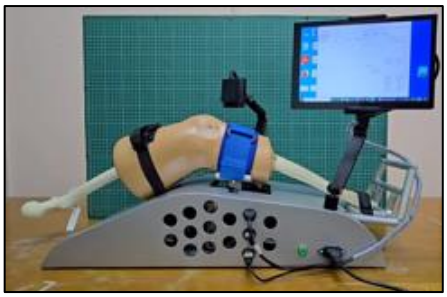

Figure 1. Prototype Lachman-O-Meter with synthetic knee model

RESULTS:

The Lachman-O-Meter demonstrated high interrater reliability with manual examination for complete ACL tears, mild tears, and intact ACLs (Table 1). Interestingly, lower interrater reliability for moderate ACL tears suggested its sensitivity to subtle changes, highlighting its ability to detect minimal tibial translation as low as 0.33 mm.

Table 1. Interrater reliability results

ACL tear	Cohen's kappa coefficient	95% CI
Complete	0.80	0.29 – 1.22
Moderate	0.43	0.33 – 0.53
Mild	1.00	0.53 – 1.00
Intact	0.90	0.53 – 1.00

Table 2 illustrates the accuracy, sensitivity, and specificity of Lachman-O-Meter in diagnosing complete ACL tear, moderate ACL tear and mild ACL tear.

Table 2. Diagnostic accuracy results

ACL tear	Accuracy (95% CI)	Sensitivity (95% CI)	Specificity (95% CI)
Complete	0.65 (0.45 – 0.65)	0.30 (0.10 – 0.30)	1.00 (0.80 – 1.00)
Moderate	0.75 (0.51 – 0.75)	1.00 (0.52 – 1.00)	0.67 (0.51 – 0.67)
Mild	1.00 (0.76 – 1.00)	1.00 (0.76 – 1.00)	1.00 (0.76 – 1.00)

DISCUSSIONS:

The study supports the reliability and objectivity of Lachman-O-Meter in diagnosing ACL injuries, particularly in early-stage detection and post-surgical monitoring. By quantifying anterior tibial translation, the device minimizes examiner bias. However, its lower sensitivity for complete ACL tears suggests the need for further refinement.

CONCLUSION:

Lachman-O-Meter is an effective tool to be used in the diagnosis of complete ACL tear, moderate ACL and mild ACL tear.

REFERENCES:

1. Sokal P et. al. KSST. 2022; 30(10):3287-3303.
2. Soudbakhsh D et. al. J Biomed. Appl. 2011;23(3):181-192.