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Evaluation of Multiligament Knee Injuries: Correlation Between Diagnostic Methods

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- Pedro HSAF Galvão[1,2]: No conflicts of interest to disclose.
- Enzo S Mameri[1,3]: No conflicts of interest to disclose.
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Evaluation of Multiligament Knee Injuries: Correlation Between Diagnostic Methods

BACKGROUND

- MLKI: complex condition; challenging in Dx and Rx.
- Correlation between PE and objective diagnostic tools like MRI and instrumented stability tests remains unclear in MLKI

OBJECTIVES

- Assess the reliability of PE tests in MLKI
- Evaluate the validity of PE relative to instrumented stability methods and MRI findings

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METHODS

- **Design**: Trans-sectional Diagnostic Study. 46 MLKI Patients (2020-2024)
- **PE**: Standardized maneuvers by five knee surgeons
- **Instrumented Stabi**lity: Digital Rollimeter, Varus-Valgus and Posterior Stress Radiographs
- **MRI**: Evidence of structural ligament tear

OUTCOMES

- Inter-rater Reliability for each physical examination test (Kendall's W)
- Validity relative to Instrumented Stability and MRI (Cohen's Kappa)

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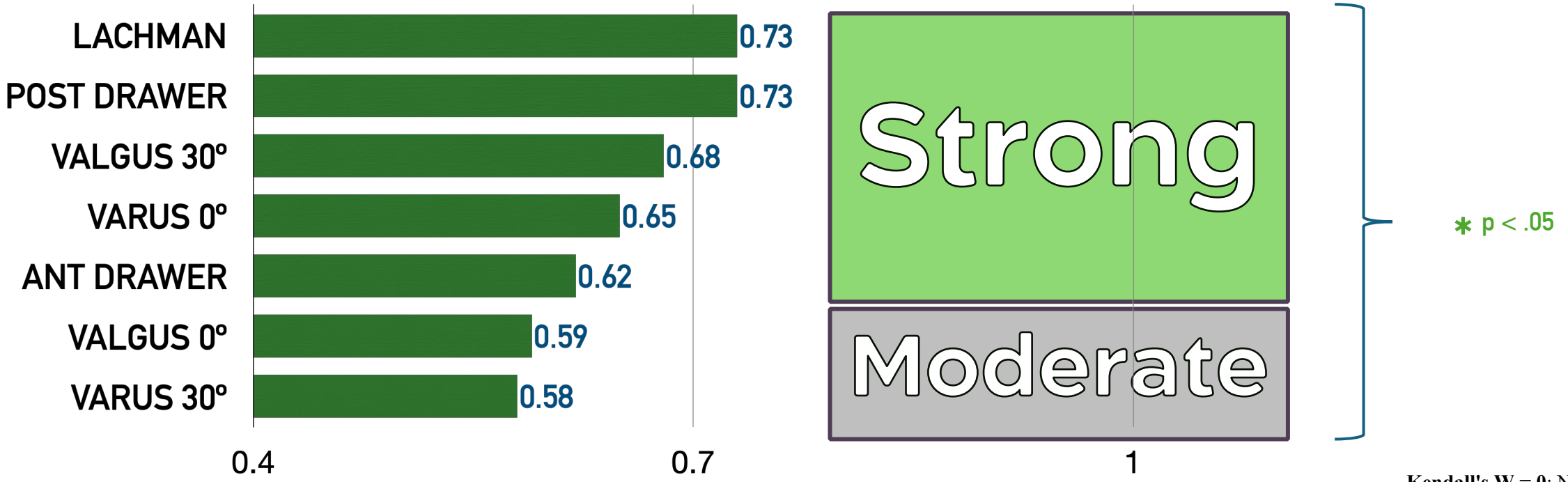
RESULTS

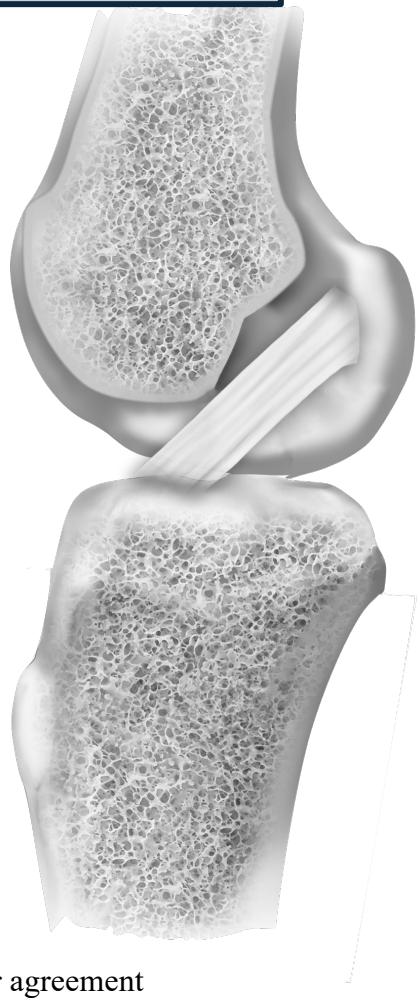
PHYSICAL EXAMINATION INTER-RATER RELIABILITY



Kendall's W = 0: No agreement.
0 < W < 0.2: Weak agreement.
0.2 ≤ W < 0.4: Fair agreement.
0.4 ≤ W < 0.6: Moderate agreement.
0.6 ≤ W < 0.8: Strong agreement.
0.8 ≤ W < 1: Very strong agreement.
Kendall's W = 1: Perfect agreement.

RESULTS

ACL



Kappa:
<0 Poor agreement
0.0-0.20 Slight agreement
0.21-0.40 Fair agreement
0.41-0.60 Moderate agreement
0.61-0.80 Substantial agreement
0.81-1.0 Almost perfect agreement

Anterior Drawer

SLIGHT AGREEMENT vs Rollimeter (ATT SSD >3 mm): K 0.078, p 0.95

Kappa value not statistically significant.
The observed agreement could plausibly be due to chance.

MODERATE AGREEMENT vs MRI evidence ACL tear: K 0.476, p <0.01

Lachman

SLIGHT AGREEMENT vs Rollimeter (ATT SSD >3 mm): K 0.148, p 0.71

Kappa value not statistically significant.
The observed agreement could plausibly be due to chance.

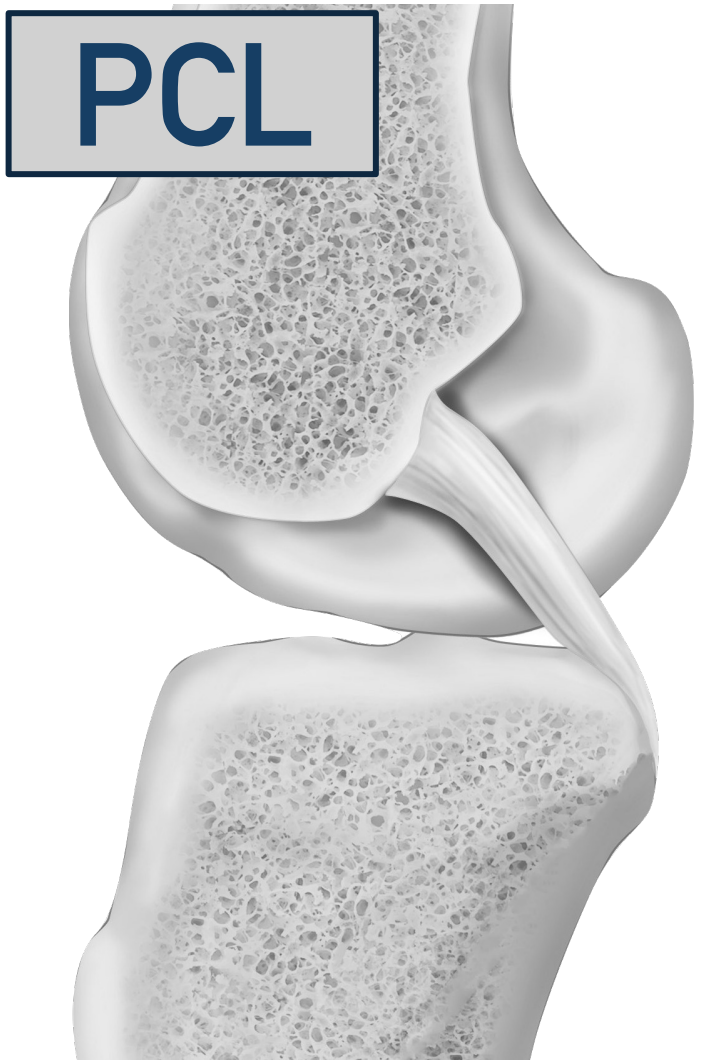
FAIR AGREEMENT vs MRI evidence ACL tear: K 0.380, p <0.001

Rollimeter vs MRI

SLIGHT AGREEMENT ATT SSD >3 mm vs MRI evidence ACL tear: K 0.03, p 0.903

Kappa value not statistically significant.
The observed agreement could plausibly be due to chance.

RESULTS



Posterior Drawer

MODERATE AGREEMENT vs Posterior Stress Radiograph (SSD ≥8 mm):
K 0.532, p < 0.001

MODERATE AGREEMENT vs MRI evidence PCL tear:
K 0.476, p <0.001

Posterior Stress Radiograph vs MRI

FAIR AGREEMENT PTT SSD ≥8 mm vs MRI evidence PCL tear:
K 0.24, p 0.903

Kappa value not statistically significant.
The observed agreement could plausibly be due to chance.

Kappa:
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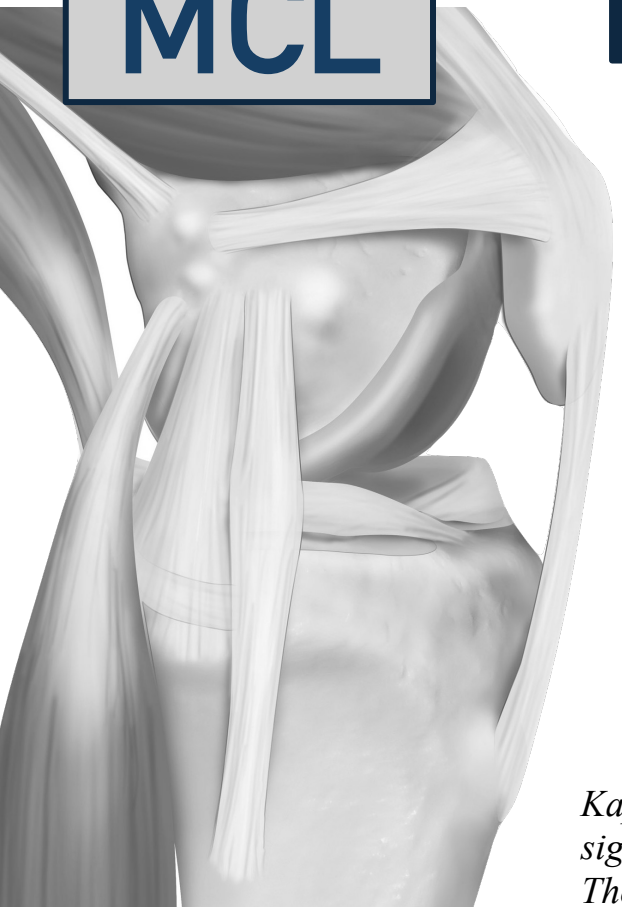
RESULTS

MCL



Valgus Stress 30°

Kappa value is not statistically significant.
The observed agreement could plausibly be due to chance.

SLIGHT AGREEMENT vs Valgus Stress Radiograph (SSD ≥3.2 mm): K 0.054, p 0.85

FAIR AGREEMENT vs MRI evidence MCL tear: K 0.238, p 0.08

Valgus Stress 0°

Kappa value not statistically significant.
The observed agreement could plausibly be due to chance.

SLIGHT AGREEMENT vs Valgus Stress Radiograph (SSD ≥9.8 mm): K 0.164, p 0.83

FAIR AGREEMENT vs MRI evidence MCL+POL tear: K 0.282, p 0.21

Kappa value not statistically significant.
The observed agreement could plausibly be due to chance.

Valgus Stress Radiograph vs MRI

SLIGHT AGREEMENT SSD ≥3.2 mm vs MRI evidence MCL tear: K 0.15, p 0.33

MODERATE AGREEMENT SSD ≥9.8 mm vs MRI evidence MCL+POL tear: K 0.47, p 0.191

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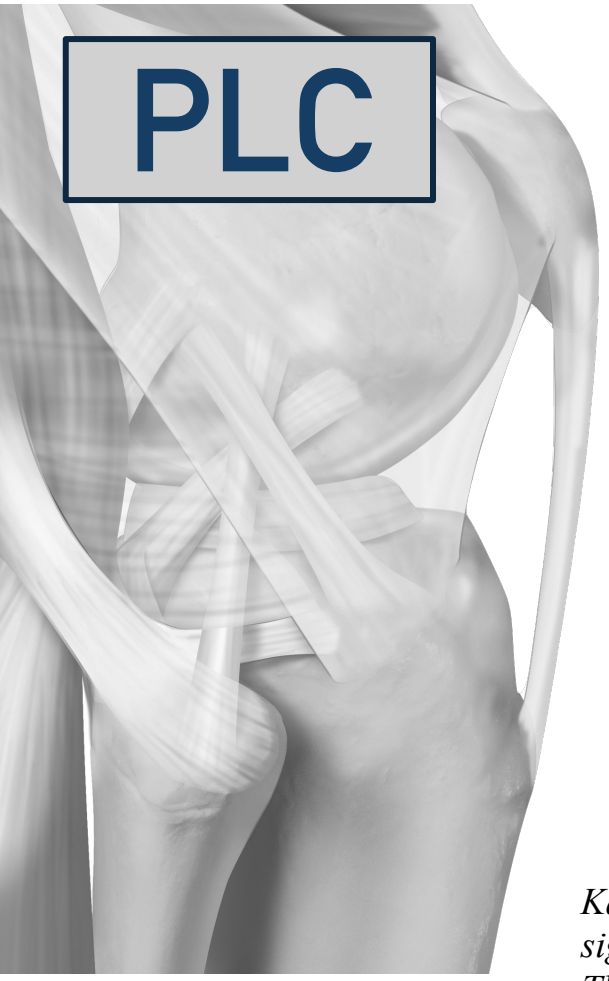
RESULTS



Varus Stress 30°

Kappa value not statistically significant.
The observed agreement could plausibly be due to chance.

SLIGHT AGREEMENT vs Varus Stress Radiograph (SSD ≥2,0 mm): K 0.118, p 0.42

SLIGHT AGREEMENT vs MRI evidence FCL tear: K 0.14, p 0.47

Varus Stress 0°

FAIR AGREEMENT vs Varus Stress Radiograph (SSD ≥4.0 mm): K 0.348, p <0.001

FAIR AGREEMENT vs MRI evidence PLC tear: K 0.228, p 0.15

Kappa value is not statistically significant.
The observed agreement could plausibly be due to chance.

Kappa value not statistically significant.
The observed agreement could plausibly be due to chance.

Varus Stress Radiograph vs MRI

FAIR AGREEMENT SSD ≥2.0 mm vs MRI evidence FCL tear: K 0.26, p 0.204

FAIR AGREEMENT SSD ≥4.0 mm vs MRI evidence PLC tear: K 0.32, p 0.153

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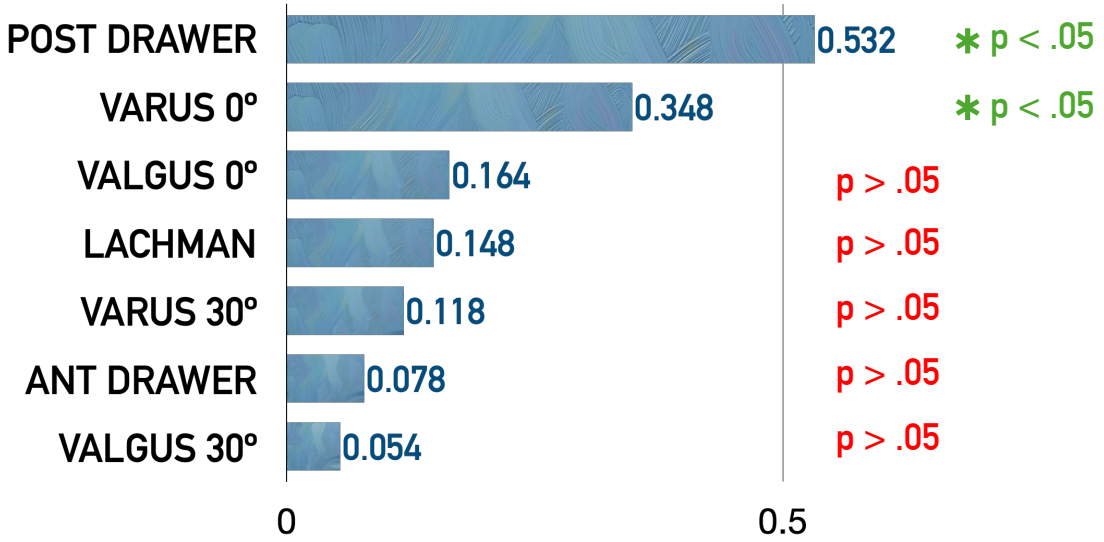
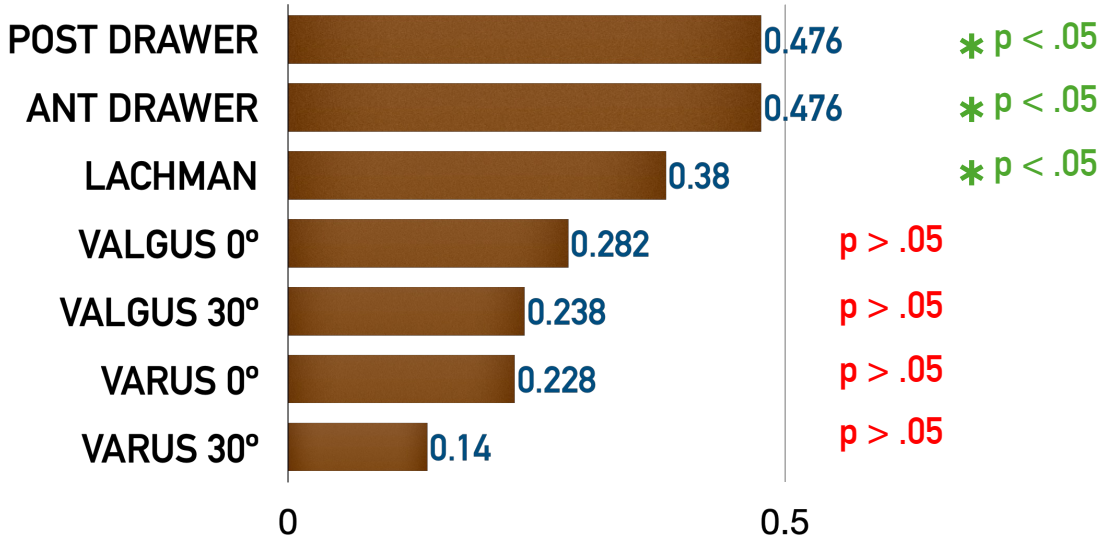
KEY TAKEAWAYS

PHYSICAL EXAM vs INSTRUMENTED STABILITY



POSTERIOR DRAWER AND VARUS 0° STRESS TESTS BETTER CORRELATE WITH INSTRUMENTED STABILITY MEASUREMENTS

PHYSICAL EXAM vs MRI



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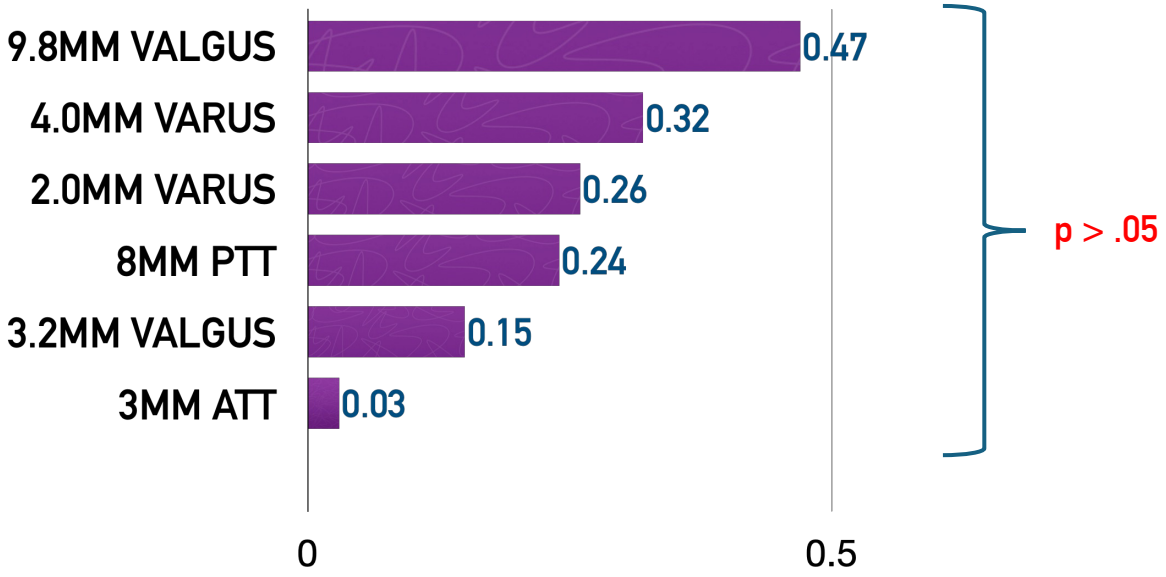
POSTERIOR DRAWER, ANTERIOR DRAWER, AND LACHMAN TESTS BETTER CORRELATE WITH MRI EVIDENCE OF STRUCTURAL TEAR

KEY TAKEAWAYS

INSTRUMENTED STABILITY vs MRI



VARIABLE (SLIGHT TO MODERATE) AGREEMENT BETWEEN MRI AND INSTRUMENTED STABILITY COULD PLAUSIBLY BE DUE TO CHANCE (all p > .05)

Kappa:
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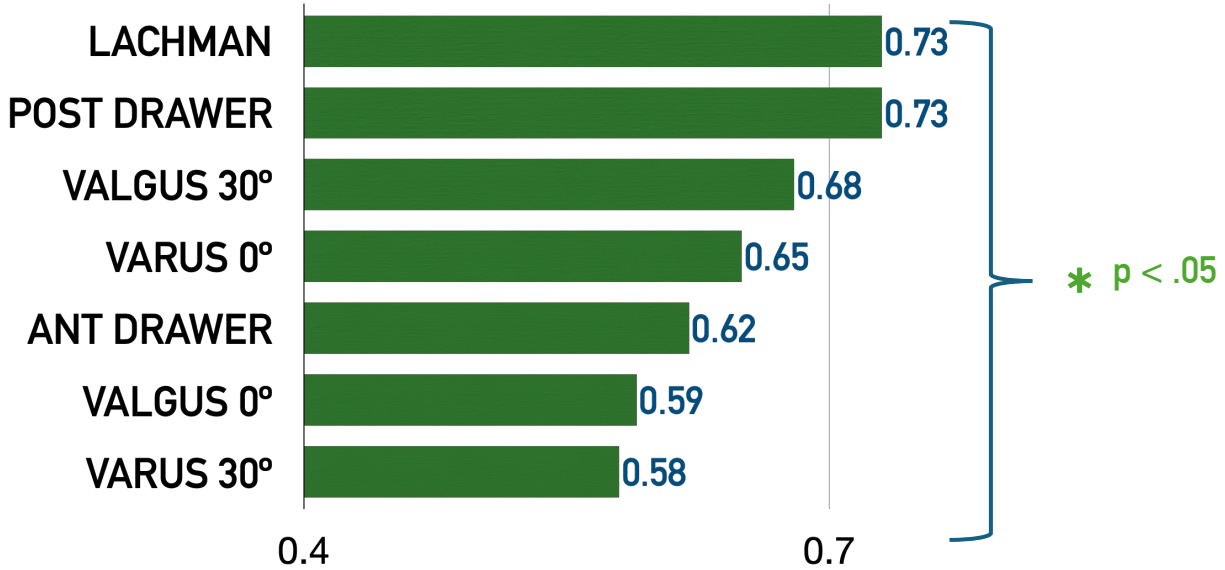
PHYSICAL EXAMINATION INTER-RATER RELIABILITY



PHYSICAL EXAMINATION TESTS PRESENT MODERATE TO STRONG INTER-RATER RELIABILITY

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Kendall's W = 1: Perfect agreement.

CONCLUSION

PE:

- Reliable;
- Valuable for initial assessment, but should be used with other diagnostic modalities

Objective Measures:

- Lack of strong correlation highlights the complexity of MLKI diagnosis;
- Collateral Ligament injuries may correlate poorly, particularly with MRI

Further Research:

- Need to understand discrepancies, develop accurate diagnostic classifications and therapeutic algorithms

REFERENCES

1. Moatshe, G., Chahla, J., LaPrade, R. F., & Engebretsen, L. (2017). Diagnosis and treatment of multiligament knee injury: state of the art. **Journal of ISAKOS: Joint Disorders & Orthopaedic Sports Medicine**, 2(3), 152-161.
2. Jackman, T., LaPrade, R. F., Pontinen, T., & Lender, P. A. (2008). Intraobserver and interobserver reliability of the kneeling technique of stress radiography for the evaluation of posterior knee laxity. **The American journal of sports medicine**, 36(8), 1571-1576.
3. LaPrade, R. F., Heikes, C., Bakker, A. J., & Jakobsen, R. B. (2008). The reproducibility and repeatability of varus stress radiographs in the assessment of isolated fibular collateral ligament and grade-III posterolateral knee injuries: an in vitro biomechanical study. **JBJS**, 90(10), 2069-2076.
4. LaPrade, R. F., Bernhardson, A. S., Griffith, C. J., Macalena, J. A., & Wijdicks, C. A. (2010). Correlation of valgus stress radiographs with medial knee ligament injuries: an in vitro biomechanical study. **The American journal of sports medicine**, 38(2), 330-338.
5. Jung, T. M., Reinhardt, C., Scheffler, S. U., & Weiler, A. (2006). Stress radiography to measure posterior cruciate ligament insufficiency: a comparison of five different techniques. **Knee Surgery, Sports Traumatology, Arthroscopy**, 14(11), 1116-1121.
6. Schulz, M. S., Russe, K., Lampakis, G., & Strobel, M. J. (2005). Reliability of stress radiography for evaluation of posterior knee laxity. **The American journal of sports medicine**, 33(4), 502-506.
7. Jackman, T., LaPrade, R. F., Pontinen, T., & Lender, P. A. (2008). Intraobserver and interobserver reliability of the kneeling technique of stress radiography for the evaluation of posterior knee laxity. **The American journal of sports medicine**, 36(8), 1571-1576.
8. Ganko, A., Engebretsen, L., & Ozer, H. (2000). The rolimeter: a new arthrometer compared with the KT-1000. **Knee Surgery, Sports Traumatology, Arthroscopy**, 8(1), 36-39.