groups of lateral meniscal disorders: 1) torn DLM (Group A; N=52; mean age, 29.6 ± 15.6 years), 2) lateral meniscal tear without subluxation (Group B; N=114; mean age, 38.6 ± 12.6 years), 3) lateral meniscal tear with subluxation (Group C: N=27; mean age, 27.6 ± 12.8 years), 4) normal menisci (Group D: N=50; mean age, 24.0 ± 13.7 years). The popliteal hiatus width and the ratio between the popliteal hiatus and the lateral tibial plateau were measured on both the coronal and sagittal planes on preoperative MRI for all groups. The comparisons of preoperative popliteal hiatus width on MRI were performed among the repair group around the popliteal hiatus (N=69), the repair group but not around the popliteal hiatus (N=33), and partial meniscectomy group (N=91).

Results: The coronal and sagittal popliteal hiatus widths from group A (coronal: 3.8mm ± 3.8, sagittal: 2.6mm ±2.0), group B (coronal: 1.9mm ± 1.5, sagittal: 1.8mm ± 1.4), and group C (coronal: 2.0mm ± 1.5, sagittal:1.8mm ± 1.3) were significantly different compared with those of group D (coronal:1.1mm ± 0.9, sagittal: 1.0mm ± 1.2) (P<0.05). Significant differences in the coronal and sagittal widths of the popliteal hiatus were observed between group A and B along with group A and C (P<0.05), while there were no differences between groups B and C. Considering popliteal hiatus width of >5mm as positive, the group A patients showed the highest incidence of positive findings (26.9%), while only 5.3%, 3.7%, and 0% of patients were found to be positive in group B, C, and D, respectively. Furthermore, the coronal and sagittal popliteal hiatus widths on preoperative MRI in patients who underwent arthroscopic meniscus repair around the popliteal hiatus (coronal: 3.2mm ± 3.5, sagittal: 2.4mm ± 1.8) were significantly larger than those in patients who underwent partial meniscectomy (coronal: 2.0mm ± 1.4, sagittal:1.9mm ± 1.5) and arthroscopic meniscus repair not around the popliteal hiatus (coronal: 1.8mm ± 1.8, sagittal: 1.6mm ± 1.3). Conclusion: Patients with unstable tears on the DLM and LM showed a large popliteal hiatus width that should be carefully evaluated for meniscus repair around the popliteal hiatus.

Category: Knee - Ligaments (Not ACL)

Clinical Outcomes after Multi-Ligamentous Knee Injuries in Patients Over 40-Years-Old at Average 4-Years Follow-Up

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Summary:
The purpose of this study is to investigate outcomes following surgical treatment of multi-ligamentous knee injuries in patients who were at least 40-years-old at the time of injury, using descriptive statistics and multiple regression to identify predisposing factors to patient-reported outcomes.

Data:
Purpose: Multi-ligamentous knee injuries (MLKIs) are typically caused by high-energy mechanisms that warrant complex clinical decision-making and operative management to achieve optimal outcomes for patients. There is limited literature regarding these rare presentations, with even less information examining the clinical outcomes with respect to the age at which the injury was sustained. The purpose of this study is to investigate clinical outcomes following surgical treatment of MLKIs in patients who were at least 40-years-old at the time of their injury. Methods: The study design was a multi-center retrospective cohort study. Forty-four patients who underwent surgical repair for MLKI from May 2013 to August 2021 and were at least 40-years-old at the time of their injury were identified from two separate institutions. Patients-reported outcomes assessed included International Knee Documentation Committee Subjective Knee (IKDC), Subjective Knee Form, the Lysholm Knee Score, the Tegner Activity Scale (TAS), return-to-sport and return-to-work surveys, and Visual Analogue Scale (VAS) for pain and satisfaction. A multiple regression model was used to quantify the impact of various factors related to the initial injury, including age, sex, BMI, time of follow-up, history of dislocation with injury, and mechanism of injury on the assessed outcome measures. Results: The mean age of the cohort was 48.1 ± 7.0 years old. The mean overall follow-up was 60.8 months ± 36.3 (range 12-167). This cohort reported the following: mean IKDC of 63.4 ± 23.5, mean Lysholm score of 72.6 ± 23.6, and mean Tegner scores of 6.3 ± 2.2 before injury and 4.0 ± 2.0 at the time surveyed. These scores align similarly to the literature, indicating mediocre daily functional status. There were 18 patients that reported engagement in sports, with only 5 returning at a mean of 55.5 (± 26.2) weeks.

The multiple linear regression model found dislocation to have a coefficient of -22.17 in relation to IKDC (p = 0.009), indicating that prior dislocation would predict a significant functional detriment as measured by the IKDC. A similar regression model with the Lysholm score as the outcome variable found dislocation to have a coefficient of -19.18 (p=0.053), approaching significance. None of the other included variables were found to be significantly predictive of poorer outcome measures (p > 0.05), including age. Conclusions: These results demonstrate that age may not be a significant factor to consider with respect to operative management in patients over 40 years old. Instead, dislocation status was found to be a much more significant predictor of clinical outcomes following operative management of MLKIs. Further research should be directed toward understanding which predisposing factors affect the long-term outcomes of MLKI injuries, given the often random nature of their presentation.

Category: Knee - Ligaments (Not ACL)

Partial Superficial MCL Combined With Complete Deep MCL Injury Results In Increased Anteromedial Laxity And Increased Forces On The ACL – A Cadaveric Biomechanical Study

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Summary:
In this in vitro biomechanical study, the sMCL was the primary restraint of valgus laxity, with the dMCL being the primary restraint of external rotation in extension. Both the dMCL and sMCL were co-primary restraints of anteromedial rotation. The addition of a partial sMCL injury resulted in increased valgus laxity, AMR and increases in ACL forces.

Data:
Introduction: Recent studies have highlighted the importance of the deep and superficial MCL (dMCL and sMCL respectively) in controlling anteromedial rotation (AMR). Conflicting data exists as to which of these structures is most important, and no data exists that determines the impact of a combined dMCL and partial sMCL (parsMCL) injury. The purpose of this study was therefore to evaluate knee kinematics and in situ ligament forces during simulated clinical laxity tests following sMCL and dMCL sectioning in ACL intact and deficient knees. We hypothesized that the dMCL has a role in controlling AMR, with the sMCL having a greater role in controlling valgus rotation (VR). Furthermore, a combined dMCL and parsMCL injury would result in increased AMR and increased ACL graft forces. Methods: Testing was performed on 16 cadaveric knee specimens. Three distinct cutting protocols were used. 1 (n=8) - ACL/ dMCL/parsMCL/sMCL; 2 (n=4) - ACL/sMCL/dMCL; 3 (n=4) - dMCL/parsMCL/ sMCL/ACL. The responses of each specimen to VR (8 Nm), external rotation (ER), (4 Nm) and AMR (combined anterior-directed force (89 N) and external torque (4 Nm)) tests at 0°, 30°, 60°, 90° of flexion were recorded while intact and after each cutting stage. Joint kinematics were re-applied, allowing for in situ ligament forces to be measured. Sample sizes were determined to detect differences of 1° or 5% between states with 80% power and 95% confidence. Results: In ACL deficient knees, an isolated dMCL resulted in a small increase in VR (<1.5°). The addition of parsMCL caused a significant increase in VR (2.1° +/−0.4°, p = 0.006). When the ACL was intact, parsMCL injury caused a small (1.4°) increase in VR. A small increase in ER was observed with isolated dMCL injury in ACL deficient knees at all flexion angles, showing statistical significance at 0° (1.7° +/−1.7°, p = 0.047) and 90° (1.5° +/−1.3°, p = 0.016). ParsMCL injury created a larger statistically significant increase in ER at 30°, 60°, and 90° of flexion. With the ACL intact, dMCL transection caused a small increase in ER at 60° (0.3° +/−0.2°, p = 0.012), with no significant effect from parsMCL. In ACL
deficient knees, dMCL transection resulted in an increase in AMR, with statistically significant differences at 0° (1.9° ± 1.9°, p = 0.039) and 90° (2.4° ± 2.4°, p = 0.037) of flexion. Further parsMCL injury resulted in a larger statistically significant increase in AMR (ranging from 2.7° to 4.0°). A significant increase in ACL load was observed during VR and ER following dMCL injury. Subsequent parsMCL injury resulted in a 250% increase in ACL loading during VR.

Conclusion: In combined ACL/MCL injury, the dMCL is the primary restraint of ER and AMR in extension, parsMCL causes significant joint laxity in VR and ER (>30° flexion), and both the dMCL and sMCL are co-primary restraints of AMR in flexion. Combined dMCL and parsMCL injury results in load being transferred to the ACL. This could result in higher ACL graft forces post ACL reconstruction that could lead to graft failure.