00177 Simultaneous Multi-ligament Knee Strain Measurement: Post-ACL Injury Analysis of PCL, MCL and LCL Under Internal Rotation

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Aims: The objective of this study is to determine the strain changes on Posterior Cruciate Ligament(PCL), MCL and Lateral Collateral Ligament(LCL) after ACL is cut.

Methodology: Eight porcine knee specimens were used for this study and fitted on a mechanical tester with the ability to apply a constant torque while allowing flexion-extension. Differential variable reluctance transducers (DVRT) were used to measure the strain of all four ligaments of the knee during 0Nm, 1.5Nm and 3Nm internal torque through 30 to 120 degrees flexion. ACL was subsequently cut and the strain profiles of the remaining three ligaments were analysed and compared.

Result: The strain profile showed an increased strain on the ACL upon flexion at all applied internal torque and is consistently most strained amongst all four ligaments. MCL strain decreases across flexion and internal torque applied. PCL showed reciprocity with ACL. LCL was consistently unengaged in all conditions of the experiment. After ACL is cut, analysis showed no change in strain profile of MCL at 0Nm internal torque to the state before ACL injury while experiencing significant increased strain when loaded with 1.5Nm and even higher strain when loaded with 3Nm internal torque. It is also noteworthy that due to anterior translation of the tibia bone after ACL is cut, PCL assumed a loose state which produced a significant drop in strain value with the lowest strain occurring at approximately 65 degrees. PCL trend uniformly increases with increasing internal torque applied.

Conclusion: MCL is only engaged and resist internal rotation after ACL is cut. Therefore MCL is likely the next ligament to confer internal rotation stability after ACL is injured thus supporting the high frequency of ACL plus MCL injury pattern in MLKI. PCL trend suggest increasing engagement with increasing applied torque. LCL is not engaged in internal torque under all flexion angle.