

The Effect of Knee Flexion Angle During Graft Fixation on Tibiofemoral Joint Kinematics for Anterolateral Procedures when Combined with Anterior Cruciate Ligament Reconstruction

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Summary:

This work showed that an isolated ACL reconstruction leaves residual laxity in treatment of combined ACL plus anterolateral injury, and that the laxity is abolished in anterior drawer by both modified Lemaire and anterolateral ligament reconstruction, while internal rotation laxity was also abolished by the modified Lemaire when tensed at 0-60° flexion and the ALL when tensed at 0° flexion.

Abstract:

Background: Injuries to the anterolateral complex (ALC) may leave residual laxity if only intra-articular ACL reconstruction is undertaken. Although there is an increasing interest in combining anterolateral procedures with ACL reconstruction, important aspects of these procedures such as the effect of knee flexion angle during graft fixation are unknown. The aim of the current study was therefore to determine how knee flexion angle during graft fixation affects tibiofemoral joint (TFJ) kinematics for a modified Lemaire tenodesis (Lemaire) and an anterolateral ligament (ALL) procedure – both combined with ACL reconstruction – in eliminating any residual laxity.

Methods: In a controlled laboratory study, twelve cadaveric knees were mounted in a test rig with TFJ kinematics recorded from 0° - 90° knee flexion using an Optical Tracking System. The following loads were applied: 90-N anterior-posterior tibial forces, 5-Nm internal tibial rotation torques, and combined 90-N anterior force and 5-Nm internal rotation torque. Intact, ACL-deficient and anterolateral-deficient states were tested before a B-PT-B ACL reconstruction was performed. Thereafter Lemaire tenodeses and ALL reconstructions were performed in a randomised order with graft fixation at 0°, 30° and 60° of knee flexion with 20-N tension. Repeated measures ANOVA and Bonferroni-adjusted t tests were used for statistical analysis.

Results: In the combined ACL and anterolateral deficient state, the isolated ACL reconstruction left residual laxity for both anterior translation and internal rotation (Both: $P < 0.05$). Anterior translation was restored for all combinations of ACL and anterolateral procedures (All: $P > 0.05$). For internal rotation the Lemaire tenodesis reduced laxity overall as compared to the combined ACL and ALC injured state ($P < 0.05$) – such that it was not greater than the intact knee laxity regardless of knee flexion angle at graft fixation ($P > 0.05$). The ALL procedure did not reduce the overall internal rotation laxity below that with isolated ACL reconstruction ($P > 0.05$). When compared to intact knees the ALL reconstruction left residual laxity in internal rotation ($P = 0.043$), with significant laxity when the graft was fixed at 30° or 60°, but not when fixed at 0° ($P > 0.05$).

Conclusion: This work adds further evidence that in combined ACL and anterolateral injury, isolated ACL reconstruction does not restore normal laxity. When combined with ACL reconstruction the Lemaire, regardless of the angle of knee flexion for graft fixation, and also the ALL reconstruction fixed in full extension are able to restore normal TFJ laxity. Surgeons wanting to combine a Lemaire tenodesis with the ACL reconstruction can safely tension the graft at their preferred knee flexion angle across 0° to 60°, whereas an ALL reconstruction should be tensed in full

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knee extension. However, the ALL reconstruction did not reduce rotation laxity significantly compared to the isolated ACL reconstruction in the combined lesion of ACL deficiency plus ALC lesion.