additional meniscal repair or LET. (Fig.1 Right) The in situ force of the ACL and ACL graft under both anterior and simulated pivot-shift loading was not different between the two conditions. Conclusion: Any additional meniscus repair or LET in addition to the ACL reconstruction was required to restore normal knee kinematics in the ACL and lateral meniscus torn knee. When encountering unreparable lateral meniscus tear in an ACL-injured knee, LET might be considered in addition to ACL reconstruction.

Category: Knee - Lateral Extraarticular Tenodesis

Clinical Outcomes And Return To Sport After Revision Acl Reconstruction With Lateral Extraarticular Tenodesis: Comparison To A Control Group At A Minimum 2-Year Follow-Up

Abstract ID# 23103

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Summary:
High risk patients with revision ACL reconstruction using quadriceps tendon autograft and lateral extraarticular tenodesis do just as well as lower risk controls.

Introduction: High rates of clinical failure and graft rupture remain a problem with isolated ACL reconstruction (ACLR) in at-risk populations. There is therefore a renewed enthusiasm for lateral extra-articular tenodesis (LET) which provides additional extra-articular restraint to better control anterolateral rotational laxity in at-risk cases including revision ACLR. There is a lack of high quality comparative evidence to support this rationale. The purpose of this study is to compare clinical outcomes and return to sport in patients who undergo revision ACL reconstruction with LET compared to those without LET (control group).

Methods: All patients who underwent revision ACL reconstruction with and without LET between January 2018 and February 2020 were queried at our institutional registry. The LET group was compared to the control group (revision ACLR without LET) and followed for a minimum of 24 months post-surgery to evaluate patient reported outcome measures, satisfaction, return to sports, rate of reoperation, and psychological readiness for return to sport (using the ACL-Return to Sport after Injury Scale, ACL-RSI). Results: A total of 81 patients with a mean follow-up of 2.75 years were included. LET group contained 37 patients (76% female) with a mean age of 26.6 years and BMI of 23.5 kg/m² compared to 44 patients (80% female) with mean age of 28.2 years and BMI of 26.9 kg/m². There were no significant differences between the LET and control groups with respect to mean post-operative PROMIS Pain Intereference (47.7 ± 48.3, p = 0.46) and PROMIS Mobility scales (53.3 ± 52.9, p = 0.97). In addition, there were no differences in post-operative IKDC (78.5 ± 78.3, p = 0.45), Marx (7.9 ± 7.2, p = 0.64), or SANE (73.1 ± 74.2, p = 0.38) scores. The same held true with regards to post-operative ACL-RSI scores between the groups (43.3 ± 50.1, p = 0.38).

Return to play rates after revision ACLR were similar in the LET group compared to the control group (55% vs 45%, p = 0.40) with similar confidence to play their pre-injury sport (scale out of 100, 58.2 vs 56.2, p = 0.82). Conclusion: Satisfaction and patient reported outcome scores after revision ACL reconstruction are good with or without LET. While both groups have similar rates of return to play and reoperation at greater than 2-year follow-up, these results suggest the addition of LET to revision ACLR may provide similar outcomes in high-risk patients when compared to isolated revision ACL reconstruction.

Category: Knee - Lateral Extraarticular Tenodesis

Clinical Outcomes and Failure Rates in Patients Undergoing Revision ACLR With or Without Modified Lemaire Lateral Extra-Articular Tenodesis

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Summary:
A retrospective analysis of patients who underwent revision ACL reconstruction with or without lateral extraarticular tenodesis (LET) identified similar failure rates between groups; however, patients who had an additional LET demonstrated statistically significant improvements in activities of daily living and sport and recreation KOOS subdomain scores at a minimum 2 year follow up.

Data:
Introduction: Revision anterior cruciate ligament reconstruction (R-ACLR) represents a technically demanding procedure leading to lower clinical outcomes and reduced patient satisfaction compared to primary ACLR reconstruction. The addition of lateral extra-articular tenodesis (LET) has been demonstrated to lower primary ACLR reconstruction failure rates. The purpose of this study was to report a retrospective analysis of patients who underwent R-ACLR with or without LET with a minimum of 2 years follow-up. The hypothesis was that the addition of LET leads to higher patient-reported outcomes (PROMs) and a decrease in failure rate compared to isolated ACLR. Methods: Seventy-four patients with a minimum of 2 years follow-up (range 24-120 months), who had a high-grade positive pivot shift test under anesthesia (≥ 2) were included. Postoperative radiographic measurements included medial posterior tibial slope (PTS) angle, lateral femoral condylar ratio (LFCR), and osteoarthritis (OA) grade. Knee Injury and Osteoarthritis Outcome Score (KOOS) and the International Knee Documentation Committee (IKDC) Subjective Knee Form were collected. Failure criteria were defined as residual positive pivot test = 2 during clinical assessment, objective knee instability symptoms, and/or postoperative MRI exam showing a complete graft tear. An ANCOVA was used to compare PROMs between groups, adjusted for patient age, study site and length of follow-up. Statistical significance was set at p < 0.05 for all analyses. Results: Thirty-nine patients underwent isolated R-ACLR (mean age (SD) 29.2 ± 12.2) and 35 had an additional LET (24.6 ± 7.4). A first R-ACLR was performed in 84.6% vs 82.8% respectively. Autologous extensor mechanism was the most common graft utilized (71.7% vs 85.7%). One stage revision ACLR was performed in most cases (69.5%). Radiographic analysis showed a similar incidence of postoperative OA changes (KL grade = 2) without a significant difference between the groups (43.6% vs 48.6%, p = 0.67). The medial PTS (mean ± SD) (9.6 ± 3.1 vs 8.5 ± 1.8 p = 0.05) and LFCR (mean ± SD) (0.64 ± 0.03 vs 0.66 ± 0.1 p = 0.24) measurement preoperatively were not significantly different. PROMs were higher in the LET group with KOOS ADL (39.5 ± 2.0 vs 79.2 ± 1.6; 0.003) and KOOS Sport (63.0 ± 3.6 vs 74.3 ± 3.8; 0.049) subdomains reaching statistical significance, with the latter reaching a minimum clinically important difference threshold. No other differences were found in the other KOOS subdomains or IKDC. No postoperative complications were found related to the addition of LET fixation on the lateral femoral condyle. Failure rates were not significantly different between the groups (12.8% vs 11.4%, p = 0.99). Conclusion: Revision ACLR with additional LET showed a similar failure rate compared to isolated R-ACLR in patients presenting with high-grade rotational laxity following failed ACLR. Clinical outcomes suggested better functional results in the LET group with significantly higher activities of daily living, and sport and recreation KOOS subdomain scores. Additional studies should be performed with higher numbers of patients to investigate the potential protective effect of LET in revision ACLR patients.

Category: Knee - Lateral Extraarticular Tenodesis

Biomechanical Contribution Of The Anterolateral Complex In ACL-Reconstructed And ACL-Deficient Knees During Simulated Activities Of Daily Living

Abstract ID# 21756

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Summary:
The purpose of this study was to examine the contributions of the ACL during ‘in vitro’ clinical laxity tests and simulated ADL movements and the results of this study provides further evidence that an ACL procedure should be considered in ACL injured knees with high grade rotational laxity.

Data:
Introduction Previous biomechanical cadaveric studies have demonstrated residual laxity in knees that have undergone anterior cruciate ligament reconstruction (ACLR) with associated anterolateral complex (ALC) injury, assessed during ‘in vitro’ internal-external or anterior-posterior laxity. The role of the ALC has never been evaluated during simulated activities of daily living (ADL) such as cutting or pivoting motions. Thus, the purpose of this study was to examine the contributions of the ALC during ‘in vitro’ clinical laxity tests and simulated ADL movements Method Twelve intact cadaveric knees were mounted onto a joint motion simulator (AMTI Vivo). The ACL was transected and anatomic single-bundle ACLR was performed using a synthetic graft with an initial tension of 80 N at 30° of flexion angle, which was measured using a loadcell attached to the graft. Each knee was subjected to clinical laxity tests (Pivot-shift, Lachman, and anterior drawer tests), as well as simulated ADL, comprising cutting maneuvers and inside and outside pivoting. Tension was applied to the quadriceps and hamstring strings to simulate dynamic muscle force during ADL. ALC dissection was performed by releasing the tibial attachment of the anterolateral ligament from the lateral meniscus and the femoral attachment from the most posterior limit of the iliotibial band as far proximal as the distal Kaplan fiber attachment, which was left intact. All tests were applied in the following stages: ACLR, ACL-Cut, ACL-R+ALC-Cut, and ACL-Cut+ALC-Cut. After cutting ALC, the measured kinematics of both ACLR and ACL-Cut conditions were fed back to the knee to determine the force contribution of the ALC based on the sequential resection and superposition technique. Results In the ACLR stage, resection of the ALC led to an increase in anterior translation and internal rotation of 2.3 mm and 4.5°, respectively, and by 2.7 mm and 3.9° in the ACL-Cut stage. During Lachman and anterior drawer tests, cutting the ALC caused an increase in tibial translation by 1.7 mm and 1.5 mm in the ACLR stage, versus 3.0 mm and 2.4 mm in the ACL-Cut stage, respectively. In both ACLR and ACL-Cut stages, statistically significant differences were detected between the kinematics in intact and injured ACL. During the simulated cutting maneuver and inside and outside pivoting, dissection of the ALC resulted in an average increase in internal rotation by 2.3°, 2.1°, and 1.7° with the ACLR versus 2.8°, 1.5°, and 1.7° with the ACL-Cut, respectively. During pivot shift, Lachman and anterior drawer test, in the ACLR stage, the average anterior force contribution of the ALC was 34%, 7%, and 10%, respectively, whereas it was 49%, 30%, and 29% in the ACL-Cut stage. Furthermore, the average anterior force contribution of the ALC was 16%, 15%, and 9% in ACLR, and 31%, 44%, and 49% in ACL-Cut, respectively, for the cutting maneuver, inside pivoting, and outside pivoting. Conclusion An ‘in vitro’ combined ACL+ALC knee injury results in a significant increase of AP translation compared to an ACL injury alone. ACLR alone failed to restore knee kinematics during simulated ADL when a concomitant ALC injury was performed. This study provides further evidence that ALC should be addressed when treating ACL-injured knees with preoperative high-grade rotatory laxity.

Category: Knee - Lateral Extraarticular Tenodesis

Isolated Lateral Extra-articular Tenodesis (LEAT) for Chronic Rotational Instability following Primary Anterior Cruciate Ligament (ACL) Reconstruction has Low Surgical Morbidity and Improves Knee Stability

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Summary: The isolated LEAT procedure appears appropriate and successful in addressing ongoing subjective and objective rotational instability in the ACL reconstructed knee.

Data: Background Augmentation of the lateral structures of the knee using a Lateral Extra-Articular Tenodesis (LEAT) in combination with ACL reconstruction is thought to improve rotational instability, though the exact indications for LEAT remain controversial. We propose that the LEAT procedure can also be used in isolation in the ACL reconstructed knee with an intact graft but mild to moderate chronic subjective and objective rotational instability. This procedure ideally provides sufficient adjunctive knee stability while avoiding the higher surgical morbidity, complication rate and prolonged post-operative rehabilitation of full revision ACL reconstruction. Methods A prospective consecutive case series of patients undergoing isolated LEAT by a single surgeon for chronic rotational instability following previous ACLR were followed from 2016 to 2022. Inclusion criteria consisted of an ACL reconstruction with appropriately placed bone tunnels and intact graft on MRI, with subjective knee instability and positive pivot shift on clinical examination. Patient demographics, pre-operative imaging, pre- and post-operative patient-reported outcome measures (PROMs) were analysed. Results Twelve patients were identified. Mean age was 29.3 years (Range: 20–41 years) and 50% were male. A modified MacIntosh LEAT was used for all patients. The mean time from ACL reconstruction to the LEAT procedure was 68 months. Mean follow up time was 15.5 months (Range: 8–59 months). In all patients the pivot shift was obliterated post-LEAT procedure. Four patients underwent concomitant meniscal repair (33%) and three patients underwent meniscal debridement (25%) at the same operation. No complications were reported but one patient is awaiting removal of interference screw for superficial irritation. Significant improvements were demonstrated in PROMS including Sane, Tegner, ACL-RSI and EQ-5D scores. Conclusions The isolated LEAT procedure appears appropriate and successful in addressing ongoing subjective and objective rotational instability in the ACL reconstructed knee with intact graft and appropriate tunnel positioning and is a useful option in this cohort of patients. It offers a low surgical morbidity and complication rate in comparison to revision ACL reconstruction and provided good patient-reported outcomes across a series of measures. This study is the largest of its kind in the available published literature.

Category: Knee - Lateral Extraarticular Tenodesis

Clinical Outcomes of Combined ACL & Anterolateral Ligament Reconstruction Versus Isolated ACL Reconstruction: A Matched-Pair Analysis of 2018 Patients

Abstract ID# 21582

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Summary: Risk of ACL graft rupture is 3-fold greater with isolated ‘gold standard’ BTB grafts when compared to ACL+ALLR with hamstring autografts.

Data: Background: The aims of this study were to compare the clinical outcomes following “gold standard” ACL reconstruction (ACLR) with a bone patellar-tendon bone (BPTB) autograft versus ACLR combined with an anterolateral ligament reconstruction (ALLR) using hamstring tendon autografts (HT), in a large series of propensity matched patients. The hypothesis was that combined reconstructions would confer better graft rupture rates and lower non-graft rupture related re-operation rates than isolated ACLR with BPTB Methods: A retrospective analysis of prospectively collected data was performed. Patients undergoing combined ACL+ALLR using HT between 2003 and 2019 were propensity matched in a 1:1 ratio to patients undergoing isolated ACLR using BPTB. At the end of the study period rates of graft rupture, contralateral knee injury and any other reoperations or complications that occurred were identified by database interrogation, review of medical records and standardized telephonic interview. It was anticipated that there would be significant differences in the duration of follow-up between the groups due to a larger proportion of patients undergoing combined reconstructions toward the latter part of the study period. For that reason, statistical techniques that are unaffected by any differences in durations of follow-up between groups were used to evaluate graft survivorship, re-operation free survivorship and the significance of potentially important risk factors. Specifically, Kaplan Meier survivorship analyses and Cox-proportional hazards models were used because both evaluate time to event data and are independent of the overall duration of follow up. Results: A total of 2018 patients (1009 matched pairs) were included. The mean duration of follow up was 101.3 Kaplan Meier Analysis demonstrated a significantly better graft survivorship in the ACL+ALLR group when compared to the BPTB group at every time point assessed. The Cox model demonstrated that patients in the BPTB group were > 3-