Summary:
We have presented a modified, practical method to predict the ACL hamstring graft size with high specificity using pre-operative MRI measurements that does not require any specialized software or methods, and can be reliably done even by junior members of the surgical team.

Data:
Background: Predicting hamstring graft size pre-operatively for the surgical reconstruction of the anterior cruciate ligament (ACL) is important as it may help pre-empt an insufficient diameter in graft size intra-operatively, which may lead to graft failure. While there are multiple published models for the prediction of the hamstring graft pre-operatively using magnetic resonance imaging (MRI) picture archiving and communication systems (PACS), most are not feasible and practical. We aim to ask the following questions: (1) Can an ACL hamstring graft size be practically predicted in a numerically continuous manner, by surgeons or surgical assistants of all levels of training, using the pre-operative MRI from any native MRI PACS system? (2) Using this method of prediction, what is the degree of correlation between the predicted and actual graft size? (3) If we define an adequate actual graft size as more than or equal to 8mm, what is the performance of this method of prediction in terms of specificity, sensitivity and discriminative ability?

Methods: A retrospective review of 112 patients who underwent primary ACL reconstruction with quadrupled hamstring semitendinosus-gracilis grafts at a tertiary institution between January 2018 and December 2018 was conducted. Two independent and blinded evaluators with no prior radiology posting experience measured the cross-sectional lengths and breadths of both semitendinosus and gracilis grafts using standard MRI PACS for all included patients. Data of the actual graft sizes used intraoperatively were also extracted. Results: We found that the graft diameter can be predicted in a numerically continuous manner as the square root of 2 * (AB + CD), where A and B refer to the semitendinosus cross-sectional length and breath respectively, and C and D refer to the gracilis cross-sectional length and breath respectively. The Pearson’s correlation coefficient between the predicted and actual graft diameter was 0.661 (p < 0.001), which shows a moderate positive correlation. Our method yields a high specificity of 92.6% and a moderate sensitivity of 67.2% if we define an adequate actual graft size as more than or equal to 8mm. A logistic regression model was performed is significant (p < 0.001), with the odds of the actual graft diameter being adequate increases by 12.8 for each additional mm of the predicted graft diameter (95% CI [5.2, 38.2]), and an area under receiver-operating characteristic (ROC) curve plotted with the respective logistic regression models shows good discrimination (AUC = 0.856). Conclusions: We have presented a modified, practical method to predict the ACL hamstring graft size with high specificity using pre-operative MRI measurements that does not require any specialized software or methods, and can be reliably done even by junior members of the surgical team.

Category: Knee - ACL Graft Choice

Analysis of Graft Types used with Internal Brace Augmentation for ACL Reconstruction: A Systematic Review

Abstract ID# 22013
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Summary:
The findings of this review demonstrate that ACL reconstruction with suture tape augmentation has a positive effect on all graft types in terms of strength and load capacity without limiting range of motion of the knee.

Data:
Background: New techniques are being created to decrease the failure rate of ACL grafts and prevent revision surgery. One such technique involves high strength suture tape, also referred to as an InternalBrace<sup>®</sup> (Arthrex Inc.). Recent literature has highlighted the overall use of suture tape for ACL reconstruction, but no study has compared suture tape augmentation between graft types. The purpose of this study was to perform a systematic review of the literature to determine the potential benefits of augmenting with an internal brace depending on type of graft (ie BPTB, quadriiceps, hamstring). Methods: A systematic literature search of MEDLINE (Ovid), Embase, Scopus, Web of Science Core Collection, clinic atrials.gov, and the Cochrane Central Register of Controlled Trials (CENTER) was performed in March 2022 according to PRISMA guidelines to identify all articles related to suture tape augmentation of ACL grafts. Studies examining biomechanical properties and clinical patient outcomes with internal bracing were included. Studies including revision surgery, additional ligament injury, and ACL repair surgery were excluded. Results: A total of 926 studies were identified, 10 of which met inclusion criteria. 5 studies used hamstring tendon (HT) (50%), 3 used quad tendon (QT) (30%), 1 used bone-patellar tendon-bone (BPTB) (10%), and 1 study used both HT and QT grafts (10%). Across multiple studies, HT grafts on porcine models showed a range of decreased dynamic and peak elongation (15-56%), increased load to failure (20-77%), and increased initial and final dynamic stiffness (31-47%) of suture tape augmented grafts compared to controls. Human studies found no significant difference in post-operative physical exam findings compared to control groups, with suture tape augmented grafts having significantly less laxity post-surgery compared to hamstring tendon alone (0.8 vs 1.9 mm). QT graft animal studies increased graft strength with normal graft incorporation and graft-to-bone healing at 6-month post-surgical histological assessment. Human studies showed positive outcomes with suture tape augmentation, with one study showing 9 out of 11 patients (82%) returning to pre-injury activity level. Another study found no difference in negative outcomes, along with higher KOOS scores reported in suture tape augmented patients compared to controls. The BPTB graft bone model study found decreased cyclic displacement by 31% (2.9 ± 0.8 mm) and increased load (758 ± 128 N) and stiffness (156 ± 23 N/mm) in the suture tape augmentation group compared to non-augmented groups. Conclusion: HT, QT, and BPTB grafts augmented with suture tape demonstrate an effective method for ACL reconstruction. All graft types used with suture tape augmentation showed no evidence of clinical disadvantage, with some studies indicating significant biomechanical or clinical advantages compared to conventional ACL reconstruction. Notably, HT with suture tape augmentation reduced laxity, which was not seen in the use of QT. Further research is required to better understand the clinical application of suture tape augmentation for ACL reconstruction.

Category: Knee - ACL Graft Choice

The Impact of a Decision Aid on Patient Treatment Choice After Anterior Cruciate Ligament Injuries

Abstract ID# 22703
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Summary:
Patients and doctors reported that a Decision Aid for patients with anterior cruciate ligament injuries was very useful in shared decision-making about treatment options. However, the Decision Aid did not significantly alter the proportion of patients selecting non-surgical and surgical treatments or the proportion of patients switching to surgery within the first year.

Data:
Background: Patients with anterior cruciate ligament (ACL) injury are faced with a choice between surgery or non-surgical treatment with intensive rehabilitation. To offer patients a treatment meeting their individual values, lifestyle, and conditions, patients must be involved in the decision-making. Often Decision Aids are used during the process of shared decision-making to help patients to make informed, preference-based decisions in collaboration with health professionals. Studies have indicated that Decision Aids seemed to reduce the number of surgeries in favor of more conservative options. Based on international criteria, current literature, and former patients’ experiences and suggestions, a Decision Aid for patients with ACL injury has been developed. However, the users’ experience and the impact of the Decision Aid on the proportion of patients selecting non-surgical and surgical treatments have not been investigated. Aims 1. To investigate both patient and doctors’ experiences using the Decision Aid in Shared Decision-making. 2. To investigate whether exposure to the Decision Aid had an impact on the proportion of patients selecting non-surgical and surgical treatments and whether the exposure to the Decision Aid affected the proportion of patients switching from non-surgical to surgery treatment within the first year.

Methods: The Decision Aid was evaluated by semi-structured interviews with patients, and a focus group interview with the doctors. In a consecutive case series, proportions of patients selecting non-surgical and surgical treatments were compared before (Period: January 2015 to January 2017) and after patients’ exposure to the Decision Aid (Period: January 2017 to January 2019). Data were collected retrospectively from the health records of patients with ACL injuries, who presented to the Department of Sports Traumatology in a Danish University Hospital. Results Both patients and doctors
expressed that they found the Decision Aid very useful in shared decision-making clarifying the patients’ values concerning issues important to treatment options. Further, 1,053 patients with ACL injuries were included: 563 patients with no exposure to the Decision Aid and 490 patients with exposure to the Decision Aid. Before implementation of the Decision Aid, 27% of the patients choose non-surgical treatment and after implementation of the Decision Aid, it was 30% (p = 0.22). Before implementation of the Decision Aid, 21% of patients who initially chose non-surgical treatment, had surgery within the first year, and after implementation of the Decision Aid, it was 16%. However, the 5% reduction was not statistically significant (p = 0.26). Conclusion Patients and doctors reported that the Decision Aid for patients with ACL injury was very useful in clarifying the patients’ values important to treatment options. The exposure to the Decision Aid did not significantly alter the proportion of patients selecting non-surgical and surgical treatments or the proportion of patients switching to surgery within the first year.

Category: Knee - ACL Graft Choice

Risk of Revision and Re-Operation After ACL Reconstruction. Comparison of Quadriceps Tendon, BPTB, and Hamstring Autografts in a U.S.-Based Cohort Study of 21,980 Patients

Abstract ID# 22910

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Summary:
In a cohort of primary ACLR patients, no difference in revision or re-operation risk was observed when comparing quadriceps tendon to BPTB or hamstring, but a 1.5 times higher revision risk was found when hamstrings were compared to BPTB.

Objective: The purpose of this study was to evaluate risk for subsequent surgical outcomes, including revision and re-operation, for a cohort of primary ACLR patients according to autograft selection.

Methods: Data from a US healthcare system’s ACLR registry was used to conduct a cohort study. Primary isolated autograft ACLR patients were identified (2012-2021); those with prior procedures in the same knee were excluded. The exposure of interest autograft type: QT, BPTB, and hamstring tendons. Multivariable Cox proportional hazard regression models were used to evaluate the risk for revision and risk for re-operation within 3-years follow-up according to autograft selection. Age, body mass index, gender, race/ethnicity, American Society of Anesthesiologist’s classification, activity at the time of injury, prior contralateral ACLR, lateral meniscus injury, medial meniscus injury, femoral fixation method, femoral tunnel drilling technique, average annual surgeon volume, operative time, and operative year were considered as covariates in regression analysis; models also included a cluster term for operating surgeon to account for correlation of ACLR performed by the same surgeon. Hazard ratios (HR) and 95% confidence intervals are reported. Two-sided tests were calculated with p < 0.05 the threshold for statistical significance.

Results: The study sample comprised 21,980 ACLR performed by 290 surgeons at 53 hospitals. QT, BPTB, and hamstring autograft were used in 1103 (5.0%), 9522 (43.3%), and 11,355 (51.7%) ACLR, respectively. In adjusted models, no significant differences were observed in revision risk (HR = 1.06, 95% CI = 0.6-1.89, p = 0.837) or re-operation risk (HR = 0.97, 95% CI = 0.70-1.35, p = 0.875) within 3-years follow-up when comparing QT ACLR to BPTB ACLR. Additionally, no differences in 3-year revision (HR = 0.62, 95% CI = 0.34-1.12, p = 0.113) or re-operation (HR = 1.17, 95% CI = 0.80-1.73, p = 0.416) risks were observed when comparing QT ACLR to hamstring ACLR. BPTB were noted to have a significantly lower risk of revision (HR = 0.66, 95% CI = 0.55-0.80, p = 0.006) compared to hamstring tendons and a slightly higher risk of re-operation (HR = 1.16, 95% CI = 1.01-1.32, p = 0.03). Conclusions: The results of this large multi-center study using data from an ACLR registry found no difference in the risk of revision or re-operation when quadriceps tendon was compared to BPTB or hamstring autograft with the numbers available but did find a 1.5 times higher risk of revision when hamstring tendon autograft was compared to BPTB or hamstring autograft with the numbers available but did find a 1.5 times higher risk of revision when hamstring tendon autograft was compared with BPTB autograft and a 0.9 times lower risk of re-operation. Surgeons may use this information when choosing the appropriate graft for ACLR in their patients.