79.2 hamstring, 73.9 bone-patella-tendon-bone, P < 0.001). Similar revision rates were reported between all autograft groups (mean revision rate per 100 component years; 1.05 hamstring, 0.80 bone-patella-tendon-bone, 1.68 quadriceps, P = 0.083). Autograft revision was independent of age and gender variables. Conclusions: All autograft groups had similar patient reported outcome measures and revision rates at 2 years when concomitant knee injuries were excluded. These results suggest that quadriceps tendon is a comparable autograft choice to the status quo in the early to intermediate follow-up period. Previous research that have suggested difference in outcomes between autograft options may have been confounded by concomitant knee injuries. Further research is required to quantify the longer term outcomes for quadriceps tendon use.

Category: Knee - ACL

**Reduction in re-rupture rates following implementation of return to sport testing after ACL reconstruction; 313 patients with a median follow-up of 50 months**

Abstract ID#: 21880  
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Summary:  
Passing a RTS-test battery following ACLR reduces ACL re-rupture by 36.21% and contralateral ACL injury by 19.18% at mid-term follow-up.

Data:  
Objectives To assess mid-term effectiveness of a return to sport (RTS) test battery in relation to preventing ACL re-rupture following reconstruction. Secondary purposes to assess timing of passing a RTS-test battery post-surgery, age in relation to RTS outcomes and contralateral ACL injuries. Methods Patients undergoing ACLR between August 2014 - December 2018 performed a RTS-test battery following rehabilitation. The RTS-test battery consisted of the ACL-RSI, single leg hop, triple hop, and triple cross-over hop, box drop vertical jump down, single leg 4 rep max incline leg press and a T-test. Pass criteria was = 90% LSI in addition to symmetrical, controlled takeoff and landing patterns. Results 352 patients underwent RTS-testing following ACLR with 313 (89%) contactable at a median of 50 months (SD11.41, range28-76) post-surgery. The re-rupture rate was 6.60% after passing the RTS-test battery and 10.34% following failure (p=0.24). Contralateral ACL injury rate during the study follow-up period was 6.07%. Median age of patients passing their first RTS-test battery was significantly older than those who failed (p=0.0003). Re-ruptures in those who passed the RTS-test battery first time all occurred late (~34 months) compared to those who failed first time which all occurred early (~33 months) (P=0.044). Median age of re-rupture was significantly younger compared to those who didn’t sustain a re-rupture (p=0.025). Conclusion Passing a RTS-test battery following ACLR reduces ACL re-rupture by 36.21% and contralateral ACL injury by 19.15% at mid-term follow-up. Younger patients are more likely to fail a RTS-test battery and are at higher risk of contralateral ACL rupture.

Category: Knee - ACL

**Choose Your Poison: Bone-Tendon-Bone Or Hamstring Grafts In Professional Athletes For ACLR: Reduced Hamstring Strength or Worse Jump Metrics**

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Data:  
Results Hamstrings muscle strength was significantly less when using hamstrings graft (1.63 Nm/kg) compared to bone-patellar tendon (1.80 Nm/kg) (p<0.001) but there were no differences in quadriceps strength between the grafts. Conversely, athletes showed greater concentric (85%) and eccentric (86%) impulse asymmetries (p<0.001) during a two-leg vertical jump when a bone-patellar tendon graft was used compared to athletes with a hamstring graft (93% and 98%, respectively). There was a statistically but not clinically significant difference for posterior-to-anterior knee laxity between graft (p=0.032, 1mm). Conclusions Hamstrings muscle strength is not fully restored when using hamstrings graft for ACLR and jumping ability is affected when using bone-patellar bone graft. These findings can help inform surgical choices.

Category: Knee - ACL

**The Cut-Off Point To Discriminate A Higher Chance Of Re-Tear Is 6.5 Degrees Of Hyperextension In Isolated Anterior Cruciate Ligament Reconstruction With Hamstring Autograft**

Abstract ID#: 21923  
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Summary:  
The cut-off point established to discriminate an ACL re-tear was 6.5 degrees of hyperextension.

Data:  
Background: The outcome of an ACL reconstruction surgery depends on many factors. The degree of knee hyperextension in isolation has not been studied in detail as a risk factor that may lead to graft failure after an ACL reconstruction. The aim of this study is to create a cut-off point for hyperextension that best discriminates re-tear and to verify whether this cut-off point can predict re-tear regardless of other characteristics after primary ACL reconstructions with hamstring autografts. Methods: A cohort of patients submitted to primary isolated ACL reconstruction with hamstrings autografts was retrospectively evaluated. Patients were stratified according to the degree of passive knee hyperextension measured in the normal contralateral knee at surgery time. The following data were collected: patient demographic data (age and gender), time from injury to surgery, passive knee hyperextension, KT-1000 and pivot-shift, associated meniscus injury and treatment, intra-articular graft size, follow-up time, occurrence of graft failure and postoperative Lysholm and IKDC subjective form. A ROC curve was constructed to identify the cut-off point of the hyperextension that best discriminates re-rupture. Unadjusted odds ratios (OR) were estimated with the respective 95% confidence intervals of each characteristic with re-rupture using bivariate logistic regressions to quantify the association of characteristics with re-rupture. Results: Data from 457 patients were evaluated. Thirty-two presented a re-tear. There was a significant difference in hyperextension between patients with and without re-tear (p < 0.001), with the cut-off point established by the ROC curve from 6.5 degrees, with sensitivity of 78.1% and specificity of 76.7%. Patients with greater hyperextension had a statistically higher frequency of women, longer injury time, greater intra-articular graft size, greater post-op KT-1000 and higher frequency of re-tear, whereas
the subjective IKDC and Lysholm were statistically lower in patients with greater hyperextension. When a meniscus injury was present, in patients with greater hyperextension, the frequency of medial meniscal injury was statistically higher than in patients with less hyperextension. Only hyperextension showed a statistically significant association with re-rupture when evaluated alone (p < 0.001). Regardless of the other characteristics evaluated, only hyperextension statistically influenced the re-tear of patients (p < 0.001), and the chance of re-tear in patients with hyperextension greater than 6.5 was 14.65 times the chance of patients with hyperextension less than 6.5. Conclusion: The cut-off point established to discriminate an ACL re-tear was 6.5 degrees of hyperextension. Only hyperextension statistically influenced a re-tear and the chance of re-tear in patients with hyperextension more than 6.5 degrees was 14.65 times the chance of patients with hyperextension less than 6.5.

Category: Knee - ACL

Risk Factors For Anterior Cruciate Ligament Graft Failure In Elite Athletes: An Analysis Of 342 Professional Athletes With A Mean Follow-Up Of 100 Months From The Santi Study Group

Abstract ID# 22036
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Summary:
Professional athletes undergoing isolated ACLR and aged 21 or younger are at >2-fold risk of graft failure. Orthopedic surgeons treating elite athletes should combine an ACLR with a LEAP to improve ACL graft survivorship.

Data:
Anterior cruciate ligament (ACL) injuries are amongst the most common knee injuries sustained in elite sport and athletes generally undergo ACL reconstruction (ACLR) to facilitate their return to sport. Multiple studies have reported predictors for ACL failure including age, activity level, graft size, graft choice, increased posterior tibial slope and meniscal deficiency. However, no studies are specific to professional athletes and include the addition of a lateral extra-articular procedures (LEAP). The purpose of this study was to determine the risk factors for graft failure in professional athletes undergoing ACLR. It was hypothesized that athletes who underwent combined ACLR with a LEAP would experience significantly lower rates of graft rupture in comparison to those who underwent isolated ACLR. Professional athletes who underwent primary ACLR using autograft by the senior author (BSC) between January 2003 and January 2020 with a minimum follow-up of 2 years were considered for study inclusion. Patients were excluded if they underwent major concomitant procedures, including multiligament reconstruction surgery or osteotomy. Patient notes were reviewed by an investigator, independent of the primary surgeons, to determine if they had sustained a further ipsilateral knee injury, sustained a contralateral knee injury or had undergone any reoperations or complications after the index procedure. Key demographics and additional secondary surgery were also documented. A total of 420 professional athletes underwent ACLR during the study eligibility period. After application of the exclusion criteria, 342 athletes were identified as eligible for final inclusion with a mean follow-up of 100.2 +/- 51.9 months (range, 24 - 215 months). 31 graft failures (9.1%) were reported, all requiring revision surgery due to symptomatic instability. The rate of graft failure was significantly higher when ACLR was not combined with a LEAP (15.5% v 6.0%, p = 0.0105) and in younger athletes (13.8% v 6.6%, p = 0.0290). A multivariate analysis was performed using the Cox model and demonstrated that athletes undergoing an isolated ACLR had a >2-fold higher risk of ACL graft failure (Hazard Ratio (HR) = 2.678 (1.173:4.837), p = 0.0164) when compared to a combined ACLR with a LEAP. Additionally, athletes aged 21 or younger were also at >2-fold risk of graft failure (HR = 2.381 (1.313:5.463), p = 0.0068). Gender, sport and graft type were not found to be significant risk factors. Secondary surgery on the ipsilateral knee took place in 62 athletes (18.1%). Additionally, 42 athletes (13.2%) had a subsequent ACL rupture of the contralateral knee. The main finding of this study was that professional athletes who underwent isolated ACLR had a >2-fold higher graft failure rate than when ACLR was combined with a LEAP. Additionally, athletes aged 21 or younger also had a >2-fold higher graft failure rate when compared to older athletes. To the knowledge of the authors, this is the first study to specifically analyze risk factors for ACL graft failure in elite athletes of all sports including the addition of a LEAP. Orthopedic surgeons treating elite athletes should combine an ACLR with a LEAP to improve ACL graft survivorship.

Category: Knee - ACL

ACLR Reconstruction With Hamstring Tendon Is Associated With A Sixfold Increase In Failure Rates Compared With Patella Tendon Grafts In Young Females - A Cohort Study From The New Zealand ACL Registry

Abstract ID# 22817
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Summary:
ACLR reconstruction with hamstring tendon is associated with a sixfold increase in failure rates in young females when compared with patella tendon graft.

Data:
Introduction: Young female athletes are a specific population group that is at high risk of primary ACL rupture and subsequent graft failure. Despite large numbers of ACL reconstructions being carried out in young females, there is limited analysis of outcomes in this group, leading to low levels of evidence for graft choice. This study utilizes ACL Registry data to analyze the effects of graft choice on graft survival and PROMs in females aged 15-20 years old. Method: Prospective data captured by the New Zealand ACL Registry between April 2014 and March 2022 were reviewed. Females aged between 15-20 were included with a minimum follow-up of 1 year. The primary outcome measure is ACL graft failure during the study period with the key independent variable being graft type, patellar or hamstring tendon autograft. This is summarised as the rate per 100 patient years and is compared between the two groups using the hazards ratio generated from a Cox-proportional hazards regression. Secondary outcome measures were Marx activity scores, and the Knee Osteoarthritis and Outcome Score (KOOS) patient reported outcome measure. Results: A total of 1261 primary ACL reconstructions in females aged 15-20 were reviewed. Hamstring grafts were used in 797 reconstructions (63%), and patella tendon graft used in 464 reconstructions (37%). There was no difference between the groups in terms of age, time to surgery, pre-injury Marx or KOOS scores. Patella tendon grafts were a larger diameter, 9.5mm vs 8.1mm on average (p<0.001). Patients with a hamstring tendon graft had a graft revision rate of 7.6% compared with 1.1% in patients with a patella tendon graft (hazard ratio 6.1; 95% CI, 2.4-15.1; P<0.001). No differences were noted when comparing KOOS subscales between hamstring and patella tendon groups at 1, 2 and 5 years follow up. The patella tendon group had higher Marx scores at 12 months 8.6 vs 7.3 (P<0.001). This difference did not persist at 2 and 5 years follow up. Conclusion: This New Zealand ACL Registry study on graft failure rates in females aged 15-20 years old demonstrates a 6.1 times higher ACL graft failure rate with hamstring grafts compared to patella tendon grafts.

Category: Knee - ACL

Outcomes Of Arthroscopic Posterior Capsular Release for Loss Of Knee Extension after Anterior Cruciate Ligament Reconstruction: Minimum 2-Year Follow Up

Abstract ID# 23245
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Summary:
In our series, arthroscopic posterior capsular release resulted in significant improvement of knee extension and patient reported outcome scores at 6 month and 2 years postoperatively with a low rate of recurrent stiffness.