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Summary:
Complications following primary ACLR using quadriceps tendon autograft were recorded in 10.5% of knees, with persistent knee pain being most common. No difference was reported in the overall incidence of complications with the use of the QT versus QTPB grafts, however persistent knee pain was 2.7x greater with use of a soft tissue quadriceps graft.

Data:
Background: Anterior cruciate ligament reconstruction (ACLR) surgery with quadriceps tendon (QT) grafts – both with and without a patellar bone plug – have gained popularity in recent years in both the primary and revision setting. Nevertheless, with the use of QT autografts, postoperative complications occur.

Purpose: To systematically review the incidence of postoperative complications following primary anterior cruciate ligament reconstruction (ACLR) with quadriceps tendon autograft, while comparing complication rates in patients undergoing all soft-tissue quadriceps tendon (QT) grafts versus quadriceps tendon grafts with a patellar bone plug (QTPB). Study Design: Systematic Review; Level of Evidence IV Methods: A literature search was performed by querying PubMed, Embase, and Scopus databases from database inception through August 2022 using the 2020 PRISMA guidelines. Inclusion criteria consisted of level I to IV human clinical studies in English or English-language translation reporting complications following primary ACLR using quadriceps tendon autograft. The incidence of complications within the included studies was extracted. Differences in the incidence of postoperative complications between ACLR with quadriceps tendon with and without a patellar bone plug were calculated. Results: Twenty studies from 2004-2022, comprised of 2,381 patients (n=852 QT, n=1,529 QT with patellar bone plug) were included. Forty-five complications were reported in 10.5% of knees, with persistent knee pain being most common. No difference was reported in the overall incidence of complications with the use of QT versus QTPB grafts, however persistent knee pain was 2.7x greater with use of a soft tissue quadriceps graft.

Category: Knee - ACL Graft Choice

Donor Site Morbidity Following Anterior Cruciate Ligament Reconstruction Using Quadriceps Tendon Versus Bone-Patellar Tendon-Bone Autograft: Results at 2-Year Follow-Up

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Summary:
High satisfaction rates and negligible major complications were observed with respect to donor site morbidity with both QT and BTB autograft ACL reconstruction.

Data:
INTRODUCTION: Bone-patellar tendon-bone (BTB) autograft has historically been regarded as the gold standard for anterior cruciate ligament reconstruction (ACLR). Despite widespread utilization of BTB autografts, multiple complications following BTB harvest have been reported, including anterior knee pain, difficulty kneeling, patellar tendon rupture, patella fracture, tendon contracture, and numbness. The quadriceps tendon (QT) autograft has been proposed as an alternative graft in young, high demand patients to achieve comparable clinical outcomes while avoiding complications associated with BTB autograft. Recently, a novel 10-question donor site morbidity (DSM) instrument was developed by Hacken et al that was used to evaluate DSM following BTB ACLR. However, to date, the instrument has not been used to evaluate DSM following QT harvest. Therefore, a retrospective evaluation of DSM following ACLR with QT versus BTB autograft was performed. METHODS: All patients who underwent ACLR with QT autograft between January 2018 and February 2020 were identified in a single institution registry and matched to a control group of patients who underwent BTB autograft ACLR on the basis of age and sex. DSM was assessed using a 10-question DSM instrument and scores were compared to traditional patient reported outcome measures including the IKDC, Marx Activity Scale, and SANE scores. Post-operative complications including quadriceps tendon rupture, patella fractures, and graft failure were assessed via registry query. Multivariate analysis was conducted to investigate factors associated with DSM. RESULTS: Thirty-two QT patients (15M,17F) with a mean age of 23.0 years (range 13-45) were compared to 61 BTB patients (32M,29F) with a mean age of 22.2 (range 13-45) who responded at a minimum 24-months after surgery. DSM scores were rated good or excellent in 26/31 QT patients(81%) versus 43/61 BTB patients(72%) (P=0.45). Significant differences were noted between graft types with respect to presence of numbness, with 37/61 BTB patients(61%) versus 10/32 QT patients(31%) reporting mild, moderate, or diminished sensation to light touch (P=0.02). Differences were also noted in kneeling pain, with 30/61 BTB patients(49%) versus 6/32 QT patients(19%) reporting either mild pain with kneeling or inability to kneel on hard surfaces (P=0.01). Finally, differences were reported in patient-reported presence of quadriceps wasting, with 20/32 QT patients(38%) reporting atrophy versus 15/61 BTB patients(25%) (P=0.01). However, no differences were noted in pain at donor site, size of numbness, difficulty with stairs or prolonged sitting, anterior knee pain, or incision cosmesis(P>0.05). Multivariate analysis demonstrated that graft type, sex, body mass index (BMI), operative age, and meniscus integrity were not associated with DSM scores(P>0.05). Correlations between PROMS and DSM showed correlations with IKDC, Marx, and SANE(P<0.01). There were no instances of quad tendon rupture, patella fracture, or ACL graft failure in either group. DISCUSSION: DSM following ACLR with QT and BTB autograft demonstrated good to excellent results in the majority of patients. Significantly more BTB patients experienced numbness at the harvest site and pain with kneeling compared to QT patients. However, more patients reported quadriceps atrophy following QT compared to BTB autograft. PROMS correlated with DSM scores, suggesting that these instruments may be impacted by DSM following ACLR.

Category: Knee - ACL Graft Choice

Tibial Tunnel Expansion And Correlation With 4-Strands Graft Maturation 2 Years After ACL Reconstruction Using Tibial and Femoral Adjustable Cortical Suspensions

Abstract ID: #21375
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Summary:
At 2 years of ACL reconstruction using a ST4 fixed with ASF, the average tibial tunnel enlargement was 13% and no correlation was found between graft maturation and tibial expansion.

Data:
Introduction Reconstruction of the anterior cruciate ligament (ACL) using a short quadruple semitendinosus (ST4) graft fixed with an adjustable suspensory fixation (ASF) has several advantages but is suspected to generate micromotion, tunnel widening and poor graft maturation. The aim of this study was to evaluate tibial tunnel expansion and graft maturation using a ST4 fixed at both tibial and femoral side with ASF. Methods We analyzed retrospectively 149 patients with data collected prospectively at 2 years of follow up with magnetic resonance imaging (MRI). Maturation was analyzed by the Signal-to-Noise Quotient (SNQ) and Howell score at the tibial and articular part of the graft (T1 and Ar Graft). The expansion, the bone-graft contact and the graft volume in the tibial tunnel were calculated by MRI measurement. Results At 25.6 months, MRI analysis showed 13% +/-17 expansion of the tibial tunnel, the mean SNQ was 3.75 +/-7.11 for the T1 graft and 1.97 +/-3.49 for the Ar graft, the Howell score of the Ti graft was...
41% of grade I, 37% grade II, 20% grade III, 2% grade IV, the Howell score of the Ar graft was respectively 61, 26, 13 and 1%. The proportion of the graft in contact with the bone wall of the tibial tunnel was 81% ± 23%, the mean filling of the graft volume inside the tibial tunnel was 80%. No significant correlations were found between tibial tunnel expansion and graft maturation at both locations: SNQ Ti graft (p = 0.455), SNQ Ar graft (p = 0.455), Howell score Ti (p = 0.58) and Ar graft (p = 0.47). Graft maturation was correlated with the proportion of graft-to-bone contact and graft occupancy volume (p = 0.05). Conclusions At 2 years of ACL reconstruction using a ST4 fixed by ASF, the average tibial tunnel enlargement was 13% and no correlation was found between graft maturation and tibial expansion. Maturation appears to be correlated with graft-bone contact and graft occupancy volume in the tibial tunnel.

Category: Knee - ACL Graft Choice

A Randomised Controlled Trial Comparing Hamstring Tendon Versus Quadriceps Tendon Autograft In Anterior Cruciate Ligament Reconstruction: 2-Year Clinical Results

Abstract ID#: 22064
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Summary:
Quadriiceps autograft tendon shows similar 2 year clinical results, patient reported outcomes and return to sport rates compared with hamstrings autografts used for anterior cruciate ligament reconstruction in the athletic population.

Data:
Background: Numerous graft options are reported when undertaking anterior cruciate ligament reconstruction (ACLR), though a lack of high-quality evidence exists comparing quadriceps (QT) and hamstrings (HT) autografts. Purpose: To investigate patient outcomes in patients undergoing HT versus QT ACLR. Study Design: Randomised controlled clinical trial. Methods: Following recruitment and randomization, 112 patients (HT=55, QT=57) underwent ACLR. Patients were assessed pre- and post-operatively (6 weeks and 3, 6, 12 and 24 months) with a range of patient-reported outcome measures (PROMs), graft laxity (KT-1000), active knee flexion and extension range of motion (ROM), peak isokinetic knee extensor and flexor strength and a 6-hop performance battery. Limb Symmetry Indices (LSIs) were calculated for strength and hop measures. Secondary procedures, ACL re-tears and contralateral ACL tears were reported. Results: No group differences (p>0.05) were observed in demographics, injury or surgery history. All PROMs and knee ROM measures significantly improved (p<0.0001) though, apart from the Anterior Cruciate Ligament Return to Sport after Injury (ACL-RSI) score which was significantly better (p<0.05) in the HT group at 3, 6 and 12 months, no other group differences (p>0.05) were observed. No group differences were observed in side-to-side laxity (p=0.407), while there was no significant change in laxity from 6 to 24 months (p=0.105). While the HT group demonstrated significantly greater (p<0.05) quadriceps strength, LSIs at 6 and 12 months, the QT group demonstrated significantly greater (p<0.05) hamstrings strength LSIs at 6, 12 and 24 months. The HT group demonstrated significantly greater (p<0.05) LSIs for the single horizontal (6 months), lateral (6 and 12 months) and medial (6 months) hop tests for distance. Up until 24-months, 1 patient (QT at 22 months) had suffered a re-tear, with 2 contralateral ACL tears (QT at 19 months, HT at 23 months). Secondary procedures included 5 in the HT group (MUA, notch debridement, meniscal repair) and 6 in the QT group (MUA, notch debridement, meniscal repair, tibial tunnel transfer, osteochondral autologous transplantation). Conclusions: The two autograft groups performed well for PROMs (apart from the ACL-RSI), knee ROM and laxity. However, greater hamstring strength LSIs were observed for the QT cohort, with greater quadriceps strength (and hop test) LSIs in the HT cohort. Longer-term patient follow up will continue to evaluate RTS and later-stage re-injury between the two graft constructs.

Category: Knee - ACL Graft Choice

DOSTAR: Dual or Single Hamstring Tendon for ACL Reconstruction. A Randomised Control Trial.

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Summary:
This study seeks to compare the outcomes between Single Tendon (ST) and Dual Tendon (DT) ACLR, given there is no prospective randomised controlled trial (RCT) in the literature comparing outcomes between these options Data:
Introduction: Hamstring autograft is the most common graft used worldwide for ACL reconstruction (ACLR). Hamstring harvest has been associated with reduced hamstring strength, donor site pain and muscle strains after return to sport. There is conjecture as to the importance of the gracili tendon in contributing to pain, flexion strength and rotational stability. Traditional hamstring graft requires both tendons to be harvested to achieve a graft of sufficient length and diameter, but newer techniques allow for a shorter, broad single tendon graft. To date there has been no prospective randomised controlled trial evaluating outcomes after single or dual hamstring tendon ACLR. The aim of this study is to compare post-operative clinical outcomes between single (semimembranosus only) versus dual (semimembranosus and gracilis) hamstring tendon grafts. Methods: In this ongoing double blinded prospective randomised controlled trial (RCT) (registered as a clinical trial with the Australia New Zealand Clinical Trials Registry (ACTRN12620000927921)) patients were recruited and randomised a priori into a single tendon (ST) or a dual tendon (DT) group for ACLR. All anaesthetic and surgical techniques were uniform between the groups aside from graft technique and tibial fixation. Patients were evaluated pre-operatively and at 6-months post-ACLR using patient-reported outcome measures (PROMs) including the IKDC, Lysholm and Modified Cincinnati knee scores, as well as a visual analog scale for pain frequency (VAS-F) and severity (VAS-S). At 6 months post-ACLR, the Graft Morbidity Score (GMS) was completed, while knee laxity (KT-1000), hop performance and peak isokinetic quadriceps and hamstrings strength were assessed. Results: Overall, 71 patients (ST = 34; DT = 37) were assessed at 6 months post-surgery on a per protocol analysis, with a further 13 patients excluded at time of surgery as their selected graft did not meet a minimum 8mm diameter. No significant group differences (P>0.05) were observed in demographics (age, sex, height and body mass) or surgical characteristics (concomitant meniscal repairs and tibial bone tunnels). Graft diameters were significantly smaller in the ST group compared to the DT group (mean difference [MD], -0.67mm; 95% CI, -0.91 to -0.43; P<0.001). A significantly lower GMS was reported in the ST group compared to the DT group (effect size [ES], 0.649; 95% CI, 2.4 to 16.2; P=0.01). No significant group difference were observed for other PROMs (P>0.05) or knee laxity (P=0.362). Conclusion ST (versus DT) harvest results in significantly less donor site morbidity and this is the first prospective RCT to determine this. There were no differences between ST and DT hamstring ACLR were observed in PROMs, knee laxity and hamstring strength. Younger female patients tend to have inadequate single tendon size to produce a graft of sufficient diameter, and alternative techniques should be considered. Further endpoints include radiological analysis, longer term donor site morbidity, revision rates and return to sport and will continue to be presented in the future.

Category: Knee - ACL Graft Choice

A Novel Practical Method To Predict Anterior Cruciate Ligament Hamstring Graft Size Using Pre-Operative MRI

Abstract ID#: 21619
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