

estimated area of physeal disruption (1.64 cm² vs. 0.74 cm², $P < 0.001$), femoral (32.1° vs. 72.8°, $P < 0.001$) and tibial (50.1° vs. 60.5°, $P = 0.003$) tunnel drill angles, medial/lateral location of the femoral tunnel (24.2 mm vs. 36.1 mm from lateral cortex, $P = 0.001$), and distance from the lateral aspect of the distal femoral physis and the femoral tunnel exit (4.7mm vs. 26.7mm from the perichondrial ring, $P < 0.001$). All patients who underwent femoral tunnel drilling at an angle of greater than 25° from the transverse axis experienced a <6% disruption of physeal area.

Conclusion: With femoral tunnel drilling techniques that create more oblique tunnels, the area of physeal damage is larger, more eccentric and closer to the perichondrial ring. Since most studies noting the safety of transphyseal ACL reconstruction have utilized a vertical femoral tunnel, surgeons should be aware that if an independent femoral tunnel drilling technique is utilized during transphyseal ACL reconstruction, the physis is at greater risk when drilling at more horizontal angles. Angles greater than 25° from the transverse axis may safely create <6% physeal area damage.

A Matched-pair Comparison of Patient-reported Outcomes following Primary ACL Reconstruction with Hamstring Autograft vs Hybrid Graft

SS-13

April 14, 11:45 AM

MATTHEW KRAEUTLER, M.D., PRESENTING AUTHOR

SEONG KIM, NONE

COLIN BROWN, NONE

DARBY HOUCK, NONE

BRIAN DOMBY, M.D.

KIRK REYNOLDS, M.D.

ERIC MCCARTY, M.D.

Introduction: With the relatively recent introduction of hybrid autograft-allograft grafts for anterior cruciate ligament reconstruction (ACLR), few studies have compared outcomes between autografts versus hybrid grafts. The purpose of this study is to compare patient-rated outcomes between hamstring autografts and hybrid grafts for ACLR.

Methods: At a minimum two-year follow-up, patients who had undergone primary ACLR with hamstring autograft (A) or hybrid (H) graft (hamstring autograft with peroneus longus or tibialis posterior allograft) were contacted to fill out a survey containing the Knee injury and Osteoarthritis Outcome Score (KOOS), Subjective IKDC score, Single Assessment Numeric Evaluation (SANE), SF-12, and visual analog scale (VAS) for activity level prior to injury and at follow-up. A matched-pair analysis was performed by matching patients in each group by gender and by age at the time of surgery within three years. Paired t-tests were used to compare outcomes between groups.

Results: Twenty matched-pairs were formed, including nine males and eleven females in each group. Average age at surgery was 34 years (range, 13-57 years). Average follow-up was 3.3 years. No significant differences were found in any of the KOOS subscale scores, Subjective IKDC

(A: 75, H: 77), SANE (A: 86, H: 90), SF-12 Physical (A: 53, H: 53) or Mental (A: 53, H: 52) component scores, or activity level prior to injury (A: 7.5, H: 7.4) or at time of follow-up (A: 6.7, H: 6.2).

Conclusion: Patients undergoing primary ACL reconstruction with a hybrid graft (hamstring autograft plus allograft) have similar subjective outcomes to those with a hamstring autograft. Further studies are needed to determine patient characteristics which favor the use of hybrid grafts.

Allograft/Autograft Anterior Cruciate Ligament Reconstruction Equal Outcomes at All Ages With No Anterior Knee Pain: Average 7 Year Follow-Up

SS-14

April 14, 11:50 AM

KEVIN PLANCHER, M.D., PRESENTING AUTHOR

STEPHANIE PETTERSON, M.P.T., PH.D.

ALLISON GREEN, PH.D.

Introduction: Anatomic ACLR yields superior outcomes by restoring knee kinematics and stability though optimal graft source remains controversial. Bone-patellar-tendon-bone (BPTB) autograft ACLR is superior to hamstring for stability; however, anterior knee pain has been reported. Additionally, allografts are associated with higher risks of failure and infection. We hypothesize that allograft BPTB ACLR using biointerference screw will yield successful return to sports comparable to autograft ACLR without anterior knee pain.

Methods: Patients with allograft (17-58 years) and autograft (15-50 years) ACLR by a single surgeon (N=153) underwent evaluations including knee ROM, stability testing, Lysholm, IKDC, and Tegner questionnaires. Radiographic evaluation included preoperative plain film knee series and MRI, and postoperative MRI and CT scans. Allograft source was <40years of age and non-irradiated. Modified rehabilitation programs included return to pivoting sports at ≥6months. 2x2 ANOVA and independent samples t-test evaluated differences in outcomes ($p < 0.05$).

Results: Follow-up was 7.2±5.4years (range:2-15). Functional scores (Lysholm:87±18 vs. 87±15, $p = 0.974$; IKDC:80±18 vs 82±15, $p = 0.618$) and KT-1000 measurements (30lbs $p = 0.926$; manual maximum $p = 0.490$) were not statistically significant between groups. Activities associated with anterior knee pain were not difficult for either group and all patients returned to moderate and vigorous sports. There were two autograft failures (1.3%) after 5 years due to unknown reasons and four allograft failures (2.6%) due to traumatic reinjuries at an average of 3.8 years postoperatively. All but one underwent revision allograft ACLR without recurrence. To date, there is no evidence of lysis from the interference screws.

Conclusion: Allograft and autograft single-bundle ACLR successfully return individuals to high level sports (e.g. skiing, soccer) and restore knee stability. Allograft is an acceptable option for ACLR in patients >16 years of age

without evidence of increased re-rupture rate or any signs of infection. Modified harvest and closure techniques reduce anterior knee pain after autograft BPTB.

Two Year Follow-up Comparing 2-Incision vs Anteromedial Portal Techniques for Femoral Drilling During Primary ACL Reconstruction **SS-15**

April 14, 11:55 AM

TYLER CARLLEE, M.D., PRESENTING AUTHOR

ZACHARY RIES, M.D.

BRIAN WOLF, M.D.

ANNUNZIATO AMENDOLA, M.D.

CAROLYN HETRICH, M.D.

MATTHEW BOLLIER, M.D.

Introduction: Anteromedial (AM) and 2-incision are two commonly used techniques for drilling the femoral tunnel during ACL reconstruction. The purpose of this study was to compare clinical and radiographic outcomes of patients undergoing primary ACL reconstruction using either AM or 2-incision technique with minimum 2-year follow-up.

Methods: 138 prospectively enrolled patients undergoing primary ACL reconstruction were divided into two groups based on femoral drilling technique and were evaluated pre-operatively, 6 weeks and 2 years post-operatively. Outcomes scores were collected at each visit using SF-36 PCS and MCS components, KOOS, and the Knee Activity Rating Scale.

Results: 48 patients underwent AM technique and 90 patients underwent 2-incision. Univariate analysis revealed no difference in pre-operative outcomes with the exception of AM group having higher KOOS Knee Pain ($p=0.023$) and Womac Pain ($p=0.036$). Following surgery, 2-incision femoral tunnels had a higher radiographic coronal angle ($68.8^{\circ}\pm 8.6^{\circ}$ vs $51.4^{\circ}\pm 11.3^{\circ}$; $p<0.001$) and clinical extension ($1.2^{\circ}\pm 2.7$ vs $2.9^{\circ}\pm 4.0^{\circ}$; $p=0.010$). There were no differences in knee flexion, complications, or re-rupture. There were also no differences clinical outcome scores with the exception of AM group having a higher 6-week and 2-year post-op KOOS ADL ($p=0.030$ and 0.050 , respectively) and KOOS Womac ($p=0.030$ and 0.050 , respectively), although likely not clinically relevant given the pre-operative differences. Multivariate analysis showed no clinical or outcome differences between AM and 2-incision techniques.

Conclusion: ACL reconstruction using the AM technique yielded lower radiographic coronal tunnel angle and slightly decreased knee extension. The theoretical risk of graft failure secondary to higher coronal angle leading to a "sawing" of the graft as it passes around a sharper femoral corner was not observed. Additionally, differences in pre-operative KOOS likely made post-operative differences irrelevant. We conclude there are no clinically relevant differences at 2 years in patients undergoing primary ACL reconstruction using either the AM or 2-incision femoral drilling techniques.

Fibrin Clot Prevents Bone Tunnel Widening after ACL Reconstruction with Allograft **SS-16**

April 14, 1:45 PM

CAROLA VAN ECK, M.D., PH.D., PRESENTING AUTHOR

LEVENT SURER, M.D.

CAN YAPICI, M.D.

CLAUDIA GUGLIELMINO, M.D.

JAMES IRRGANG, P.T., PH.D., A.T.C., F.A.P.T.A.

FREDDIE FU, M.D, D.Sc

Introduction: Bone tunnel widening is a potential complication after ACL reconstruction. The aim of this study was to evaluate if adding a fibrin clot to the allograft for anatomic single-bundle ACL reconstruction would reduce tunnel widening.

Methods: Fifty patients who underwent anatomic single-bundle ACL reconstruction were included. Twenty-five patients received an allograft alone and 25 patients received an allograft with fibrin clot. All patients underwent standard plain anterior-posterior and lateral radiographs of the operated knee immediately after surgery and at 1 year follow-up. The size of the tunnels was measured at both time points to calculate tunnel widening. A t-test was used to compare tunnel widening between the allograft and the allograft + fibrin clot group.

Results: There was significantly less tunnel widening in the allograft + fibrin clot group for the femoral tunnel width in the middle and distal portion of the tunnel and for the tibial tunnel width in the proximal and distal portions, as compared to the allograft only group.

Conclusion: Adding a fibrin clot to the allograft in anatomic single-bundle ACL reconstruction reduces the amount of tunnel widening at one year follow-up.

Increased Lateral Tibial Plateau Slope Predisposes Male College Football Players to ACL Injury **SS-17**

April 14, 1:50 PM

CAROLA VAN ECK, M.D., PH.D., PRESENTING AUTHOR

AMIR AZAR, M.D.

ZANEB YASEEN, M.D.

JAMES IRRGANG, P.T., PH.D., A.T.C., F.A.P.T.A.

FREDDIE FU, M.D, D.Sc

VOLKER MUSAHL, M.D.

Introduction: There are conflicting reports regarding the role of bony morphology characteristics such as an increased tibial slope as a risk factor of anterior cruciate ligament (ACL) injury. The purpose of this study was to determine if there is a correlation between bony morphology characteristics and ACL injury risk in male college football players.

Methods: Ninety male college football players who underwent magnetic resonance imaging (MRI) for a knee injury between 2005 and 2014 were included. Subjects with an ACL injury (ACL injury group) were matched for age, height, weight and BMI to subjects without ACL