constructions with 4-strand hamstring tendons (semitendinosus and gracilis.

Methods: 56 patients with ACL injury in one knee were recruited with 27 allocated to the double bundle ACL reconstruction group and 29 to the single bundle ACL reconstruction group and were analyzed including Lysholm knee scores, Tegner activity scores, Lachman and pivot shift test results, and radiographic stabilities were also compared between the two groups after a minimum of 3 year follow-up.

Results: Clinical outcomes were similar in the two groups at 3 year follow-up ($p>0.5$). Furthermore, stability results of Lachman test, pivot shift test, and radiological findings at 3 year follow-up failed to reveal any significant inter-group differences ($p>0.05$). Notchplasty rate was different between two groups: double bundle (25.9%) and single bundle group (58.6%) ($p<0.05$). In double bundle ACL reconstruction group, there was no extension deficit showing PL bundle rupture but 3 cases (11.1%) of medial joint tightness implying PL bundle tightness.

Conclusion: Double bundle ACL reconstruction does not produce better in clinical outcomes and postoperative stabilities after a minimum of 3 year follow-up. This suggests that only AML fiber reconstruction in ACL injury patients can produce a stable and reliable clinical result. Notchplasty rather than methods of ACL reconstruction may play an more important role in early postoperative rotational stability in double bundle ACL reconstruction.

The Evaluation of Revascularization Following Arthroscopic Anterior Cruciate Ligament Reconstruction Using Vascular Angiography Imaging and Serum Vascular Markers (SS-40) *Aldo Izaquirre, M.D., Luis Sierra, M.D., Yulia Savitskaya, Ph.D., Enrique Villalobos, M.D., Arturo Almazan, M.D., Clemente Ibarra, M.D.*

Introduction: To investigate the relationship between the vascular markers expression, the variables of vascularity at the tendon-bone interface and the functional outcome in the early phase after the arthroscopic anterior cruciate ligament reconstruction (ACLR): the temporal changes of angiogenesis status.

Methods: Between July 2007 and October 2008 25 patients with arthroscopic ACLR were chosen from those admitted at the Department of Sports Medicine & Arthroscopy. Mean follow-up was 12 months. Control data was collected from 25 subjects by Blood Bank. The ANG were measured by ELISA kit from R&D Systems. Express ELISA techniques have been developed to quantify immune marker of angiogenesis (anti-ANG IgG) in INR. Digital angiography imaging was used to evaluate the revascularization following arthroscopic ACLR. Functional outcome was evaluated using the International Knee Documentation Committee (IKDC) scoring. Before surgery, and at 1, 2, 3, 4, 5, 8, and 12 weeks after it, a control IKDC assessment, serological vascular markers, and vascular imaging measurements were completed.

Results: Neovascularization was confirmed by the angiogenic markers including ANG and anti-ANG IgG. Mean serum ANG levels in patients after ACLR were significantly higher at all time points, except on day 17 ($m\pm SD$, ng/mL: 334.9 ± 93.9 versus 443.6 ± 91.1; $P\leq0.005$). Levels were found equal after day 17 in both donors and ACLR patients. Digital angiography imaging research of ACLR blood supply and blood vessel indicated a significant difference between the revascularization of the normal and the pathological ACLR ($P\leq0.0089$). The vascularity at the tendon-bone interface was present as early as 3 weeks after surgery and increased over next 5 weeks. For patients with ACLR ANG expression was directly associated with levels of secretory anti-ANG IgG of this patients ($r=0.93$; $P\leq0.0001$). Serum anti-ANG IgG levels in ACLR patients were significantly correlated with the vascular state, i.e., patients after surgery with higher serum anti-ANG IgG levels ($m\pm SD$, ODx1000: 499 ± 163 versus 625 ± 118; $P\leq0.005$) had hypervascularity. Postoperative IKDC score was positively correlated with expression of ANG and anti-ANG IgG. Additionally, a significant association was seen between intensity of revascularization and functional outcome: IKDC score ($r=0.93$; $P\leq0.0001$).

Conclusion: A significant relationship was found between the examined variables of vascularity at the tendon-bone interface, IKDC score, and the dynamic change of serum levels of vascular markers after ACLR. ANG and anti-ANG IgG concentrations are elevated in the sera of patients after ACLR and correlate with individual and composite measures of the revascularization activity. Sensitive methods for visualizing revascularization following ACLR, such as digital angiography, are emerging as clinically important tools in the assessment of revascularization activity. Imaging technologies capable of evaluating vascularity at the tendon-bone will have a practical value in assessment of functional outcome following ACLR. Measurement of serologic vascular markers and angiography vascular imaging can be used to identify early revascularization following ACLR and show promise for functional outcome. Serological vascular markers and vascular imaging after ACLR will become useful tools in the assessment of revascularizat-

tion activity and immune response to surgical intervention.

Bone-patellar Tendon-bone Autograft vs Hamstring Autograft Anterior Cruciate Ligament Reconstruction in the Young Athlete: A Retrospective Matched Analysis with 2 to 10 year Follow-up (SS-41) *Eric Kropf, M.D., Randy Mascarenhas, M.D., Michael Tranovich, B.A., James J. Irrgang, Ph.D., P.T., A.T.C., Freddie H. Fu, M.D., D.Sc., Christopher D. Harner, M.D.*

Introduction: Patellar tendon and hamstring autografts are the most common graft choices in anterior cruciate ligament (ACL) reconstruction, but the ability of these grafts to return young athletes not just to activity, but to their previous level of play is still somewhat uncertain. This study sought to examine clinical and patient-reported outcomes as well as return to sport in athletes younger than 25 following ACL reconstruction with either patellar tendon (PT) or hamstring (HS) autografts using a matched-pairs case-control experimental design.

Methods: Twenty-three matched pairs were obtained based on gender (56.5% Female), age (18.3 $\pm$ 2.5yrs PT vs.17.6 $\pm$ 2.6 HS), and length of follow-up (4.7 $\pm$ 2.1yrs PT vs. 4.2 $\pm$ 1.6 HS). All patients reported participating in very strenuous (soccer, basketball etc.) or strenuous (skiing, tennis etc.) sporting activity 4-7 times/week prior to their knee injury. Patient-reported outcomes included return to play data, the IKDC, SAS, ADLS, and SF-36 forms. Clinical outcomes included knee range of motion, laxity, and hop/jump testing.

Results: Most patients in both groups were able to participate in very strenuous or strenuous sporting activity at follow-up [18 (78.3%) PT vs. 19 (82.6%) HS]. However, only 13(56.5%) of the PT subjects and 10 (43.5%) of the HS patients were able to return to pre-injury activity levels in terms of frequency and type of sport ($p=.63$). HS patients showed higher ADLS ($p<.01$) and SAS ($p<.01$) scores and better restoration of extension ($p<0.05$).

Conclusion: While both hamstring and patellar tendon graft types allow young athletes to return to some degree of strenuous or very strenuous sporting activity, only approximately half of all patients were able to return to their pre-injury level in terms of type and frequency of sport. Patellar tendon reconstruction may allow more patients to return to the same level of pre-injury sport, but hamstring grafts lead to better preservation of extension and higher patient-reported outcome scores.

Outcomes after Transphyseal Anterior Cruciate Ligament Reconstruction in Patients with Open Growth Plates (SS-42) *Christopher M. Larson, M.D., Christie Heikes, M.D., Chris Ellingson, M.D., M. Russell Giveans, Ph.D.*

Introduction: Concerns about growth disturbance after transphyseal ACL reconstruction in the presence of open growth plates exist. The hypothesis was that transphyseal soft tissue ACL reconstruction in individuals with open growth plates would result in minimal risk for growth disturbance.

Methods: Between 5/03 and 10/07, 30 skeletally immature individuals with a mean age of 13.9 years (range 9 - 15 years) underwent ACL reconstruction with soft tissue grafts (22 hamstring autograft, 8 tibialis anterior allograft) using extraphyseal fixation. 22 knees had wide open growth plates and 8 knees had partially open growth plates. Outcomes were prospectively evaluated with KT-1000 measurements, IKDC, Cincinnati, and Lysholm scoring. Radiographs were evaluated for asymmetric physeal closure, growth arrest lines, and knee alignment, and patients were also clinically evaluated for limb alignment and leg length inequality at minimum 2 year follow-up.

Results: The mean knee scoring was 93.8 pts (IKDC), 97.0 pts (Cincinnati), and 92.4 pts (Lysholm) at 3.2 years mean follow-up (range, 1 - 6 years). The mean KT-1000 side to side difference at most recent follow-up was 0.77 mm. Minimum two-year radiographic and clinic evaluation revealed three Harris growth arrest lines, no asymmetric physeal closure, and a mean side to side difference of 1.4 degrees for radiographic tibiofemoral angle, and 0.3cm leg length inequality. Three patients sustained a graft re-rupture (10.0%).

Conclusion: Transphyseal ACL reconstruction with soft tissue grafts and extraphyseal fixation in patients with open growth plates resulted in good to excellent outcomes in 90% without evidence for clinically significant growth abnormalities.

Fatigue Mediated Alteration of Knee Proprioception in the Adolescent Athlete: An Implication for Sports Related Injuries (SS-43) *Henry T. Goitz, M.D., Gaurav Jindal, M.D., Clinton Brawner, M.S., Nancy Hall, P.A., A.T.C., Clifford M. Les, D.V.M., Ph.D., Steve Keteyian, D.V.M., Ph.D., M.R.C.V.S.*

Introduction: Knee injuries generally occur late in the course of athletic play, suggesting that fatigue may contribute to altered neuromuscular control. The present study aims to investigate the effect of whole body fatigue on knee joint proprioception.