

based on clinical history and findings on physical examination, and that the presence of a posterior HAGL on MRI does not mandate repair, especially when other problems (i.e. rotator cuff pathology) explain the patient's pain. Further study of the relationship between the MRI abnormalities and objective findings in patients diagnosed with a posterior HAGL lesion should lead to a better understanding of this lesion and assist in developing optimal treatment strategies.

Double-Bundle vs. Single-Bundle Anterior Cruciate Ligament Reconstruction: Prospective, Randomize Clinical Study (SS-08). *Timo Jarvela, MD, Markku Jarvinen, MD*

Summary: Sixty-five patients were randomized into either double-bundle (n = 35) or single-bundle (n = 30) ACL reconstruction with hamstring tendons and bioabsorbable screw (Hexalon, Inion Company, Finland) fixation in both group. At the 1-year follow-up, the rotational stability and the early anterior stability were significantly better in the double-bundle group than in the single-bundle group. In addition, none of the patients in double-bundle group had graft failure, while four patients in the single-bundle group had. However, knee scores were equal at the follow-up, and all the results were significantly better at the follow-up than preoperatively, in both groups.

Purpose: The purpose of this prospective, randomized clinical study is to compare the outcomes of anterior cruciate ligament reconstruction when using either double-bundle or single-bundle technique and bioabsorbable interference screw fixation with both techniques.

Methods: Sixty-five patients were randomized into either double-bundle (n = 35) or single-bundle (n = 30) ACL reconstruction with hamstring tendons and bioabsorbable screw (Hexalon, Inion Company, Finland) fixation in both group. The evaluation methods were clinical examination, KT-1000 arthrometer measurements, radiographic evaluation, as well as International Knee Documentation Committee (IKDC), and Lysholm knee scores.

Results: There were no differences between the study groups preoperatively. For the minimum of 1-year follow-up (range, 12 to 19 months), 31 patients of the double-bundle group and 27 patients of the single-bundle group were available (89%). At the follow-up, the rotational stability, as evaluated by pivot shift test, was significantly better in the double-bundle group than in the single-bundle group. Also, the early anterior stability was significantly better with double-bundle technique, although at 1-year follow-up, no significant difference

between the groups was found anymore. In addition, none of the patients in double-bundle group had graft failure, while four patients in the single-bundle group had. However, knee scores were equal at the follow-up, and all the results were significantly better at the follow-up than preoperatively, in both groups.

Conclusions: Rotational stability and early anterior stability were significantly better with double-bundle technique than with single-bundle technique in ACL reconstruction with hamstring autografts and bioabsorbable screw fixation. However, both fixation techniques improved patients' performance.

Magnetic Resonance Imaging Measurement of the Two Bundles of the Normal Anterior Cruciate Ligament (SS-09). *Steven B. Cohen, MD, Corinne VanBeek, MD, James Starman, MD, Derek Armfield, MD, James Irrgang, MD, Freddie Fu, MD*

Summary: To date, no study has assessed the magnetic resonance imaging (MRI) appearance of the AM and PL bundle. The purpose of this study was to assess the MRI appearance of the AM and PL bundle in patients with a normal ACL in order to determine the average length and width of each bundle as measured on digital imaging. In the sagittal plane MRIs, the AM bundle was an average of $36.9 \text{ mm} \pm 2.8 \text{ mm}$ in length, and $5.1 \text{ mm} \pm 0.7 \text{ mm}$ in width. The PL bundle, by contrast, was an average of $20.5 \text{ mm} \pm 2.4 \text{ mm}$ in length, and $4.4 \pm 0.8 \text{ mm}$ in width. In the coronal plane, the width of the AM bundle was $4.2 \pm 0.8 \text{ mm}$ and the PL bundle $3.7 \pm 0.8 \text{ mm}$.

Purpose: Anatomical studies have shown that the normal anterior cruciate ligament (ACL) consists of two distinct functional bundles, the anteromedial (AM) and posterolateral (PL) bundles. Cadaveric measurements of the bundles have revealed that the AM bundle is approximately 38mm in length and 7.1 mm in diameter, while the PL bundle is 18mm in length and 6.7 mm in diameter.

Arthroscopic assessment has shown that all individuals with a normal ACL, regardless of age, have both an AM and PL bundle. To date, no study has assessed the MRI appearance of the AM and PL bundle. The purpose of this study was to assess the MRI appearance of the AM and PL bundle in patients with a normal ACL in order to determine the average length and width of each bundle as measured on digital imaging.

Methods: Fifty consecutive MRIs of the knee were prospectively collected using a 1.5 Tesla magnet. Demographic data was collected including age, gender, height and weight.

The length and width of each ACL bundle were measured on digital MRI using Stentor, Philips Medical System. Measurements were performed on sagittal and coronal images through the ACL and were independently measured in blinded fashion by 2 observers. In the sagittal plane, the AM bundle was defined as the oblique fibers inserting at the anterior border of the ACL on the tibia and the proximal aspect of the lateral femoral condyle attachment. The PL bundle was defined as the oblique fibers inserting posteriorly on the tibial insertion, and inferiorly on the lateral femoral condyle. In the coronal plane, the AM bundle was defined as the central of the two bundles; whereas the PL bundle was defined as the lateral of the two bundles, from its insertion on the tibia to its origin in the intercondylar notch.

Results: The average age of patients included was 33.5 years (range: 15-61) There were 20 females and 30 males. Both the AM and PL bundles were visualized for all 50 patients. In the sagittal plane MRIs, the AM bundle was an average of $36.9 \text{ mm} \pm 2.8 \text{ mm}$ in length, and $5.1 \text{ mm} \pm 0.7 \text{ mm}$ in width. The PL bundle, by contrast, was an average of $20.5 \text{ mm} \pm 2.4 \text{ mm}$ in length, and $4.4 \pm 0.8 \text{ mm}$ in width. In the coronal plane, the width of the AM bundle was $4.2 \pm 0.8 \text{ mm}$ and the PL bundle $3.7 \pm 0.8 \text{ mm}$. The inter-observer reliability for length of the ACL in the sagittal plane was .849 with a 95% CI of .748 to .911 for the AM bundle, and .748 with a 95% CI of .597 to .849 for the PL bundle.

Conclusion: This is the first study that quantifies the two anatomic bundles of the ACL based on MRI. Digital MRI allows for a high degree of accuracy. Providing precise measurement of the AM and PL bundles of the ACL on MRI allows for an accurate determination of damage to one or both of the bundles following injury.

Tunnel Positioning of AM and PL Bundle in Anatomic ACL Reconstruction (SS-10). *Thore Zantop, MD, Wolf Petersen, MD, Freddie Fu, MD*

Summary: The centre of the femoral PL bundle is shallow and inferior to the AM bundle. To reproduce the anatomy, it is mandatory to place the tunnels exactly within the femoral origin and tibial insertion of the ACL.

Purpose: Aim of the current study was to provide anatomical details of AM and PL bundle of the ACL giving guideline for tunnel positioning in anatomical ACL reconstructions.

Methods: A total of 20 human cadaveric knees (range 45-87 years) were dissected and the the medial femoral condyle cut to expose the ACL. The bundles were separated due to their tensioning pattern and the distances of the centre of AM and PL bundle to the

articular cartilage were measured. Radiographic analyses were performed using the techniques of Bernard and Hertel and Harner at the femur as well as the method by Harner and Stäubli and Rauschnig at the tibia.

Results: The center of the PL bundle was more shallow and inferior when compared to the center of the AM bundle with a distance of 6.5 mm and a mean of 5.8 mm to the shallow and inferior cartilage margin, respectively. On the tibia, the center of the AM bundle is aligned with the anterior horn of the lateral meniscus. According to Bernard and Hertel the center of the AM bundle is at 18.5% and 22.3% and the PL bundle at 29.3% and 53.6%. At the tibia, the centre of the AM bundle is at 30% and the PL bundle is located at 44% according to Stäubli and Rauschnig.

Conclusions: The centre of the femoral PL bundle is shallow and inferior to the AM bundle. To reproduce the anatomy, it is mandatory to place the tunnels exactly within the femoral origin and tibial insertion of the ACL.

Double Bundle ACL Reconstruction Better Restores the Tibiofemoral Pressure and Contact (SS-11). *Yusuke Morimoto, MD, Mario Ferretti, MD, Rodrigo Kaz, MD, Patrick Smolinski, MD, Freddie Fu, MD*

Summary: In order to evaluate the tibiofemoral pressure and contact area after ACL reconstruction, ten knees from cadavers were tested under 1000 N axial load. The tibiofemoral pressure and contact area were marked in a pressure measuring film placed between tibia and femur. Double-Bundle (DB) ACL reconstruction demonstrated better restoration of the average and maximum tibiofemoral pressure as well as tibiofemoral contact area when compared to the Single-Bundle (SB) ACL reconstruction. These in vitro findings may suggest that DB ACL reconstruction better preserve the cartilage after an ACL reconstruction compared to the SB ACL reconstruction.

Purpose: The long-term clinical outcomes of ACL surgery show a large amount of patients with cartilage degenerative changes. Biomechanical studies have shown that Double-Bundle (DB) ACL reconstruction better restores the knee biomechanics when compared to the conventional Single-Bundle (SB) ACL reconstruction. However, it is unknown whether the tibiofemoral cartilage pressure and contact area is better restored after DB reconstruction when compared to SB reconstruction. The purpose of this study is to evaluate the tibiofemoral pressure and contact area after SB or DB ACL reconstruction.

Methods: 10 knees from cadavers were used for this study. Five knees were tested for DB and five for SB