ISAKOS

International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine

9th Biennial ISAKOS Congress • May 12-16, 2013 • Toronto, Canada

Paper #182

Which Auto Graft Can Reproduce the Native ACL Footprint Size? A Cadaver Study.

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Summary:
The purpose of this study was to compare the size of commonly used auto grafts (hamstring, bone-patella-tendon-bone) and the size of the native ACL insertion site to determine which auto graft can reproduce the native ACL size most accurately using cadaveric knees. Only the ST-G auto graft was able to reproduce the native size of the ACL footprint on the femoral side.

Abstract:
Purpose:
The purpose of this study was to compare the size of commonly used auto grafts (hamstring, bone-patella-tendon-bone) and the size of the native ACL insertion site to determine which auto graft can reproduce the native ACL size most accurately using cadaveric knees. For clinical relevance, revealing this issue would be useful information when surgeons select the auto graft in ACL reconstruction.

Materials and Methods:
Fourteen non-paired cadaveric knees of Japanese population were used (5 Males, 9 Females, mean age 79.3±8.2 years).
The semitendinosus muscle and the gracilis muscle were harvested from the tibial insertion site to the proximal end of the tendon tissue (n=14). Simulating anatomical double bundle ACL reconstruction using a semitendinosus tendon alone (ST), the harvested semitendinosus was cut in half. The bigger half of the graft was regarded as the antero-medial (AM) bundle, and the remaining half was regarded as the postero-lateral (PL) bundle. Each graft was doubled and the diameter measured using a graft sizing tube (Smith and Nephew Inc, Andover, Massachusetts). Simulating anatomical double bundle ACL reconstruction using semitendinosus and gracilis tendons (ST-G), the bigger half of the semitendinosus tendon and the gracilis tendon was doubled and regarded as the AM bundle, and the smaller half of the semitendinosus tendon was regarded as the PL bundle. The size of each graft was measured using the method above. To calculate the total graft area, the following formula was used: Hamstrings graft area (mm2) = (AM diameter/2)2×3.14 + (PL diameter/2)2×3.14. Simulating anatomical ACL reconstruction using a rectangular BPTB graft, a 10-mm wide BPTB graft was harvested from the central portion of the patella tendon with 15-mm long bone plugs on both ends (n=14). To calculate the area of the BPTB graft, the following formula was used: BPTB graft area (mm2) = 10 (mm) width × thickness of patella tendon (mm). The outline of the femoral ACL footprint was marked with colored ink. After marking the ACL footprint, each footprint was photographed with a Casio EXILIM S12 digital camera (Casio, Co. Ltd., Tokyo, Japan). The pictures were downloaded to a personal computer, and the footprint area was analyzed using Image J software (National Institute of Health). The accuracy of the area measurement was less than 0.1 mm, and 0.1mm2. Each graft area (ST, ST-G, and BPTB) and ACL footprint area were compared with the Friedman test, and the Wilcoxon signed ranks test was used for pairwise analysis (SPSS Inc., Chicago, IL).

Results:
The average areas of the ST, ST-G, and BPTB graft were 52.3±7.3, 64.4±9.2, and 32.7±6.5mm2, respectively. The sizes of the native femoral and tibial ACL footprint were 85.4±26.3, and 145.4±39.8mm2, respectively. Only the ST-G graft showed no significant difference in graft size when compared with the femoral ACL footprint (ST: p=0.008, ST-G: p=0.186, BPTB: p=0.000). At the tibial side, the size of all reconstructed graft areas were significantly smaller than

that of the native ACL footprint (ST: p=0.000, ST-G: p=0.000, BPTB: p=0.000).

Conclusion:
Only the ST-G auto graft was able to reproduce the native size of the ACL footprint on the femoral side. None of the auto grafts could reproduce the size of the tibial ACL footprint. For clinical relevance, ST-G graft is recommended in order to reproduce the native size of the ACL in anatomical ACL reconstruction with auto graft.