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Outcomes and complications associated with knee flexion angle during graft tensioning for anterior cruciate ligament reconstruction

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Introduction: Few clinically-based, outcomes studies have been designed to understand the implications of knee flexion angle at the time of graft tensioning during anterior cruciate ligament (ACL) reconstruction. Knee positioning at the time of graft tensioning is of importance due to the risk of complications associated with over-tensioning or under-tensioning of the ACL graft. There is currently no consensus regarding ideal knee positioning during graft tensioning. Some orthopaedic surgeons report a preference for graft tensioning anywhere between 0° of knee flexion and 30° of knee flexion. The study was designed to systematically review the highest level of clinical evidence regarding the outcomes and complications of graft tensioning at 0° of knee flexion and 30° of knee flexion for single-bundle ACL reconstruction with hamstring autograft.

Methods: Following PRISMA guidelines, a systematic review of the PubMed, EMBASE, and Cochrane Library databases was conducted. The following search terms were used: "anterior cruciate ligament reconstruction," "hamstring autograft," "outcomes", and "complications. 501 studies were initially identified. Inclusion criteria were English-language, human subjects, Level I and Level II studies in which a single-bundle hamstring autograft technique was performed for ACL reconstruction and an explicit statement was made of the knee flexion angle at the time of graft tensioning as either 0° of knee flexion or 30° of knee flexion. Exclusion criteria were non-English language, non-human subject, Level III and Level IV studies in which a non-hamstring autograft and non-single bundle technique was performed for ACL Reconstruction. Following strict application of the above criteria and removal of duplicate studies across databases, 491 of the identified studies were excluded. Ten studies were deemed eligible for systematic review. The eligible studies were assessed for bias and methodological quality. Relevant data was extracted, and the studies were analyzed by two independent reviewers on the basis of knee flexion angle at the time of graft tensioning, post-operative functional outcomes, and graft failure. Descriptive statistics were generated in order to conduct a quantitative assessment of the relationship between functional outcomes of ACL reconstruction and knee flexion angle at the time of graft tensioning for ACL reconstruction. Post-operative data was analyzed in three categories: (1) objective functional outcomes, (2) subjective functional outcomes, and (3) graft failure. Objective functional outcomes were assessed using the KT-1000 Arthrometer. KT-1000 Arthrometer was measured by side-to-side difference with normal defined as <3 mm. Subjective functional outcomes were measured using the International Knee Documenting Committee (IKDC) Score, the Lysholm Knee Score, and the Tegner Activity Scale. Graft failure was defined as re-rupture of the ACL graft requiring subsequent revision procedure.

Results: Ten studies were subjected to systematic review. Data from 448 subjects was analyzed. The average post-operative KT-1000 Arthrometer for graft tensioning at 0° of knee flexion was 2.2 mm while 30° of knee flexion was 1.4 mm. The average -post-operative IKDC Subjective Score was 87.0 for graft tensioning at 0° of knee flexion and 81.7 for graft tensioning at 30° of knee flexion. The average post-operative Lysholm Knee Score was 91.7 for the 0° of knee flexion group and was 82.0 for the 30° of knee flexion group. The average post-operative Tegner Activity Scale Scores for the 0° of knee flexion group and the 30° of knee flexion group were 5.3 and 5.2, respectively. The reported graft failure rate for the 0° of knee flexion group was 2.1% while the reported graft failure rate for the 30° of knee flexion group was 3.4%.

Conclusions: The results of the study are supported by previously reported data from biomechanical cadaver models. There is a lack of high-quality, randomized controlled trials which decreases the ability to infer the true effectiveness of one knee flexion angle at graft tensioning over another. Further subgroup analysis needs to be performed to address the influence of additional variables such as surgical technique (i.e. anteromedial portal vs. transtibial femoral drilling approach) on post-operative outcomes following ACL reconstruction.

Level of Evidence: Level II, Systematic Review of Level I and Level II Studies

Biography

Stephanie Jones is a 2nd year medical student at Morehouse School of Medicine. She received her Bachelor of Arts in Psychology from Duke University in 2014. She is the president of the Bonnie Simpson Mason Orthopaedic Surgery Interest Group at Morehouse School of Medicine and a scholar in the Nth Dimensions Program. She has presented her research at the National Sports Medicine Foundation conference in Lansdowne, Virginia and the National Medical Association conference in Los Angles California. Following completion of her Doctor of Medicine degree, she will apply to residency programs in Orthopaedic Surgery and complete a fellowship in Sports Medicine.

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