Failure Rate and Clinical Outcomes of Anterior Cruciate Ligament Reconstruction Using Autograft Hamstring Versus a Hybrid Graft

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Purpose: To compare the revision rate and subjective outcome measures of autograft hamstring versus a soft tissue hybrid graft combining both autograft hamstring and tibialis allograft for isolated anterior cruciate ligament (ACL) reconstruction. **Methods:** A single-center retrospective, nonrandomized, comparative study of isolated ACL reconstruction revision rates for subjects who underwent arthroscopic reconstruction of the ACL using autograft hamstring or a soft tissue hybrid graft using both autograft hamstring and tibialis allograft was performed. Patients with isolated ACL tears were included and underwent anatomic single-bundle reconstruction using an independent tunnel drilling technique and a minimum of 24 months' follow-up. The primary outcome assessed was the presence or absence of ACL rerupture. Secondary clinical outcomes consisted of the International Knee Documentation Committee, University of California at Los Angeles (UCLA) ACL quality of life assessment, and the visual analog pain scale. **Results:** Between February 2010 and April 2013, 95 patients with isolated ACL tears between ages 18 and 40 met the inclusion criteria and were enrolled. Seventy-one autograft hamstring and 24 soft tissue hybrid graft ACL reconstructions were performed during the course of this study. The follow-up period was 24 to 32 months (mean 26.9 months). There were no statistically significant differences in patient demographics or Outerbridge classification. No statistically significant differences in ACL retears (5.6% auto, 4.2% hybrid; $P = .57$) were found between groups. Clinical International Knee Documentation Committee and UCLA ACL quality of life assessment improvement scores revealed no statistically significant differences in autograft and hybrid graft reconstructions (41 ± 11, 43 ± 13; $P = .65$) (38 ± 11, 40 ± 10; $P = .23$). The mean pain level decreased from 8.1 to 2.8 in the autograft group and 7.9 to 2.5 in the hybrid group ($P = .18$). **Conclusions:** The use of a hybrid soft tissue graft has a comparable rerupture rate and clinical outcome to ACL reconstruction using autograft hamstring. **Level of Evidence:** Level III, retrospective comparative study.

It is estimated that more than 200,000 anterior cruciate ligament (ACL) reconstructions are performed annually in the United States.[1] Successful clinical outcomes involving various reconstructive techniques, implants, and rehabilitation protocols have been described in the literature previously.[1] The optimal graft for ACL reconstruction is a heavily debated topic and numerous studies have been conducted to determine the optimal graft for the patient.[1-7]

Recently, autograft ACL reconstruction has been shown to have a lower rerupture rate, predominantly in younger, physically active subjects when compared with allograft tissue.[1,8,9] In addition, the use of allograft tissue in young athletic patients, especially in those less than 25 years of age, has recently been questioned because of documented failures rates as high as 23% with allograft compared with 6% with autograft.[2,3,8,10-16] Although harvesting autologous tissue for reconstruction eliminates the risk of disease transmission and allows for earlier graft incorporation when compared with allograft tissue, there is a risk of harvest site morbidity, damage to the graft, and smaller than desired and recommended graft size.[16-21] The authors have described increased revision rates as high as 22% when using soft tissue autografts less than 8 mm in

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diameter[22,23] and quadruple stranded hamstring grafts of less than 8.5 mm in diameter are a risk for poor patient outcomes, finding a 6.8 times greater relative risk in the rate of graft failure, particularly in patients under the age of 20.[19]

Another commonly used graft for primary ACL reconstruction is allograft tissue that has increased in use from 17.4% to 45.6% between 2002 and 2008.[24] One of the major benefits of using allograft tissue for ACL reconstruction is a predictable graft size with no donor site morbidity.[3] Despite the benefits of using an allograft, usage carries disadvantages as well such as increased surgical cost, graft availability, an increased risk of immune response, and disease transmission resulting in postsurgical complications and even increased rates of graft failure.[1,16] Several recent studies have shown a 4 times higher probability of rerupture for all patients after allograft ACL reconstructions when compared with autograft reconstructions[3,4,25] and up to 5 times higher probability specifically in patients under 25 years of age.[12,26-28]

A hybrid graft combining both autograft hamstring and allograft soft tissue is a viable reconstructive option for surgeons who desire performing ACL reconstruction using a soft tissue graft.[26] It provides surgeons the ability to customize graft size by augmenting autograft hamstrings with soft tissue allografts.[5,6,8,29,30] Hybrid grafts may be used as a primary graft for reconstructions or to enhance autologous hamstring tissue when it is iatrogenically damaged or is of insufficient size when harvested. A Multicenter Orthopaedic Outcomes Network study cohort revealed statistically significant inferior Knee Injury and Osteoarthritis Outcome Score (KOOS) sport and recreation function scores when evaluating autograft reconstruction outcomes 2 years after ACL reconstruction with as little as a 1-mm decrease in graft size.[22] Although the question of allograft versus autograft for reconstruction of the ACL is a heavily debated topic by orthopaedic surgeons, there is a paucity of research comparing the clinical benefit of using hybrid grafts with autograft tissue. Li et al.[31] recently reported postoperative peripheral blood inflammatory markers, knee stability, and clinical outcomes and found no difference when comparing ACL reconstruction with autograft hamstring and a soft tissue hybrid graft. The purpose of this study was to compare the revision rate and subjective outcome measures of autograft hamstring versus a soft tissue hybrid graft for isolated ACL reconstruction. We hypothesized that a hybrid soft tissue ACL reconstruction would demonstrate no significant difference in retear rates or clinical outcomes using International Knee Documentation Committee (IKDC) and ACL quality of life assessment (ACL-QL) scores when compared with an all autograft hamstring ACL reconstruction.

Methods

This is a single-center retrospective, nonrandomized, observational study with prospectively collected data evaluating the rerupture rate of isolated ACL reconstruction using autograft hamstring versus a hybrid soft tissue graft combining autograft hamstring semitendinosis and gracilis tendons with soft tissue allograft in isolated ACL tears as previously described.[26] The clinical study received approval through the Main Campus Institutional Review Board. Strict inclusion and exclusion criteria were used. The inclusion criteria were (1) a complete isolated ACL tear confirmed with magnetic resonance imaging and during diagnostic arthroscopy requiring primary reconstruction, (2) no additional ligament injury or laxity requiring surgical intervention, (3) physically active, and (4) between 18 and 40 years of age with radiographic evidence of skeletal maturity. Patients were excluded if they had any of the following: (1) injury requiring concurrent meniscal allograft, osteotomy, or cartilage restoration or resurfacing procedure, (2) meniscal tear requiring partial meniscectomy or repair, (3) history of immunological disease, (4) history of addiction to drugs, solvents, or alcohol, or (5) previously failed ACL reconstruction or any prior ipsilateral or contralateral knee surgical intervention.

Patients (N = 406) were identified with ACL tears between February 2010 and April 2013. There were 295 subjects excluded for not meeting the inclusion criteria of an isolated ACL tear. There were also 16 subjects who met inclusion criteria yet declined to participate in the study. Enrollment of 95 patients meeting criteria was voluntary with no enrolled patients lost to follow-up. Subjects were educated and counseled preoperatively regarding the nature of their injuries and surgical treatment options, including graft options. All patients underwent a diagnostic arthroscopy confirming the diagnosis and arthroscopic ACL reconstruction by an experienced orthopaedic surgeon fellowship trained and certified in Orthopedic Sports Medicine using independent femoral tunnel drilling using an accessory anteromedial portal at the 10:30 or 1:30 position in the right and left knee, respectively. All patients were scheduled for autograft hamstring and also consented for the possibility of a hybrid graft should the surgeon determine the patient's hamstring tissue alone not be sufficient for the reconstruction when measured at the time of graft preparation during surgery.[26] Soft tissue allografts used by the research hospital are tibialis grafts sterilized without radiation using a BioCleanse tissue sterilization process (RTI Surgical, Alachua, FL).[32]