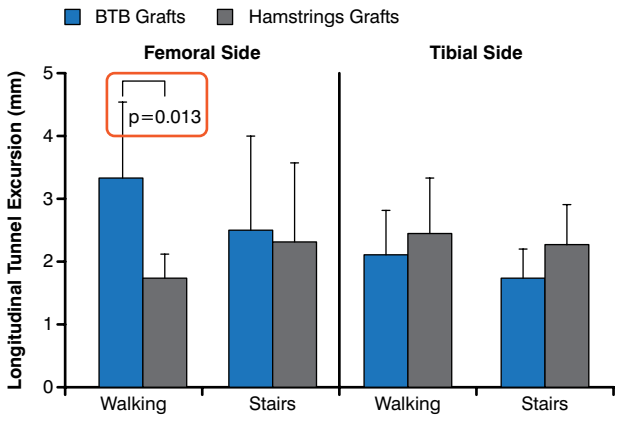
Prior to implantation, six .8-mm tantalum beads were embedded into each graft, pairs of which were located within each bone tunnel and in the graft midsubstance. Computed tomographic scans were obtained 6 weeks postoperatively and used to create 3-dimensional femur and tibia bone models. Cylindrical coordinate systems were then fit to the bone tunnels to examine tunnel motion, and dynamic stereo x-ray images were collected while patients walked on a treadmill and descended stairs. Longitudinal (along tunnel axis) and transverse (within tunnel cross section) graft motion was quantified by 2 methods. One was described as graft excursion, defined as the total path distance traveled by the graft over a set period of time (walking: 200 ms following foot strike; stair descent: 300 ms following single-leg support).

Postoperative rehabilitation was similar in both groups, with all patients having returned to their activities of daily living at 6 weeks postoperatively. The grafts were still moving in all patients within the femoral and tibial bone tunnels at the 6-week follow-up testing. The BTB group displayed significantly more longitudinal graft excursion within the femoral tunnel compared with the HS patients (Figure 1). It is important to note that all patients were doing well at follow-up. The findings of this study showed no evidence of faster graft osteointegration of BTB over HS, no detectable midsubstance strain because the grafts were still moving within the bone tunnels, and no difference in knee kinematics between the grafts, Dr. Irvine said.

Dr. Irvine acknowledged that some limitations of this study included its small sample size and the absence of contralateral knee data. Although 1-year follow-up testing remains under way for this trial to assess whether the pattern of findings in this study changes as healing progresses, future studies using quantitative magnetic resonance imaging will be essential to further assess graft healing.

Figure 1. Longitudinal Graft Motion in Bone Tunnels 6 Weeks After ACL Reconstruction



ACL, anterior cruciate ligament; BTB, bone–patellar tendon–bone autograft.

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On November 12, 2014, the bracket was added to this figure.

Autograft ACL Repair More Durable Than Allograft

Written by Nicola Parry

Craig R. Bottoni, MD, Tripler Army Medical Center, Honolulu, Hawaii, USA, presented data from a study that was conducted to assess the long-term results of primary anterior cruciate ligament (ACL) reconstructions using either allograft or autograft. The results showed that, in a young, athletic population, reconstructed ACLs failed 3 times as often with allografts compared with autografts.

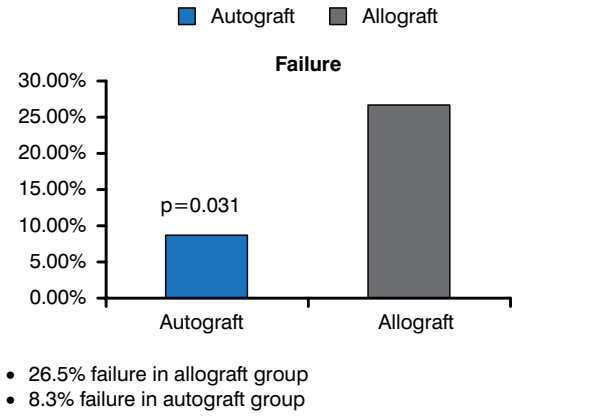
ACL reconstructions are becoming increasingly common, and with >250,000 tears occurring each year in the United States, resulting in >100,000 reconstructions, the use of allografts is also becoming more common. With this in mind, Dr. Bottoni and colleagues conducted a prospective, randomized controlled study to compare the long-term clinical and subjective outcomes after 100 primary ACL reconstructions in 99 patients with a symptomatic ACL-deficient knee who received either hamstring autograft tissue (n=50; mean age, 28.9 years) or tibialis posterior tendon allografts (n=50; mean age, 29.2 years).

Participants were predominantly active-duty military personnel. All allografts were from a singular American Association of Tissue Banks–approved tissue bank, and they were aseptically processed and fresh frozen without terminal irradiation. Graft fixation was the same in all cases, and all patients followed the same rehabilitation protocol, using physical therapists who were blinded to their patients' surgical procedure. Patients underwent preoperative and postoperative assessments of graft integrity, knee stability, and functional status, and they also completed telephone- and Internet-based questionnaires.

Exclusion criteria included patients younger than 18 years old, as well as those who had multiligamentous injury or had undergone previous knee ligament surgery. The primary outcomes were graft integrity, subjective knee stability, and functional status.

After a minimum of 10 years of follow-up, 2 patients died, and 1 was lost to follow-up. In the population that remained for analyses, however, more than 80% of all grafts remained intact and had maintained stability. Autografts had a failure rate of 8.3%, however, compared with 26.5% for allografts (p=.031; Figure 1). Dr. Bottoni

Figure 1. Comparison of Failure Rate Using Allograft Versus Autograft



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pointed out that although these findings are in contrast to previous reports of similar failure rates of autografts and allografts in a young, athletic population of patients, those data did not derive from randomized controlled trials.

In the remaining patients whose graft was intact, there was no difference in the mean Single Assessment Numeric Evaluation, Tegner, or International Knee Documentation Committee scores.

Dr. Bottoni acknowledged that some limitations of this study included the subjective assessment of graft stability as well as the fact that the study involved only the tibialis posterior type of allograft. Consequently, the results can be applied to only this type of allograft and cannot be extrapolated to other types of allografts. It is therefore possible that other types, particularly those with bone, such as the bone–patellar tendon–bone or Achilles grafts, may have resulted in different outcomes, concluded Dr. Bottoni.

Open Subpectoral Technique Improves Biomechanical Performance of Biceps Tenodesis

Written by Nicola Parry

Stephen F. Brockmeier, MD, University of Virginia, Charlottesville, Virginia, USA, presented data from a matched cadaveric study that was conducted to compare the arthroscopic suprapectoral and open subpectoral techniques for biceps tenodesis. The data showed that the arthroscopic suprapectoral biceps tenodesis (ASPBT) technique results in a more proximal tenodesis location, tends to overtension the biceps, and has a significantly reduced ultimate load to failure, compared with an open subpectoral biceps tenodesis (OSPBT) technique.

Tenodesis is an accepted treatment option in the management of pathology involving the long head of the biceps (LHB) tendon. However, although there is evidence that biceps tenodesis of the diseased tendon can improve patient symptoms, the optimal location for tenodesis remains controversial. The procedure can be performed open or arthroscopically, but there is a lack of evidence-based consensus available to guide surgeons' decision making.

With this in mind, Dr. Brockmeier and colleagues conducted a prospective study to directly compare the ASPBT using an interference screw implant and OSPBT for LHB tenodesis, particularly in terms of location, in vivo restoration of the LHB length-tension relationship, and the mechanical strength of the tenodesis.

The study included 18 matched cadaveric shoulder specimens randomly assigned to either ASPBT (n = 9) or OSPBT (n = 9). Surgery was performed by 2 sports fellowship–trained surgeons using identical techniques. A preoperative metallic bead was sutured in place 1 cm distal to the biceps musculotendinous junction, and preoperative fluoroscopy was used to measure bead location. Postoperative fluoroscopy was also performed to determine the location of the tenodesis and the metallic bead, and preoperative and postoperative fluoroscopic images were compared to determine tensioning. Biomechanical testing was then performed on a material testing system machine; the surgical constructs were subjected to cyclic loading (100 cycles), followed by load-to-failure testing.

The mean tenodesis location in the ASPBT group was 4.68 cm distal to the top of the humerus, compared with 7.46 cm in the OSPBT group ($p < .001$). According to Dr. Brockmeier, these results were similar to those obtained in a separate clinical study.

The ASPBT technique tended to overtension the biceps significantly more than the OSPBT technique (2.15 cm vs .78 cm; $p < .001$). The average load to failure in the ASPBT group was 138.7 N, compared with 197.5 N in the OSPBT group ($p < .001$), and implant pullout was significantly more common in the ASPBT (n = 7 of 9) compared to the OSPBT (n = 1 of 9) group.

The results of this study appear to favor the open technique for biceps tenodesis, showing a risk of significant biceps overtensioning per contemporary arthroscopic techniques. Compared with implants in the open technique, currently available arthroscopic tenodesis implants may be susceptible to pullout failure at lower loads, and improved implants are likely necessary to produce a construct of equivalent mechanical strength.