Commentary & Perspective

Double-Bundle ACL Reconstruction with Use of a Single Tibial Tunnel: A Technique or an Anatomic Concept?

Commentary on an article by Jin Hwan Ahn, MD, et al.: "Outcomes and Second-Look Arthroscopic Evaluation After Double-Bundle Anterior Cruciate Ligament Reconstruction with Use of a Single Tibial Tunnel"

Freddie H. Fu, MD, Paulo H. Araujo, MD, and Albert Lin, MD

Despite good outcomes reported after traditional anterior cruciate ligament (ACL) reconstruction techniques, a substantial number of patients have been found to develop osteoarthritis in mid-to-long-term follow-up studies[1,2] as the dynamic function of the knee was not reestablished after surgery[3]. As a consequence, in the past decade, the debate regarding the importance of restoring native anatomy in ACL reconstructions has led to a school of thought that suggests the solution to avoid degenerative changes following an ACL rupture could rest on reestablishing the anatomic characteristics of the ligament.

As part of this recent debate, Ahn et al. presented a well-designed, retrospective study with the purpose of reporting the clinical outcomes of double-bundle ACL reconstruction with use of a single tibial tunnel and its correlation with graft appearance in a second-look arthroscopy. The assessment parameters included outcome scores such as the Lysholm knee score, International Knee Documentation Committee (IKDC) evaluation, side-to-side anterior laxity measured with use of a KT-2000 arthrometer, rotational stability graded by the pivot-shift test, and degenerative changes graded on anteroposterior and lateral weight-bearing radiographs. The overall results showed a substantial improvement after surgery in the outcome scores, KT-2000 arthrometer results, and pivot-shift grading compared with the preoperative state. In the second-look arthroscopy, the posterolateral grafts demonstrated more tears, elongation, and poorer synovial coverage than the anteromedial grafts. Graft appearance was excellent for 65% of the posterolateral grafts and 73% of the anteromedial grafts; fair for 18.9% and 21.6%, respectively; and poor for 16.2% and 5.4%. However, no correlation was seen between graft appearance and clinical outcomes.

This study infers an important point of discussion regarding double-bundle ACL reconstruction—that is, double-bundle ACL reconstruction is not simply a technique but an anatomic concept. Their innovative, single tibial tunnel technique for double-bundle reconstruction fits a unique population of patients with small tibial insertion sites more commonly found in the Asian population, and this technique maintains the individuality of the anteromedial and posterolateral bundles without losing sight of the anteromedial and posterolateral synergetic roles. Therefore, the double-bundle principle can be accomplished in multiple ways. It should not be viewed as a so-called cookie-cutter method limited to two tunnels placed in the tibia and two tunnels in the femur, but perhaps should be focused on reestablishing the functional and synergetic role of the bundles. Along this line of thought, a variety of techniques may be employed to achieve the primary goal of reestablishing native function while at the same time tailoring the technique to accommodate the individual anatomy of the patient. The effort to preserve the native ACL function presented in this study should be applauded. The authors should also be commended for their second-look arthroscopy, which investigates the important question of whether there are separate forces acting on each bundle individually and what the physiologic manifestations of these may be. This is a concept that certainly warrants further investigation.

Although the complete accomplishment of the double-bundle concept is attempted, the technique utilized did not necessarily focus on restoring native insertion site anatomy. Anatomic reconstruction of the ACL is defined as the restoration of the ACL to its native dimensions, insertion sites, and collagen orientation[4]. Therefore, ACL reconstruction should be guided by the patient's individualized characteristics. Preoperative magnetic resonance imaging scans to measure quadriceps and patellar tendon thickness and the ACL length and insertion-site size, the latter of which can be confirmed intraoperatively, should also be considered during graft selection and sizing. This technique should be individualized to restore the insertion site to at least 60% to 80% of the cross-sectional area. Thus, the complete accomplishment of the double-bundle concept is not consistently achieved as no methodology to address individual anatomy is described. The methodology described focuses on femoral tunnel drilling in predetermined o'clock positions regardless of patient anatomy. In previous studies, the o'clock position becomes variable at different flexion angles and does not take into account individualized anatomy, thus making it an unreliable method for anatomic tunnel drilling. Furthermore, the graft sizes used were limited to the size of the patient's hamstring tendons. There is no discussion regarding the width or cross-sectional areas of

the native femoral and tibial insertions; thus, it can be inferred that, at least in some patients, there is likely a mismatch between graft size and native insertional site. These inconsistent techniques may make any further conclusion and outcome measures difficult to interpret.

In summary, Ahn et al. presented a good outcome for their series, but this conclusion should be viewed cautiously as they used nonanatomic double-bundle reconstructions. Also, no correlation was found between graft appearance and clinical outcomes. In addition, the posterolateral bundle was shown to have more deterioration than the anteromedial bundle. Despite the good results, anatomic approaches to the insertion sites and individualized surgery were not accomplished, and this may have led to the higher rate of deterioration and failure of the posterolateral bundle. Additional objective outcome measurements should be used to more accurately assess the real surgical results.

Freddie H. Fu, MD, Paulo H. Araujo, MD, and
*Albert Lin, MD**
University of Pittsburgh School of Medicine,
Pittsburgh, Pennsylvania

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