

## EVIDENCE-BASED ORTHOPAEDICS

## Anatomic Double-Bundle Anterior Cruciate Ligament Reconstruction Was Superior to Conventional Single-Bundle Reconstruction

Hussein M, van Eck CF, Cretnik A, Dinevski D, Fu FH. Prospective Randomized Clinical Evaluation of Conventional Single-Bundle, Anatomic Single-Bundle, and Anatomic Double-Bundle Anterior Cruciate Ligament Reconstruction: 281 Cases with 3- to 5-Year Follow-up. *Am J Sports Med.* 2012 Mar;40(3):512-20.

**Question:** In patients having anterior cruciate ligament (ACL) reconstruction, how does the anatomic double-bundle technique compare with the anatomic single-bundle technique, and how do both techniques compare with the conventional single-bundle technique?

**Design:** Randomized (allocation concealed), blinded (outcome assessor), controlled trial with a mean follow-up of 51 months.

**Setting:** The Artros Center for Orthopaedic Surgery and Sports Medicine in Ljubljana, Slovenia.

**Patients:** 330 active patients with a closed growth plate who had an ACL rupture. Exclusion criteria were multiligamentous injuries, severe arthritic changes, total or subtotal meniscectomy, contralateral ACL-deficient knee, or partial ACL rupture. 281 patients (mean age thirty-three years, 61% men) were included in the analysis.

**Intervention:** Patients were allocated to 3 different techniques of ACL reconstruction: anatomic double-bundle (n = 160),

anatomic single-bundle (n = 85), or conventional single-bundle (n = 85). Anatomic double-bundle reconstruction involved use of an accessory medial portal with placement of the posterolateral socket at the center of the posterolateral femoral insertion site. The anteromedial femoral tunnel was done in a similar way. For the tibial tunnels, the guide was placed in the insertion site of the posterolateral bundle with use of anatomic landmarks. The starting point of the anteromedial tibial tunnel was more anterior and central than the starting point of the posterolateral tunnel was. During anatomic single-bundle reconstruction, the femoral tunnel was placed in the center of the marked insertion sites and the tibial-tunnel director guide was placed in the center of the ACL tibial insertion site. For conventional single-bundle reconstruction, the tibial guide was placed at the center of the most posterior aspect of the ACL insertion between the medial and lateral tibial eminence. The femoral tunnel was created with use of the trans tibial tunnel technique. All grafts were fixed with EndoButton fixation devices (Smith & Nephew, Andover, Massachusetts) on the femur and with bioabsorbable interference screws on the tibia.

**Main outcome measures:** Subjective outcomes were measured with use of the Lysholm score (0 to 100; <65 = poor and >90 = excellent) and the International Knee Documentation Committee (IKDC) subjective score. Objective outcomes were the side-to-side difference for anteroposterior stability as measured with the KT-1000 arthrometer, the pivot-shift test for rotational stability (category 0 indicated the best result), and the IKDC objective score.

**Main results:** The anatomic double-bundle reconstruction was associated with better results than the conventional single-bundle technique for the Lysholm score, anteroposterior stability, rotational stability, and the IKDC objective score; the groups did not differ with regard to subjective IKDC score (Table). Compared with the anatomic single-bundle technique, the anatomic double-bundle had better results for anteroposterior and rotational stability (Table). The anatomic single-bundle reconstruction was better than the conventional single-bundle reconstruction for anteroposterior and rotational stability (Table).

**Conclusion:** In patients having ACL reconstruction, the anatomic double-bundle technique was superior to both the conventional and anatomic single-bundle techniques for restoring anteroposterior and rotational stability. The double-bundle technique also had better results than the conventional technique on the Lysholm score and the IKDC objective score.

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Anatomic double-bundle, anatomic single-bundle, and conventional single-bundle anterior cruciate ligament reconstruction at a mean of fifty-one months*						
Outcome	ADB	ASB	CSB	P value		
				ADB vs. CSB	ADB vs. ASB	ASB vs. CSB
Mean Lysholm score	93.0	91.8	90.9	0.025	0.051	0.366
Mean subjective IKDC score	92.1	90.6	90.2	0.063	0.087	0.688
Mean side-to-side difference (mm)	1.2	1.6	2.0	<0.001	0.002	0.002
IKDC score (category A)	93.1	88.5	79.2	0.009	0.245	0.224
Pivot shift (category 0)	93.1%	66.7%	41.7%	<0.001	0.001	0.003

\*ADB = anatomic double-bundle; ASB = anatomic single-bundle; CSB = conventional single-bundle; and IKDC = International Knee Documentation Committee.

## Commentary

The trial by Hussein and colleagues compared three methods of ACL reconstruction. All procedures were performed by the first author, which limits generalizability to the orthopaedic community at large.

The authors stated that "the differences [between the techniques] are small and may not be clinically relevant." The mean KT-1000 side-to-side data for the three groups were 2.0, 1.6, and 1.2 mm. When we consider that up to a 3-mm side-to-side difference is considered a successful result after ACL reconstruction, the differences between these groups are probably not clinically meaningful. Similarly, the IKDC scores for the three groups were 90.2, 90.6, and 92.1, with a difference between the highest and lowest groups of 1.9; the difference between the lowest and highest mean Lysholm score for the three groups was 2.1. Given that the minimal detectable change for the Lysholm scale is 8.9 and the minimal clinically important difference for the IKDC score is 16.7, these differences are probably not clinically meaningful<sup>1,2</sup>. Lastly, while there was a significant difference in the postoperative pivot shift between the groups, this was found mainly between 0 (normal) and 1+ (pivot glide), as well as between 1+ and 2+ (pivot shift). These differences can be difficult to discern and have not been demonstrated to be reliable or valid.

The downside of anatomic double-bundle ACL reconstruction includes a learning curve, increased surgical time, and increased complexity of revision surgery, if required. In view

of the similar outcomes for the three groups, anatomic double-bundle reconstruction for primary reconstruction is not warranted on the basis of these data.

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