ROTATIONAL LAXITY IN ANTERIOR CRUCIATE DEFICIENT AND RECONSTRUCTED KNEES: A PROSPECTIVE RANDOMIZED CONTROL TRIAL COMPARING SINGLE- AND DOUBLE-BUNDLE SURGICAL TECHNIQUES

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INTRODUCTION

In recent years, research on knee stability with rupture of the anterior cruciate ligament (ACL) has focused on rotational restraint in the transverse plane. Several studies have shown that sectioning of the ACL resulted in greater anterior and rotational laxity under torsional loads applied independently or in combination with anterior or valgus loads [1]. One effort to improve rotational stability of the knee is to reconstruct both anteromedial and posterolateral bundles of the ACL (anatomic double-bundle surgical technique). However, evidence showing functional improvement with the more complex double-bundle technique is controversial [2]. Although there have been clinical studies conducted to determine differences in functional outcome, few have specifically examined stability under quantified torsional loads.

The objective of this research was, therefore, to determine *in vivo* differences in rotational laxity between single- and double-bundle ACL reconstructions under a normalized torsional load at two angles of knee flexion. In addition, knee kinematics were compared to both pre-operative (ruptured ACL) and contralateral knees.

METHODS

Thirty-two patients with isolated ACL injury gave consent to participate in this study for which data collection and analysis protocols were described previously [3]. Knee laxity was measured in full extension and at 30º of flexion under a static normalized torque using an open-MRI scanner prior to and following ACL surgery. Subjects were randomly assigned to either a single-bundle (ACLR-1) or double-bundle (ACLR-2) semitendinosus and gracilis graft reconstruction [4] performed by the same surgeon (WvdM). A linear mixed model was applied to detect group differences with a two-tailed paired samples t-test used for post-hoc analysis.

RESULTS AND DISCUSSION

The greatest difference in range of rotation was in the ACLR-2 group in the flexed knee position, in which the mean post-operative range of rotation was 3.8º less than pre-operatively (Table 1). Figure 1 shows that this decrease in range of rotation was due to a reduction in internal rotation rather than external rotation.

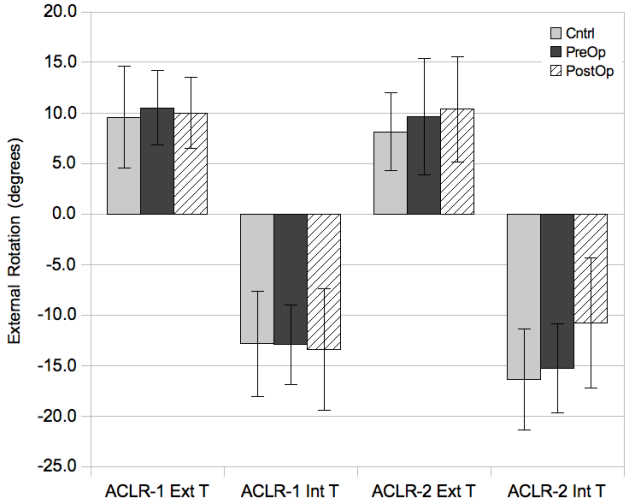

Figure 1: **Rotation in the flexed knee position under external and internal torsional loads. Results are shown for contralateral (Cntrl), ACL deficient (PreOp), and ACL reconstructed (PostOp) knees in the ACLR-1 and ACLR-2 groups.**

There were no significant differences in range of rotation prior to and following ACL reconstruction in the ACLR-1 group.

The position and orientation of the posterolateral bundle gives it the mechanical advantage needed to provide stability, specifically in internal rotation [1]. However, comparing pre- and post-operative rotational laxity with that of the contralateral uninjured knee illustrates a greater deviation from normal with the double-bundle technique. It is therefore questioned whether the double-bundle reconstructive technique improves rotational stability or overconstrains the joint in the transverse plane.

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Table 1: Group characteristics and range of rotation differences pre- to post-operatively in the extended and flexed knee positions ± SD.

Subject Group	Sex (F:M)	Age (years)	Height (cm)	Mass (kg)	Torque (Nm)	Δ RoR Extended (º)	Δ RoR Flexed (º)
ACLR-1	7:10	31.5 ± 5.7	171.5 ± 6.8	76.3 ± 13.8	5.1 ± 0.7	-1.3 ± 4.0	1.5 ± 9.2
ACLR-2	1:14	26.8 ± 6.0	177.9 ± 9.7	82.7 ± 14.9	5.4 ± 0.7	1.3 ± 2.6	3.8 ± 6.0