Format: Abstract

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Morphologic Characteristics and Strength of the Hamstring Muscles Remain Altered at 2 Years After Use of a Hamstring Tendon Graft in Anterior Cruciate Ligament Reconstruction.

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Abstract

BACKGROUND: The hamstring tendon graft used in anterior cruciate ligament (ACL) reconstruction has been shown to lead to changes to the semitendinosus and gracilis musculature.

HYPOTHESIS: We hypothesized that (1) loss of donor muscle size would significantly correlate with knee muscle **strength** deficits, (2) loss of donor muscle size would be greater for muscles that do not experience tendon regeneration, and (3) morphological adaptations would also be evident in nondonor knee muscles.

STUDY DESIGN: Cross-sectional study; Level of evidence, 3.

METHODS: Twenty participants (14 men and 6 women, mean age 29 ± 7 years, mean body mass 82 ± 15 kg) who had undergone an ACL reconstruction with a hamstring tendon graft at least 2 years previously underwent bilateral magnetic resonance imaging and subsequent **strength** testing. Muscle and tendon volumes, peak cross-sectional areas (CSAs), and lengths were determined for 12 muscles and 6 functional muscle groups of the surgical and contralateral limbs. Peak isokinetic concentric **strength** was measured in knee flexion/extension and internal/external tibial rotation.

RESULTS: Only 35% of the patients showed regeneration of both the semitendinosus and gracilis tendons. The regenerated tendons were longer with larger volume and CSA compared with the contralateral side. Deficits in semitendinosus and gracilis muscle size were greater for muscles in which tendons did not regenerate. In addition, combined hamstring muscles (semitendinosus, semimembranosus, and biceps femoris) and combined medial knee muscles (semitendinosus, semimembranosus, gracilis, vastus medialis, medial gastrocnemius, and sartorius) on the surgical side were reduced in volume by 12% and 10%, respectively. A 7% larger volume was observed in the surgical limb for the biceps femoris muscle and corresponded with a lower internal/external tibial rotation **strength** ratio. The difference in volume, peak CSA, and length of the semitendinosus and gracilis correlated significantly with the deficit in knee flexion **strength**, with Pearson correlations of 0.51, 0.57, and 0.61, respectively.

CONCLUSION: The muscle-tendon properties of the semitendinosus and gracilis are substantially altered after harvesting, and these alterations may contribute to knee flexor weakness in the

surgical limb. These deficits are more pronounced in knees with tendons that do not regenerate and are only partially offset by compensatory hypertrophy of other hamstring muscles.

KEYWORDS: muscle retraction; neo-tendon; tendon harvest morbidity; tendon regeneration

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