Connective Tissue Annotated Bibliography

Gerber JP, Marcus RL, Dibble LE, Greis PE, Burks RT, LaStayo PC. Effects of early progressive eccentric exercise on muscle structure after anterior cruciate ligament reconstruction. *J Bone Joint Surg Am.* 2007;89:559-570.

During the first 3 months following reconstruction of the anterior cruciate ligament (ACL), atrophy and strength of the quadriceps often exceeds 20% and 30%. Despite rehabilitation efforts to strengthen the quads, deficits of 10% to 20% still persist for years. The purpose of this study was to look at the effectiveness of progressive eccentric exercise on thigh musculature after reconstruction on the ACL. Forty patients that had previously undergone ACL reconstruction were randomly assigned to a rehabilitation program of either twelve weeks of eccentric exercises or a standard rehabilitation protocol. Volume and peak cross-sectional area of the quadriceps hamstrings, gracilis, and the gluteus maximus were acquired three and fifteen weeks post-surgery using magnetic resonance images to evaluate changes in muscle structure. There was a significant difference in the volume and peak cross-sectional area of the quadriceps and gluteus maximus in patients undergoing the eccentric exercise rehabilitation. No significant difference between groups was found in the hamstring and gracilis measurements. There was also a significant reduction in volume and peak cross-sectional area of the gracilis in patients that had a reconstruction using the semitendinosus-gracilis graft.

Level of evidence was determined with the *AAOS Levels of Evidence for Primary Research Question.* This therapeutic study is a high quality randomized trial with statistically significant differences between the rehabilitation groups. Levels of evidence are as follows: AAOS: Therapeutic Level 1

The bottom line of this study is to use eccentric exercises in rehabilitation after the reconstruction of an ACL to increase structural changes in the quadriceps and gluteus maximus when compared to a standard rehabilitation protocol. It is unknown whether these structural changes will have lasting or long term benefits.

This study can be useful to the profession of athletic training because of the occurrence of ACL tears in sport. The quadriceps muscle is one of the most important muscles in the lower body and is also sees the most atrophy after an ACL reconstruction. Therefore, as athletic trainers, we need to know the most efficient rehabilitation protocol to get the athlete back to full strength or with minimal atrophy. Athletic trainers, as the article pointed out, should be aware of the high eccentric muscle forces being place on the healing graft. Therefore, the eccentric exercises should be supervised to insure gradual progression.

Athletes may have an interest in their rehabilitation and should be a part of setting rehabilitation goals for themselves. They may be interested in the various treatments available to them and how the treatments have affected other patients that have been in their situation. Athletes should also be aware that the ages ranged from 18-50 years and were moderately active before surgery, so results may differ in a young active athlete.