



Grant Information Summary:

Joint Power Adaptations to Anterior Cruciate Ligament Deficiency and Reconstruction

Summary of Research Results:

Injury to the anterior cruciate ligament (ACL) of the knee is a common occurrence among the physically active. Many who suffer from this injury appear to accommodate successfully with only conservative treatment, while many others require reconstructive surgery to return to normal activities. How persons accommodate to this injury has been the subject of considerable interest.

Purpose

The purpose of this research project was to investigate how persons in three groups use the muscles of the lower extremity to control strain in the ACL (anterior tibial shear) during vigorous exercise.

Subjects

The subject groups included 1) ACL deficient subjects, 2) post-ACL surgical subjects, and 3) normal subjects.

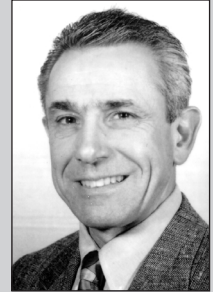
The subjects performed exercises on a special dynamometer under various load and speed conditions. Measurements of the forces generated at the hip and knee, as well as anterior tibial shear, were recorded. The results showed that in all groups anterior tibial shear was significantly reduced and hip force significantly increased as the intensity of the exercise increased. This suggests that the subjects attempted to reduce the load on the ACL when forces around the knee increased. Since hip force also increased, it is pos-

sible that the hamstring muscles, as a component of the hip extensors, become dominant when knee loads are increased to counter anterior tibial shear, and thereby protect the ACL. The post-surgical group demonstrated the highest relationship between hip torque and anterior tibial shear, suggesting that they may accommodate to ACL substitution by utilizing hip extensors to control ACL strain.

This project suggests that one of the mechanisms underlying the control of strain to the ACL is hamstring activation. As hip torque increased relative to knee torque, the amount of anterior

tibial shear decreased. This suggests that the hamstring muscles, as a component of hip extensor torque, contribute significantly to reducing the load on the ACL in vigorous closed chain exercise particularly in post-ACL surgical subjects. This effect is accentuated at more extended knee angles (-25 degrees of knee flexion) compared to more flexed angles (-85 degrees of knee flexion), indicating that the position of the knee influences the coupling of hip and knee extensor muscles. The findings underscore the importance of hamstring muscle rehabilitation following ACL injury and surgery.

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Publications & Presentation List

NATA Annual Meeting
Kansas City, MO, June 16-19, 1999

Osternig, L.R., Ferber, R., Mercer, J., and Davis, H. Effects of position and speed on joint torques and knee shear following ACL injury. *Medicine and Science in Sports and Exercise* (in press).

Osternig, L.R., Ferber, R., Mercer, J., and Davis, H. Human hip and knee torque accommodations to anterior cruciate ligament dysfunction. *European Journal of Applied Physiology* 83 (1): 71-16, 2000.



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