INTRODUCTION:
The goal of applied systematic research aimed at decreasing anterior cruciate ligament (ACL) injuries in female athletes must be to first determine the factors that make females susceptible to ACL injuries, second to develop screening tools to identify these factors in individual athletes and third to develop treatment modalities targeted to these factors in an attempt to prevent these injuries. If preventive modalities are developed to target and address injury risk factors the potential to reduce the incidence of ACL injuries in female athletes can be improved. Reducing these ACL injuries by even a percentage, thousands of knee injuries could be prevented in high school and collegiate sports annually. In addition, with the ever increasing popularity of high-risk jumping and pivoting sports like soccer, volleyball, and basketball and the rapidly growing number of participants each year, even higher numbers of ACL and other injuries might be avoided in the future.

Impulses in hamstrings to quadriceps (H/Q) strength have been correlated to greater incidence of lower extremity injury in female athletes. As females grow and develop, unlike males, hamstrings peak torque does not increase relative to body weight. Decreased H/Q ratios coincide with increased in risk for ACL injury. If the decreased hamstrings peak torque associated with maturational development is associated with increased risk of injury, then neuromuscular training may be targeted to females to reduce H/Q imbalances and reduce risk of ACL injury. The purpose of this study was to systematically review the literature to determine if a large cohort of females would demonstrate decreased H/Q ratios compared to a large cohort of males and to determine if H/Q increased with increasing isokinetic testing velocity in both sexes. We hypothesized that females would demonstrate similar H/Q compared to males at low velocities and that sex differences would increase as testing velocity increased.

METHODS:
Studies that analyzed the H/Q ratio by the use of gravity corrected isokinetic strength testing reported between 1967 and 2005 were eligible for inclusion into our systematic review. The goal was to obtain all published studies that evaluated an uninjured population of females and/or males. Pubmed, Medline and Smart databases were searched combined with cross-checked bibliographic reference lists of the publications to determine studies to be included in the systematic review. Inclusion criteria were all studies that evaluated normal populations with isokinetic knee extension and flexion. Exclusionary criteria were non-gravity corrected data, non-English and studies in which the isokinetic testing was performed in a lying position (not in seated position, flexed at hip and knee).

RESULTS:
Twenty-two studies were included in this systematic analysis based on the inclusionary and exclusionary criteria cited in the methods section. These studies contained a total of 1568 subjects (1145 male, 423 female). Isokinetic testing velocities ranged from 30°/sec to 360°/sec. The total mean H/Q ratios were 51.9 ± 8.0% for females and 60.7 ± 9.5% for males (p<0.001). Males demonstrated a statistically significant correlation between H/Q ratio and isokinetic velocity (R= 0.634, p=0.0001). They also demonstrated a statistically significant difference in the isokinetic H/Q ratio at the lowest angular velocity (mean 47.8 ± 2.2% at 30°/sec) compared to the highest velocity, mean 81.4 ± 1.1% at 360°/sec, (p<0.001). Females did not demonstrate a correlation between H/Q ratio and testing velocity (R= 0.065, p=0.77). They did not demonstrate a statistically significantly difference in the H/Q ratio at the highest versus the lowest isokinetic angular velocity (mean 49.5 ± 8.8% at 30°/sec versus 51.0 ± 5.7% at 300°/sec, N.S., p=0.84). Screening programs that monitor relative hamstrings peak torque should be developed and put into practice that will enable identification of females at increased risk for ACL injury in order to channel them into neuromuscular interventions that increase relative hamstrings muscle peak torque and decrease ACL injury risk.

REFERENCES:

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