PATELLAR TENDINOPATHY ALTERS THE DISTRIBUTION OF LOWER EXTERMITY JOINT EFFORT DURING HOPPING

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INTRODUCTION

A hop is an extensively studied task with a potential to reveal the impact of pathology on intersegmental dynamics. A composite measure of intersegmental dynamics is the support moment. It is the relative contribution of each lower extremity joint, to the total support moment, that has the potential to provide unique information regarding the movement strategies utilized to accomplish complex, coordinated, multi-joint tasks. The purpose of the current investigation was to quantify the relative contributions of the hip, knee and ankle to the total support moment, in athletes with and without patellar tendinopathy. We hypothesized that subjects with patellar tendinopathy would demonstrate altered sagittal plane moments during hopping when compared to healthy controls, shifting the relative effort away from the knee and to the hip and/or ankle.

METHODS AND PROCEDURES

Two groups of subjects were recruited for this study. Seven males with a history of patellar tendinopathy served as the experimental group and seven males without a history of knee pain or injury constituted the control group. All subjects were elite volleyball players either playing at the collegiate (local Los Angeles area universities) or professional levels. Kinematic data (VICON Oxford Metrics; 250 Hz) and ground reaction forces (AMTI; 1200 Hz) were collected while subjects performed 20 repetitions of self-selected hopping and an externally-imposed frequency (1.66 Hz) hopping. Sagittal net joint moments (inverse dynamics), total support moment, and joint contribution to the total support moment were analyzed. Group differences were explored using 2 x 2 (group x hopping frequency) multivariate ANOVAs with repeated measures.

RESULTS

For net joint moments, a significant group effect (no interaction) was observed across hopping frequencies (p=0.018). However, although the average moments varied, univariate analysis revealed that no single variable was statistically different between groups. When averaged across frequencies, the patellar tendinopathy group generated a 72% greater average hip extensor moment.
(p=0.078), 23% less knee moment (p=0.082) and 5% greater ankle moment (p=0.429).

No group effect or interaction was found for the average total support moment generated across hopping tasks. Contrastingly, the individual contributions of the hip, knee, and ankle to the total support moment, demonstrated a significant group effect (no interaction) across hopping frequencies (p=0.022). When averaged across hopping frequencies, subjects with patellar tendinopathy demonstrated greater hip contribution (p=0.030), less knee contribution (p=0.006), and similar ankle contribution (p=0.773) compared to the control participants (Figure 1).

These results illustrate the importance of examining both the absolute kinetic parameters of an activity (e.g. average net joint moments), but also the relative contribution of the individual joints to an overall objective—support of body mass against gravity during hopping.

**SUMMARY**

Subjects with patellar tendinopathy were observed to generate greater average hip extensor contribution and decreased knee extensor contribution to the total support moment. These findings were consistent across hopping frequencies. It is important to note that the distribution of joint effort to the total support moment analysis revealed important information regarding painful subject’s knee contribution that would have gone undiscovered using standard net joint moment analyses. Future studies investigating joint effort in the presence of pathology may want to consider a similar analysis.

**REFERENCES**