

Patients with Patellofemoral Pain Syndrome Demonstrate Increased Knee Abduction During Landing

Coleen Toetz, Jon Gerald Divine, M.D.

Cincinnati Children's Hospital Medical Center, Department of Sports Med/Biodynamics Center

Background: Though significant advances in diagnosis and treatment of acute knee injuries have occurred in recent years, controversy remains for one of the most common adolescent knee pathologies, patellofemoral pain syndrome (PFPS). Generally accepted is the relationship between extrinsic factors, such as overuse and repetitive joint loading, and the exacerbation of PFPS; however, the role of intrinsic factors, specifically lower extremity biomechanics during dynamic tasks, remains uncertain. *In vitro* data indicates that coronal and transverse plane motions can increase patellofemoral joint loads. The purpose of the current study is to determine if patients with active PFPS demonstrate different dynamic biomechanical characteristics. If validated, such biomechanical measures may be used in prospective studies aimed at determining the etiology of intrinsic risk factors. The hypothesis was that active PFPS patients would demonstrate increased knee abduction and rotation during a single leg landing task.

Methods and Measures: Six PFPS knees were diagnosed using a systematic PFPS classification system. Inclusion criteria were anterior or retropatellar knee pain. Exclusion criteria were: prior history of patellar instability, compression, acute trauma, repetitive trauma, neurologic disorders, or peripatellar pathologies. Six matched control legs were recruited on the basis of gender, age, height, and weight (age \pm 2 years, height \pm 5.1 cm, mass \pm 4.5 kg). Prior to testing, a visual analog scale (VAS) was administered to determine pre-test pain levels (0= no symptoms; 10 =worst pain imaginable). The lower extremity motions during a single leg lateral hop task off a 13.5 cm wooden block were evaluated using a 3-D motion analysis system.

Results: Significant differences were observed between dependent variables with a one-way ANOVA. VAS scores were significantly increased in knees with active PFPS ($P = 0.001$). Active PFPS knees also demonstrated increased knee abduction ($P = 0.044$) alignment at initial contact from the lateral drop landing. No significant group differences were determined for hip adduction or lower extremity joint rotation. PFPS was also related to increased ankle range of motion ($P = 0.012$) during stance.

Conclusions: *In vitro* measures indicate that knee abduction is associated with increased patellofemoral joint loading. This *in vivo* data quantified during dynamic tasks suggests that knee abduction is also related to chronic disorders such as PFPS. Future prospective research designs that incorporate knee abduction measures during dynamic landing in asymptomatic athletes may be beneficial. Predictive information may identify those at increased risk of PFPS and allow them to be targeted with appropriate interventions.