Four Projects: TU Institute of Sports Medicine

Effects of orthotics and/or exercise on an adult population with leg pain

The biomechanics of gait is well studied and understood. The role of the foot as a mobile adapter during the early stance phase and as a rigid lever during propulsion is paramount. Subtalar joint motion is particularly critical as the foot rapidly pronates just after foot strike and then progressively supinates through the end of the stance phase. Excessive subtalar joint motion has been associated with patellar pain syndrome, plantar fascitis, and foot and lower leg tendinitis (Donatelli, 1987). Control of the subtalar joint is also important in reducing the loads across the ankle, knee and hip joints during the gait cycle (Riegler, 1987). Orthotics are often prescribed for overuse injuries of the lower extremity, and typically aim to reduce compensatory subtalar pronation. Studies have demonstrated that orthotics are effective in short-term symptom reduction (Blake and Denton, 1985; Donatelli et al., 1988) and in the alteration of rearfoot motion (Novick, 1990). Studies have also investigated the effects of orthotics on muscle activity of the lower leg (Tomaro and Burdett, 1993). Few quantitative studies exist, however, assessing the effects of orthotics on lower extremity joint loads. It is the purpose of this study to evaluate the efficacy of orthotics in patients with lower extremity pain and/or dysfunction. Pre- and post-orthotic gait analyses and a visual analog scale will be compared to assess the effects of orthotics on lower leg pain, and kinematic and kinetic gait parameters. It is hypothesized that the use of orthotics will result in decreased pain and restoration of "normal" gait kinematics and kinetics.

Proprioception evaluation/Quantitative return to competition post ACL reconstruction

The number of girls and women in sport has increased significantly in the past three decades. So, too, have the number of injuries to the female athlete. One injury that has received much attention occurs to the anterior cruciate ligament (ACL) in the knee. It is well documented that female athletes are at greater risk for ACL injury as compared to their male counterparts. This gender discrepancy has created a challenge for clinicians and researchers involved in sports medicine. A consensus has not been reached regarding the risk factors predisposing female athletes to ACL injury. This project will be a comprehensive, prospective, multi-factorial approach to the prediction of, rehabilitation of and return to participation after ACL injuries in collegiate female athletes. The broad, long-term objectives will be to:

(1) understand the combination of factors that predispose female athletes to ACL injury,

(2) identify females at risk for noncontact ACL injury,

(3) relate injury prevention strategies to modifiable risk factors and/or injury mechanisms,

(4) identify specific biomechanical (i.e. neuromuscular, proprioceptive and motor control variables) factors associated with ACL injury,

(5) define guidelines for medical clearance and return to athletic participation, and

(6) develop optimal preventive training protocols to reduce the risk of ACL injury in the female athlete.

Approximately two-thirds of ACL injuries to female athletes do not involve contact or collision with another individual, and are therefore potentially preventable.49, 265, 288 If historical, anatomical, physiological, hormonal, competition (i.e. playing surface, exposure time), injury, performance and biomechanical (i.e. motor control strategies/movement patterns for walking, running and athletic maneuvers) data can be collected from a large sample of female athletes and examined with state-of-the-art predictive analyses, the relative contributions and associations between these causal factors will become clear. Risk factors must be elucidated before preventive and rehabilitative protocols can be designed and implemented.

Kinematic and kinetic differences between right- and left-handed professional baseball pitchers (incidence of humeral fracture)

The purpose of this study is to investigate the differences between right- and left-handed Major League Baseball pitchers in order to better understand why the predominance of humeral fractures in professional baseball have occurred to left-handed athletes.

Relationships between kinematics and kinetics in collegiate baseball pitchers

The purpose of this study is to investigate the relationships between joint loads and pitching mechanics. Due to the high speeds of movements and excessive ranges of motion in pitching, the throwing arm is particularly susceptible to injury. Little is known about the relationships between pitching mechanics and joint stresses in youth, high school or collegiate pitchers. At least thirty healthy NCAA Division I baseball pitchers will be recruited for this study from geographically close schools. The pitchers will be allowed to warm-up prior to the study. Once warm, retro-reflective markers will be placed on relevant body land marks. They will be allowed to throw additional warm up pitchers. When ready, they will throw 5-10 fastballs, breaking pitches, and change-ups. The pitches will be filmed with 6 cameras at 240 frames per second using the Motion Analysis System by Motion Analysis Corporation. Expert Vision 6.0 software will be used to collect the data. There will be a single visit to the lab lasting no more than 2 hours. After pitching, the retro-reflective markers will be removed and ice bags given to the pitchers if requested. The data will be analyzed using a custom designed software program. This study is similar to a study done by professional pitchers. Forty subjects were used in that study and statistical significance was found. Descriptive statistics will be obtained for the study pitchers and multiple linear regression analysis will be used to relate joint stress to kinematic parameters of pitching mechanics for the three levels of competition. Correlation analysis will be completed for all variables and all possible non-correlated combinations of the kinematic and kinetic parameters will be assessed in order to reach an optimal regression equation.

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