I. BACKGROUND: The Anterior Cruciate Ligament

- The knee is constructed of four main ligaments (a) that keep the knee is place functionally and restrain it from bending too far in one direction.
- The anterior cruciate ligament pulls the knee forward to keep it in the meniscus.
- The meniscus is cartilage located between the tibia and the femur and acts as a shock absorber and weight distributor for the knee.
- ACL tears result because of valgus (outward bending of the knee) collapse, specifically when the “leg (thigh) falls in adduction and internal rotation, while the knee (tibia) moves into a position of abduction as the ankle and foot move into evasion during weight-bearing motions” (c).
- Usually occurs during the cutting movement (b) so frequently seen in highly agile sports.

II. BACKGROUND: Cycling as Rehabilitation

- Advantages of Cycling: provides a low-impact, non-weight bearing, cardio-vascular, closed-chain exercise; can be easily manipulated to target varying muscle groups
- Extremely low strain on the ACL
- Useful for endurance training and strength training

III. LIMITATIONS OF CURRENT PRACTICE

1. Extreme postoperative loss of muscle mass in quadriceps femoris
   - Strength training may actualy be more important to restor than cardiovascular endurance or agility.
   - Difficult to rebuild because of compensation by the uninjured leg and within the injured leg itself.
   - Thus, a huge opportunity remains for a closed chain and ACL-sensitive method that would specifically activate the quadriceps for the injured leg alone.
   - A cycling machine that instigates single-legged pedaling could be the answer. The two-legged motion could remain, but if the power came only from the injured leg, then the compensation from the other leg would be mute (creating a “master/slave” experience).

2. Perturbation Training: a type of neuromuscular training that aids in stabilization through muscular contractions (d)
   - A physician applies unpredictable and varying forces to an unstable surface on which the patient is standing.
   - Manual perturbations are imprecise and hard to measure.
   - An interface could be created on a cycling machine that provides a “slip” where, during pedaling, there is a random and unpredictable change in resistance.
   - The same neuromuscular pathways would be activated.
   - The frequency and severity of the slip could be manipulated in a study in order to determine how much force and in which way is most effective to improve anterior cruciate ligament rehabilitation.

IV. FUTURE STUDIES

- Single Legged Cycling with ACL rehabilitation
- Standardized Perturbations with ACL rehabilitation
- A programmed ergometer, such as the Tilt Cycle, could perform such studies.

V. REFERENCES


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