ACL Rehabilitation Incorporating The Xiser Mini Stepper and HIIT

By Mark J. Smith, Ph.D.

Rehabilitation after anterior cruciate ligament (ACL) reconstruction has become more and more aggressive over the last two decades. The keys to any rehabilitation program are to reduce postoperative swelling, achieve full extension, maintain patella mobility, regain quadriceps control and minimize patellofemoral symptoms. Most orthopedic surgeons, therapists, and athletic trainers agree that closed chain exercises are beneficial in ACL rehabilitation. Closed chain exercises minimize patellofemoral stress, stabilize the tibiofemoral joint, and reduce anterior translation of the tibia on the femur.

High intensity exercise of short duration has numerous benefits to muscular development. These include stimulation of human growth hormone, an activator of muscle growth, and utilization of both type I and type II muscle fibers. Using a unique portable stepper (The Xiser Machine, , Merrick J.
Wetzler, M.D. (South Jersey Orthopedic Associates, Voorhees, NJ) and Thomas E. Maxwell, MA, A.T.C. (Athletic Department, Rutgers-Camden University, Camden, NJ) conducted a pilot study incorporating Sprint Interval Training (SIT – intermittent 60-second high intensity exercise) into a standard aggressive ACL reconstruction rehabilitation protocol.

Weighing in at only 14 pounds, the unit permits closed kinetic chain exercise using a smooth non-rebound hydraulic system that minimizes impact and joint reactive forces thereby reducing stress across the patello-femoral joint. In addition, the adjustable resistance and independent responsiveness of each foot pedal allows less resistance for the operative limb during initial rehabilitation. Without handrails the machine also enhances neuromuscular coordination and proprioception required during functional activities. Further the portability of the machine enables increased rehabilitation via in-home therapy.

The preliminary study consisted of eight athletes, who under went sub-acute ACL reconstruction (> six weeks post injury) using autologous bone-patella tendon-bone. There were five females and three males (average age - 19.3 years). All began rehabilitation within three days post-op. In addition to the standard protocol they began rehabilitation on the Xiser Machine in a seated position as soon as 60 degrees of flexion was achieved. Once the subjects had quadriceps control and could do a straight leg raise they began using the X-iser® Machine in a specialized standing position (go to xiser.com and click "Demos" to view "Short Burst Stepping"). Initially subjects supported themselves using parallel bars, a table, or a walker. When the athletes were comfortable on the machine they utilized a doorway for balance and support, but only if necessary. The athletes began with four, 30-second intervals at a sub-maximal effort and progressed to 1-minute intervals at maximum effort.
Once independent with the machine, the subjects began home-based SIT that consisted of four, 1-minute intervals at maximum effort with at least 30-minutes rest between intervals. At four weeks an additional interval-training program was incorporated into their rehabilitation in the training room. The athletes maintained the home based SIT program on the other days.

All athletes achieved independent use of the machine by three weeks and had excellent compliance with the machine. At 12 weeks full range of motion was achieved & all girth measurements were within 2.5 cm of the uninvolved thigh. Isokinetic testing was within 20% of the uninvolved knee at 16 weeks. Subjective fitness level was excellent at 12 weeks and none of the athletes complained of patellofemoral pain at six, 12 or 24 weeks. A significant amount of the quadriceps hypertrophy and strength was attributed to the unique hydraulic system and specialized form. Together they obtain a simultaneous concentric and eccentric contraction of the opposing legs resulting in no half-cycle recoveries typically seen with other stepping activities. This study and numerous case studies have demonstrated cost effective benefits to ACL rehabilitation and overall cardiovascular fitness using the X-iser® Machine.

The size and portability of the unit, along with its unique hydraulic system, also make it an excellent tool for the rehabilitation of other orthopedic conditions such as the rehabilitation of the ankle, hip and shoulder. It can further be used for the rehabilitation of conditions that have compromised balance. The machine has been used by industry professionals for rehabilitation since its inception into the marketplace in the early 1990s.