

ORTHOPEDIC REHABILITATION AND CRITERIA TO RETURN TO SPORTS AFTER ACL RECONSTRUCTION

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INTRODUCTION: The goal of anterior cruciate ligament (ACL) reconstruction is for athletes to return to their previous level of athletic ability, which has been an indicator of treatment success for many surgeons. In many cases, an ACL injury results in a premature end to a career in sports. However, ongoing advances in graft selection, anatomical graft placement, and fixations have allowed athletes to more consistently return to sports (RTS) after surgery. The combined use of strong fixation and an appropriate rehabilitation program should restore the knee function and normally allow RTS. However, the ability to make RTS is determined by many factors, including postoperative knee function, proprioception and muscle strength, associated meniscal, cartilage, or ligament injury, social factors, and psychological issues, such as fear of re-injury and motivation. And Returning to previous level of sports more determined by differences in rehabilitation than by surgical procedure, fixation method, or type of graft.

CURRENT ADVANCES IN SPORTS MEDICINE:

(1) Knee stability

Large difference in AP translation (i.e. KT-2000) between the reconstructed knee and non-injured knee do not correlate with subjective scores of knee function.. Despite increased AP translation can control the knee and do not utilize the available translation space during activity. Some patients continue to participate in sports despite a torn ACL. But rotational stability is very important. Rotational stability is a prime factor that warrants a patient to return to sports.

(2) Static laxity system

Static laxity testing system (Anterior drawer test, Lachmann test, KT-2000 arthrometer) can't represent the functional status.

(3) Muscle action

19-44% quadriceps muscle strength deficit 6 months after ACL-R. Hamstring muscle have less than 10% deficit. Some studies specified exact limits of muscle strength for allowing the patient to return to sports. Acceptable deficiency in isokinetic muscle strength is < 15%. Although theoretically, both quadriceps and gastrocnemius contraction results in increased ACL strain, Quadriceps muscle strength correlates with good outcome after ACL-R. Hamstring contraction decreases ACL strain. However, no correlation could be found between hamstring strength and functional tests.

(4) Functional performance tests

Functional performance tests (e.g. co-contraction, Carioca, shuttle run tests) have been validated as useful assessment tools after ACL-R.

(5) Proprioception and Neuromuscular control of the Knee

2 Different control system to maintain the system's homeostasis

Feedback controls : stimulation of a corrective response within the corresponding system after sensory detection.

Feedforward controls: anticipatory actions occurring before the sensory detection of a homeostatic disruption.

REHABILITATION PROTOCOL AFTER ACL RECONSTRUCTION OF KONKUK UNIVERSITY MEDICAL CENTER (KUMC):

Phase	Duration	Traditional goal	Our goal
Phase 1	0~2weeks	ROM	Active extension Full weight bearing
Phase 2	3~4weeks	Weight bearing	Quadriceps activation Strength
Phase 3	6~12weeks	Strength	Proprioception & Neuromuscular control
Phase 4	3~6months	Functional	Functional
Phase 5	6months	Return to sports	Return to sports

EVALUATION METHODS IN KUMC:

(1) One-legged hop for distance

The one-legged hop test was performed three times for each leg. The longest distances for the involved and the uninvolved limb were used. This test was designed to test the concentric and eccentric strength and neuromuscular coordination of the extremity.

(2) Co-contraction test

The co-contraction test was performed by securing a heavy Velcrobelt around the subject's waist and attaching it to a heavy 48-inchlength of rubber tubing with an outer diameter of one inch. The tubing was anchored to a metal loop secured to a wall 60 in.above the floor. A semicircle was painted on the floor with a radius of 96 in. with the metal loop at the center. The subject stood facing the wall with the toes of his/her feet on the semicircle, which stretched the tubing 48 in. beyond its recoil length. The cocontraction test required each subject to complete 5 wall-to-wall traverses of the 180° semicircle with tension applied to the overstretched rubber tubing. The subjects began the test on the right side of the semicircle, moving in a sidestep or shuffle fashion, completing the five lengths (three lengths right-to-left, two length left-to-right) in the minimum amount of time possible. This test was designed to reproduce the rotational forces at the knee necessitating control of tibial translation by the thigh musculature.

(3) Carioca test

The carioca test required the subjects to move laterally with a crossover step. The test was performed over two lengths of a distance of 40 ft. The subjects began moving from left to right, then reversed direction retracing the first 40-foot path, thus moving a total of 80 ft in the minimum amount of time possible. This test was used to reproduce the pivot shift phenomenon in the ACL deficient knee.

(4) Isokinetic muscle strength

Isokinetic muscle strength was measured using a Biodex System III Dynamometer (Biodex Medical Systems, Shirley, New York). Isokinetic muscular strength test were performed both at the common angles and at deeper knee flexion angles, classified as 0° to 90° (standard isokinetic muscle strength test in the sitting position)and 60° to 120°

(prone position isokinetic muscle strength test), respectively. To evaluate the standard isokinetic muscle strength in the sitting position, the patients were seated on the Biodex testing device with the chest, pelvis, and thigh immobilized with straps. After the range of motion of the knee joint in flexion and extension was measured, the flexion angle of the knee joint was adjusted to 0° to 90°. To measure the isokinetic muscle strength in the prone position, the knee joint was aligned with the axis of rotation, and the angle was adjusted to 60° to 120°. After the patient had warmed up and became familiar with the procedure, the measurements were repeated 4 times with an angular velocity of 60°/s. First, the contralateral side was measured, and then the side treated with ACL reconstruction was examined. The peak torque (the maximum value during the 4 repetitions) of flexor muscles was assessed, and the values of both knees were compared. The flexor deficit in the isokinetic test was calculated as follows:
 $(\text{involved knee strength}/\text{uninvolved knee strength}) \times 100.$

CONCLUSION:

1. Lack of objective criteria to reliably determine how and when to progress a patient through end stage rehabilitation.
2. Rotational stability is a prime factor that warrants a patient to return to sports.
3. Obtaining neuromuscular control and rotational stability is of utmost importance at end stage rehabilitation.
4. Our algorithm identifies postsurgical deficits and addresses them by team approach through out the return-to-sports phase.