Nonoperative Patient Management After Acute, Isolated Anterior Cruciate Ligament Injury

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Most individuals who sustain an anterior cruciate ligament (ACL) injury experience knee-joint instability during daily and sporting activities (noncopers).1-3 A small percentage of individuals who are ACL deficient return to all preinjury activity levels with no episodes of the knee “giving way” (copers).2 The purpose of this article is to review a screening examination and patient-management criteria to help clinicians identify candidates for nonoperative rehabilitation after ACL injury.

Patient Classification

Evidence supports surgical management as the treatment of choice for individuals who want to return to high-level physical activity after ACL rupture.1,3-4 There are special circumstances, however, when individuals might want to attempt to return to demanding sporting activities temporarily without undergoing surgery; for example, a senior in high school who is competing for a college athletic scholarship. Previous investigators1,2,5,6 have reported limited success in returning patients to high-level physical activity with nonoperative management. No previous work, however, was able to identify individuals early after ACL injury as having good potential to succeed with nonoperative management.

At the University of Delaware we have developed and tested decision-making criteria based on scores from a battery of tests to identify patients who have the potential to succeed with nonoperative management (potential copers).7 This screening examination consists of unilateral hop testing as described by Noyes et al.,8 reporting the number of giving-way episodes of the knee that have occurred during activities of daily living since the injury, and self-reported knee function. Before patients are allowed to participate in the screening examination they must have knee range of motion equal to that of the uninjured side, no or trace effusion, and 70% quadriceps strength on bilateral comparison and be able to hop on the injured leg without pain. Exclusion criteria for participating in the screening protocol include a repairable meniscal tear, full-thickness articular-cartilage lesion, contralateral knee injury, and concomitant ligamentous laxity. Failure to meet any of the testing criteria (see the sidebar) results in the

Criteria for Classification as Potential Coper

- Episodes of “giving way” since initial injury ≤ 1.
- Timed-hop-test score ≥ 80%.
- KOS-ADL score ≥ 80%.
- Global rating score ≥ 60%.

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patient being classified as a noncoper and referred for surgical management.

**Hop Testing**

Many clinics use one or all of the hop tests described by Noyes et al., including the single hop, triple hop, crossover triple hop, and timed hop. The testing is done on a tape measure 6 m long and 15 cm wide. The single hop involves the athlete standing on one leg, hopping once on the leg the maximum distance possible, and landing on the same leg. The distance of the hop is measured. The crossover hop is performed with the athlete standing on one leg and performing three consecutive hops. For each hop the athlete must cross the 15-cm strip and land on the same foot. For this hop test the total distance is measured. The triple hop is performed with three consecutive hops as far as possible without crossing the 15-cm strip, and again the total distance is measured. The timed hop is done with the athlete standing on one leg and hopping a distance of 6 m as quickly as possible. For the timed hop there are no guidelines on how to hop; the athlete can hop as far or as short as desired without restriction on the number of hops.

Each test entails two practice hops on the uninjured limb followed by two trials that are measured. The mean of the two trials is then calculated. The procedure is then repeated for the involved limb. To calculate the limb-symmetry index, the mean of the involved limb is divided by the mean of the uninjured for the single hop, crossover hop, and triple hop and then multiplied by 100. For the timed hop, the mean of the involved-limb trials is divided by the mean of the uninjured-limb trials and multiplied by 100.

During the screening examination all patients wear an off-the-shelf functional knee brace on the injured limb. Although the testing environment is controlled and all efforts are taken to ensure patient safety, occurrence of a giving-way episode during hop testing is still possible. Use of a functional knee brace further enhances patient safety during testing. Although the patient participates in all four hop tests, it is only the timed-hop test score that is considered part of patient classification. During our early testing and development of patient classification criteria, we found that the timed-hop score was better at predicting patient classification. It is possible that the predictive nature of the timed hop is related to increasing patient confidence as the hop-testing protocol progresses.

**Patient Self-Report of Knee Function**

The Knee Outcome Survey-Activity of Daily Living Scale (KOS-ADLS) is a self-report of knee function that consists of 14 questions with five possible answers and requires patients to rate symptoms including pain, crepitus, stiffness, swelling, instability, and weakness (each possible answer weighted from 0 to 5 points). The KOS-ADLS score is computed by dividing the number of points (based on answers given to the questions) by the total possible number of points (70) and multiplying by 100; a lower score correlates with a lower level of function, with 0 being complete disability and 100 being no impairment. The second self-report of knee function is the global rating score. This is a single value (out of 100) the patient estimates to represent his or her current activity level compared with the preinjury activity level, including athletics. A higher score represents a higher level of function.

Both self-report questionnaires are given to patients after they complete the hop-testing protocol. We have found that, because patients are typically inactive after ACL injury, completing the self-report questionnaires before hop testing often results in significantly different scores than completing them after the hop protocol.

**Validation of the Screening Examination**

Over a 2-year period, 93 patients with acute, unilateral ACL or graft ruptures without concomitant multiple ligament injuries or repairable meniscal damage were tested. Thirty-nine of the patients (42%) were classified as potential copers, and 54 (58%) were classified as noncopers. Twenty-eight of the 39 patients classified as potential copers chose to pursue a nonoperative course of management. Twenty-two (79%) of those 28 were able to successfully return to preinjury athletic activities for the competitive season. Success was defined as the ability to complete the season without an episode of giving way, or buckling, of the knee. None of the patients in this study extended their original injury as a result of participation in rehabilitation or athletic competition. Therefore, the screening examination may be considered an effective means of identifying individuals who have the potential to return to sporting activities without ACL reconstruction.