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Is ACL reconstruction a prerequisite for the patients having recreational sporting activities? ☆

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ABSTRACT

Objective: Whether surgical or conservative treatment is more effective in allowing patients to return to physical activity after anterior cruciate ligament (ACL) injury is controversial. We sought to compare mid-term outcome measures between isolated ACL tear patients who underwent reconstruction followed by closed kinetic chain exercises and those who underwent neuromuscular training only.

Methods: We retrospectively evaluated patients with ACL tears who underwent post-surgery CKC strength training after ACL reconstruction (Group A), and patients who only underwent neuromuscular training (Group B) with a minimum follow-up time of 5 years. Surgical techniques, rehabilitation, assessment of subjective knee function, one-leg hop test, assessment of joint position sense, muscle strength, and the health profile of the patient were evaluated.

Results: Overall, 43 patients were included in Group A (mean age, 32.56 ± 4.89 ; Tegner activity scale, 5) and 39 patients in Group B (31.67 ± 7.27 ; 5). Patients in both groups returned to their regular physical activity level after a similar time frame (Group A: average, 12 months; Group B, average, 13.4 months). The mean Lysholm knee score was 88.52 ± 7.65 in Group A and 86.21 ± 13.72 in Group B. Mean distances for the one-leg hop test for Group A were 135.21 ± 31.66 and 145.36 ± 42.10 mm in the reconstructed and uninjured knees, respectively. In Group B, the mean hop distances were 132.47 ± 28.13 and 147.89 ± 21.45 mm in the rehabilitated and uninjured knees, respectively. No statistical difference was observed between the groups for any of the parameters evaluated, including assessment of subjective knee function, one-leg hop test, assessment of joint position sense, muscle strength, and the health profile.

Conclusion: Our data suggest that early surgical reconstruction may not be a prerequisite to returning to recreational physical activities after injury in patients with ACL tears.

Level of evidence: Level IV, therapeutic study.

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¹ ACL: anterior cruciate ligament; BMI: body mass index; KKC: closed kinetic chain; JPS: joint position sense.

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Introduction¹

Anterior cruciate ligament (ACL) reconstruction has a high success rate, although patient outcomes depend upon injury characteristics and patient activity.^{1,2} Many factors affect the decision for surgical treatment versus conservative management, including the injury pattern, patient's sport, injury severity, potential surgical lesions, and possibility for spontaneous healing.^{2–6} Reconstruction is usually recommended for patients with high activity levels or side-to-side laxity.^{6–8} However, reconstruction is neither a prerequisite nor a guarantee for restoration of athletic activity or muscle function,^{3,9–11} and whether early reconstruction or neuromuscular training better restores knee kinematics is

debatable.¹² Additionally, self-reported assessment scores show no significant differences between patients who undergo ACL reconstruction and those do not,^{2–4,6,7,13} even in high-level athletes.¹⁴

Neuromuscular training, based on biomechanical and neuromuscular principles, aims to improve sensorimotor control and achieve compensatory functional stability. It is guided by the patient's neuromuscular function, not by the time since injury, and starts with the uninjured extremity, initiating normal movement, applying the bilateral transfer effect of motor learning to the uninjured leg, in contrast to traditional rehabilitation programs. Closed kinetic chain (CKC) exercises are the traditional exercises after ACL injury or reconstruction, and they are believed to be safe and functional.¹⁵ However, its crucial role is not only the mechanical aspects but also sensorimotor integration through motor learning in functional training.¹⁶ Furthermore, neuromuscular training is superior to traditional strength training programs alone as measured by global knee function and functional scores.¹⁷

We compared mid-term outcome measures, proprioception abilities, functional outcomes, subjective outcomes, and time to return to pre-injury activities between patients with isolated ACL tears who underwent reconstruction followed by CKC exercises and those who underwent neuromuscular training only. We hypothesized that neuromuscular training alone might provide good knee function and satisfactory activity level similar to ACL reconstruction in selected cases with isolated ligament injury.

Patients and methods

With local ethics committee approval (05.06.2013, No: 139), we retrospectively evaluated patients who underwent post-surgery strength training by CKC exercises after ACL reconstruction (Group A) and patients who only underwent neuromuscular training (Group B) with a minimum follow-up time of 5 years.

Treatment decisions were based on clinical and patient-related factors including fear of operative complications and occupation-related issues. Patients with little side-to-side laxity (1+) and recreational sporting activity levels were counselled on both treatment strategies. Treatment was determined by the surgeon and patient independent of athletic activity.

We identified 127 cases of ACL reconstruction and CKC strength training (Group A) and 139 patients who underwent neuromuscular rehabilitation without ACL reconstruction (Group B). In Group A, ACL reconstruction was performed 6–8 weeks after the initial injury. All patients first underwent a rehabilitation program consisting of inflammation control, range of motion exercises, quadriceps, and hamstring strengthening exercises. Match-paired groups were formed based on sex, age, body mass index (BMI), and activities.

Inclusion criteria were: 1) male sex; 2) 18–40 years old; 3) BMI < 30 kg/m²; 4) Tegner Activity Scale 3–7 and having only recreational sporting activities; 5) no concomitant ligamentous injury at the time of ACL injury; 6) not greater than grade 1 meniscus degeneration at the time of ACL injury; 7) no chondral lesions at the time of ACL injury; 8) no surgical intervention related to the lower extremities before or after the ACL injury or reconstruction; 9) no neurologic or vascular pathology; 10) no symptoms in the contralateral knee; and 11) no psychosocial disorders.

This study was limited to patients with isolated ACL ruptures who wished to return to regular daily activities. Patients with multiple ligament injuries or meniscal tears associated with ACL ruptures were not tested. Existing evidence indicates that patients with multiple structural damage associated ACL rupture are at high risk for further knee damage with continued participation sporting activities particularly high activity levels when managed conservatively.⁶ Patients were selected from one sex because of

differences in laxity, proprioception, and muscle strength between sexes.¹⁸

Surgical technique

One surgeon conducted all surgical procedures. After arthroscopic evaluation of the knee joint via standard anterolateral and anteromedial portals, the gracilis and semitendinosus tendons were harvested using a tendon stripper. Femoral tunnels were opened at the 10 or 2 o'clock position through the medial portal with a convenient width to accommodate hamstring tendons folded 4 times. On the tibial side, the ACL guide was set to 45° and placed at the stump of the ACL, then reamed over the guide wire after verification of the placement. The ACL stump was preserved to enhance proprioceptive and vascular properties on the tibial side. Notchplasty was not performed in any of the patients. Prepared grafts were embedded intra-articularly through the tibial tunnel and fixed by an EndoButton loop (Smith & Nephew Inc., Andover, MA, USA) at the femoral side and a bioabsorbable screw at the tibial side. After fixation of the grafts, Lachman and pivot shift tests were performed for final verification of graft tension.

Prior to rehabilitation, patients were allowed to ambulate with crutches and a knee brace locked in full extension with weight bearing as tolerated.

Rehabilitation

Strength training started within 1 week after surgery in Group A. Early range-of-motion exercise was encouraged for the first 3 weeks, with goals of full passive motion in the first week, then full active extension and 90° of flexion. Weight bearing was allowed as tolerated. CKC flexion exercises were performed to increase the degree of flexion. Prone hanging leg extension exercises were conducted to prevent extension limitation. Straight leg raises, isometric quadriceps exercises, and hip abduction and adduction exercises were performed to increase quadriceps control. Cycling, TheraBand™ strength training, mini-squats, and coordination and balance exercises (on the balance board and soft ground) were initiated 3–4 weeks post-operatively. Standing mini-squats and CKC coordination exercises were continued during this period. Resistive knee flexion and extension exercises were introduced after 6 weeks.

Patients in Group B underwent supervised neuromuscular training 3 weeks after the initial trauma aimed to improve neuromuscular control and compensatory functional stability. Movements were performed in a CKC manner as in strength training to improve functional stability. The specific activities, level of training, and progression schedule were guided by the patient's neuromuscular function including balance, joint position sense, perturbation training, weight shifts on stable and unstable surfaces, plyometric exercises, and landing strategies. Criteria for neuromuscular training were: full and pain-free knee range of motion, minimal joint effusion, at least 70% strength symmetry, and ability to hop in place without pain.

The knee brace was removed 2 weeks after reconstruction in Group A and before beginning neuromuscular rehabilitation in Group B. Clinical follow-up was done after 6, 12, 16, and 24 weeks. Jogging was allowed 12 weeks post-operatively, and pivot sports were allowed 6 months post-operatively in both groups. Contact sports were to be avoided.

Subjective knee function assessment

The validated Lysholm knee scoring system¹⁹ was used to assess subjective knee function. It was patient-administered to minimise

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