

CURRENT CONCEPTS OF REHABILITATION

Following ACL Reconstruction



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Although rehabilitation following ACL reconstruction is thought to be very important by almost all surgeons, very little discussion concerning this matter is included in most papers published on ACL reconstructions and their follow-ups. In fact, the majority of papers simply state that a modified accelerated or aggressive rehabilitation protocol is followed, with vague details concerning the rehabilitation protocol. Very few authors document their patients' compliance with the protocols. A statement indicating the time when patients are advised to go back to unrestricted work or athletic activities is often provided, but almost no one documents the actual time that their patients do go back successfully to full activities and at what level of participation. From the material provided in the literature, very little information can be obtained about what constitutes a safe and effective rehabilitation program. There are, however, a number of articles published in the recent past which use study designs (randomized clinical trials – RCTs) which allow the reader to glean some meaningful information about the safety and efficacy of rehabilitation programs. The purpose of this brief article is to provide a summary of the information obtained from such publications which can be used to help construct an appropriate rehabilitation protocol, as well as to identify important aspects of rehabilitation where our present knowledge is wanting.

IMMEDIATE VERSUS DELAYED MOTION

Five RCTs comparing delayed versus immediate motion after ACL reconstruction have shown that the ill effects of immobilization can be minimized without compromising the integrity of the healing graft during rehabilitation following ACL reconstruction.^[12,16,26,28,30] Early mobilization prevents problems with motion loss often seen after prolonged avoidance of movement. It was also found to reduce pain and avoid adverse changes within the articular cartilage.^[6,19] There is little evidence that immediate motion after ACL reconstruction coupled with meniscal repair is associated with poorer outcomes, although no RCTs document this.

IMMEDIATE VERSUS DELAYED WEIGHTBEARING

Prospective RCTs comparing immediate versus delayed weightbearing performed by Jorgensen et al^[18] and Tyler³⁸ revealed no significant difference in clinical, patient and functional outcomes, indicating no evidence of permanent elongation of the graft or disruption of the initial fixation. However, the effect of early weightbearing on the healing of articular cartilage damaged at the time of the ACL injury or meniscus repair is unknown.

OPEN VERSUS CLOSED KINETIC CHAIN EXERCISES

Open kinetic chain (OKC) versus closed kinetic chain (CKC) exercises following ACL reconstruction have been evaluated in four RCTs.^{7,17,23,27} Only one of these studies, all of which involved bone-patellar tendon-bone autografts, revealed any difference in the anterior laxity at the time of follow-up (one year or less).⁷ Bynam's group⁷ showed increased anterior laxity and poorer patient satisfaction at one year postoperatively, whereas the other studies revealed no adverse effects on anterior laxity when OKC exercises were utilized.^{17,23,27} There were several differences in the timing and dosage of the treatments used and the determination of A-P laxity, which makes the results of these investigations difficult to compare. Thus, there appears to be no consensus about the effects of OKC knee extensor exercises during the early phases of healing following ACL reconstruction in spite of the potential disadvantages of early use of OKC exercises.

REHABILITATION BRACES

Four RCTs have demonstrated that the use of rehabilitation braces in the early postoperative period following an ACL reconstruction results in less swelling, pain and wound drainage than when these braces were not used.^{4,13,14,24} However, at final follow-up (range 1-2 years), no differences were found with regard to knee range of motion, subjective satisfaction, A-P laxity, activity level, muscle strength or ability to perform one-legged hop tests whether a rehabilitation brace was used or not.

FUNCTIONAL KNEE BRACES

Two RCTs evaluating the efficacy of functional knee bracing following ACL reconstruction for a minimum of two years revealed no perceptible advantage in the use of these braces.^{21,29} In both studies, no differences in A-P laxity, functional testing, patient satisfaction, range of motion or strength were found between the group treated with a functional brace compared to the group that did not use functional bracing.

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HOME VERSUS CLINIC BASED REHABILITATION PROGRAMS

Beard and Dodd,¹ Fischer et al,¹⁰ Grant et al,¹¹ and Schenck et al³¹ have performed RCTs comparing home versus clinic-based rehabilitation. Although different amounts of supervision were provided in these studies, they showed that home-based rehabilitation was as effective as clinic-based programs even though the latter groups had greater supervision.

NEUROMUSCULAR ELECTRICAL STIMULATION VERSUS VOLUNTARY MUSCLE CONTRACTION

In two RCTs, Snyder-Mackler and colleagues^{36,37} found that rehabilitation incorporating combined volitional exercises and neuromuscular electrical stimulation resulted in a more normal gait pattern and stronger quadriceps compared to rehabilitation that only included volitional exercises. In one of the studies, no differences in A-P laxity between the two treatment groups were found at the time of follow-up.³⁷

SPECIFIC EXERCISE PROGRAMS

In an RCT comparing isotonic strength training versus proprioceptive training applied after six months of rehabilitation following an ACL reconstruction with hamstring grafts, Liu-Ambrose et al²⁰ found similar improvements in function and patient-oriented outcomes at 9 months following ACL reconstruction. However, a greater increase in isokinetic strength was experienced by the group which did the proprioceptive training. In a similar RCT beginning between 4 and 14 weeks postoperatively, Cooper et al⁸ observed somewhat different results because there was no advantage to proprioceptive training compared to the strengthening exercises alone.

Blanpied et al³ used an RCT to evaluate the addition of lateral slide exercises to a home-based aggressive program and found greater knee extension strength in the lateral slide group at the 8- and 12-week follow-up visits without evidence of increased A-P laxity.

Beginning at four weeks after ACL reconstruction, Meyers et al²² used an RCT to show that when eight weeks of training with either stair-climbing or cycling was added to an otherwise similar rehabilitation protocol, no differences in isokinetic strength resulted.

Hehl and colleagues¹⁵ randomized patients being rehabilitated following ACL reconstruction into one group that received isokinetic strength training or another that did not during the sixth to the ninth postoperative weeks. The isokinetic group developed greater muscle strength without suffering any increase in joint laxity at 6 months following surgery.

DURATION OF REHABILITATION

In the majority of articles the time interval that patients have been allowed to return to unrestricted athletic activities is six months or more in spite of the assumption that the duration of rehabilitation has diminished significantly in recent years. In a survey of members of the ACL Study Group presented in April, 2006, Brown⁵ (personal communication) reported that the majority of 88 respondents (71%) did not allow their athletes to return to "unrestricted cutting sports" until 6 months or more following ACL reconstruction. However, 5 respondents (5.5%) stated that they allowed a return to such sports at 3 months or even less.

It is probable that there is a wide variation in the time following ACL reconstruction that patients are ready or even want to return to sports, the degree to which they perform suggested rehabilitation protocols, and even the responses of the knee to the initial ACL injury and the ensuing surgical intervention. Thus, there is really be no fixed time that patients can and do return to sports. Shelbourne,^{32,33,34,35} who has published extensively on the subject of rehabilitation following ACL reconstruction is an enthusiastic advocate of accelerated rehabilitation. He is, however, often misquoted when the time of return to full activity is presented by others. In his 1995 study³³ he allowed his patients to return to "sports specific" activities at a mean of 6.2 weeks following the surgery, but his patients did not return to full athletic competition until a mean of 6.2 months after the surgery.

Ekstrand⁹ compared a 6 month to 8 month rehabilitation program and found a trend for patients in the extended group to have more normal A-P laxity values at 1 year follow-up. In contrast, in an RCT done by Beynon et al² comparing a 19 week to 32 week protocol no differences were found at two years in any outcome parameters evaluated (clinical, patient-oriented and functional outcomes as well as alterations in synovial fluid based markers of articular cartilage metabolism).

No RCT has demonstrated that routine return to full activities before six months is safe. The time interval between the ACL reconstruction and the return to full activities cannot be used as the only criterion for determining when return is safe and efficacious. Return to sports should not occur until the knee is painless, has no effusion, a full range of motion, and the patient has adequately rehabilitated muscles, restored agility and confidence in the knee. There is an unknown and variable interval after surgery during which the healing and remodeling ACL graft is vulnerable to injury if unrestricted activities are allowed too soon. Thus, there is little evidence that an ever-decreasing time to return to full activities will not eventually produce harm to the graft. Surgeons would be wise to avoid overzealous compliance with the athlete's desire to return to sport too soon. The exact timing of full return must be based on each individual's performance and avoidance of placing

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high stresses on the joint before healing and remodeling are well-advanced. We do not presently have enough information to prescribe a single aggressive protocol for everyone. It is the surgeon's responsibility to carefully monitor each patient's progress through their rehabilitation and avoid allowing unprepared patients to return to sports too soon.

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