

New trends nella terapia dei menischi e dei legamenti del ginocchio

ANTERIOR CRUCIATE LIGAMENT REHABILITATION

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The main goal of the rehabilitation following anterior cruciate ligament (ACL) reconstruction is to find out ways of protecting the new ACL from too much strain, but also to allow sufficient load on the healing ligament in order to stimulate strength development aimed at resulting in a good functional outcome. However, functional recovery after ACL-reconstruction is time consuming. Significant changes in quadriceps performance and patients' perception of knee function were found up to two years after surgery (4). Pain and quadriceps performance were the most important outcome measurements related to patients' perception of knee function (4). Pain and knee extension deficits three months postsurgery have been reported to predict the outcome at two years for both quadriceps performance and patients' perception of knee function (4). The load imposed on the joint by muscle actions is one of the most important factors for joint stability. Good thigh muscle strength is therefore of utmost importance for ACL-patients. The better the muscle torque preoperatively the easier to regain muscle strength postoperatively. The hamstring muscle group is an important knee joint stabilizer and a protector of the ACL. The concomitant activation of the hamstrings during quadriceps muscle activity will exert a posterior draw and protect the ACL. Quadriceps is the most vulnerable muscle group, while the hamstrings are not and strong hamstrings seem to be able to compensate for some ACL-instability.

The optimal rehabilitation program after an ACL-reconstruction is still not agreed upon. There are different opinions about i.e. when to start quadriceps training postsurgery, in what range of motion and in what way, open kinetic chain or closed kinetic chain. Earlier authors have reported that closed kinetic chain training puts somewhat less strain on the ACL during the last 40° of knee extension. It is, however, well known from several animal studies that some stress on a healing ligament produces a stronger ligament. Furthermore, we know that absence of strain on ligaments has been shown to have negative effects. With an arthroscopically implanted strain gauge in the anterior bundle of the ACL in humans Beynnon et al reported somewhat similar results regarding strain on the ACL between active knee flexion-extension (open kinetic chain) and squatting (closed kinetic chain) (2). They stated that if an ACL graft is properly placed during a reconstruction, the differences in strain on the graft during open and closed kinetic chain may not play any role (2). Thus, we know that some strain is beneficial. However, the level that distinguishes beneficial strain from harmful strain during healing has still not been established. This means that selecting only closed kinetic chain exercises for quadriceps in order to reduce the strain on the ACL and to reject open kinetic chain exercises for quadriceps because this might increase strain on the healing graft, lacks scientific support. Several studies have reported that the quadriceps torque, in particular during eccentric action is reduced one year and often longer following ACL reconstruction (i.e.5). Our group has found that ACL-reconstructed patients, who have followed a closed kinetic chain rehabilitation program had problems to return to sports such as soccer i.e. at the same level as before they were injured. This might depend on too much reduction in quadriceps torque. In a prospective matched investigation we compared a group of ACL-reconstructed patients training only closed kinetic chain with a group that had an addition of isokinetic open kinetic chain exercises starting 6 weeks postsurgery. The result showed that an addition of open kinetic chain knee extensor training does not only significantly improve knee extensor torques at six months, it also leads to a higher number of athletes that return to their original sport earlier and at the same level as before injury without compromising their knee joint stability (3, Table 1 and 2).

Evaluation of knee function after ACL-reconstruction include different outcome measurements related to impairment and disability. The functional tests used should be sensitive to the functional demands of the individual athlete. Therefore activities such as running, jumping and twisting should be included in the clinical examination to enable true assessment of the patient's knee function. The aim of the early phase of the rehabilitation is to bring the patient back to "daily life" function. After approximately three months, the figure-of-eight test and the stairs-running test would provide a quantitative assessment of "daily life" function. The next step in the rehabilitation program is to reestablish preinjury sports-related functions. Six months postsurgery the athletic patient should be able to perform the triple jump test and the stairs hopple test, which provide an assessment of functional knee joint stability.

Some authors claim that ACL-reconstructions with the patellar tendon result in anterior knee pain. However, in a prospective randomized study we found significantly more patients complaining of anterior knee pain preoperatively than postoperatively. We used a functional knee score for anterior knee pain tailored for ACL reconstructed patients

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(Table 3). The score has a good reliability and is most sensitive to patients with ACL injuries.

”Key to a successful rehabilitation”

- * Early mobilization
- * Limitations of pain and effusion
- * Full knee extension (passive - active)
- * Closed and open kinetic chain exercises
- * Eccentric quadriceps training
- * High ham/quad ratio
- * Proprioceptive and balance training
- * Sport-specific exercises
- * Gradual return to sport
- * Highly motivated patient

Table 1. Rehabilitation protocol following ACL-reconstruction

Time	Exercises
0-2 weeks	Passive knee extension exercises Active knee flexion exercises Electrical muscle stimulation (if unable to contract quadriceps or hamstrings)
2-6 weeks, add:	Patella mobilization (if needed) Gait training Closed kinetic chain exercises (quadriceps and hamstrings) Hamstring training (gradually isokinetically) Proprioceptive and balance training Stationary biking (when 100° of knee flexion)
6-12 weeks, add:	Open kinetic chain exercises for quadriceps – preferably isokinetically (gradually increase range of motion from 90°-40° (w 6) to 90°-10° (w 12) Functional exercises (stair walking, skip the rope, ”skating” on a slide board)
3-4 months, add:	Jogging straight ahead on an even surface
4-6 months, add:	Jogging and running on an uneven surface Jogging with turns 90°, 180°, 360° Cutting with 45° changes of direction Acceleration and deceleration running Sport-specific exercises

Table 2. Isokinetic quadriceps training protocol

Week	ROM (°)	Angular velocity (°/s)		Reps
		Concentric	Eccentric	
6	90-40	120	30	50
7	90-40	120	30	80
8	90-30	120	30	60
		90	90	60
9	90-30	120	30	90
		90	90	80
10	90-20	120	30	70
		90	90	70
		30	120	70
11	90-20	120	30	80
		90	90	80
		30	120	90
12	90-10	120	30	80
		90	90	70
		30	120	80
		240	240	70

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Table 3. Werner Functional Knee Score for Anterior Knee Pain after ACL-reconstruction

Pain		Sitting with flexed knees > 30 min	
None	5	No problems	5
Slight & infrequent	3	Slightly impaired	4
Constant pain	0	Difficulties	2
		Unable	0
Occurrence of pain		Squatting	
No activity related pain	15	No problems	5
During or after running	12	Slightly impaired	4
After > 2 km walk	9	Difficulties	2
After < 2 km walk	6	Unable	0
During normal walk	3		
During rest	0	Kneeling	
		No problems	5
Walking upstairs		Slight pain	4
No problems	5	Moderate pain	2
Slightly impaired	4	Unable	0
Difficulties	2		
Unable	0	Arretations - Catching	
Walking downstairs		Never	5
No problems	5	Sometimes	3
Slightly impaired	4	Frequently	0
Difficulties	2		
Unable	0		

References

1. Arvidsson I, Eriksson E, Häggmark T, Johnson RJ. Isokinetic thigh muscle strength after ligament reconstruction in the knee joint: results from a 5-10 year follow-up after reconstructions of the anterior cruciate ligament in the knee joint. *Int J Sports Med* (1981) 7-11