EISCSA State-of-the-Art Session:
"Deficit related strategies in walking and running"

Return to play after ACL knee surgery

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1. Introduction

The decision when to return back to strenuous physical activity after ACL reconstruction is challenging and the criteria to be fulfilled to send an athlete back to sports in good physical condition with a minimal risk of re-injury are not well defined yet.
The end stages of physical therapy during the 3 to 6 month post-operative period is the major challenge and the physiotherapist, athletic trainer and coach must now bridge the gap in the athletes' perceived and actual sports readiness. Although surgery may have created a mechanical stable joint, the athlete may not yet have a functionally stable knee during dynamic movements.

2. Evidence-based data

The speed and safety with which an athlete returns to sports or regains the pre-injury level of function depends largely on the rehabilitation protocol (Van Grinsven S. 2010, Trees A 2005, Cascio B. 2004, Risberg M 2004, Beynnon B 2002)
Return to level II activities (pivoting sports) are usually considered in a time frame between 6 to 9 months after surgery. But at the moment the surgeons' clinical criteria (swelling, knee laxity, scores) are not sufficient to evaluate the functional capacity to return to sport with criteria objectivating the patients' coordinative, strength and endurance capacities.
3 to 4 years after surgery only 53% of patients with ACL reconstruction had returned to previous activity level. Causes for not returning was problems with knee function (35%), fear of re-injury (24%), not motivate to continue (7%) and other (34%). (Kvist J., 2005)
In high level pivoting sports the risk of re-tear or an ACL injury of the contra lateral is high, up to 21% (Myklebust & Bahr, 2004) and the rate of any revision surgery after ACL reconstruction has been evaluated at 4,9/100 person-years (Dunn WR, 2004).
Between 50-70% of the patients' develop secondary knee osteoarthritis 10 years after ACL injury with and without ACL reconstruction (Myklebust & Bahr, 2005; Holm I, 2010).
Routine isokinetic muscle strength tests revealed quadriceps deficits of 19-44% and hamstrings deficits up to 21% at 6 months after ACL surgery (Muellner T, 1998; Risberg MA, 1999: Wojtys EM, 2000: Henriksson M, 2002).
Specific hop tests, including muscle fatigue tests and later test batteries have been developed to assess the functional and coordinative capacity after ACL reconstruction (Risberg MA 1994; Gustavsson A, 2006; Augustsson J and Karlsson J, 2004).
The analysis of landing strategies after a drop-jump maneuver is another area of interest which demonstrated altered coordinative capacities of the operated leg up to 2 years after ACL-reconstruction (Decker MJ, 2002; Paterno MV, 2007; Myer G, 2008).

3. Assessment

These findings show that modern rehabilitation processes should be criteria-based and not only time based. The monitoring of the end stages of rehabilitation and safe return to sport should include measurements of neuromuscular control, strength, power and lower extremity symmetry.

- Muscle strength: isokinetic peak torque, isokinetic muscle profile
- Hop tests: single leg hop test for distance, 6 m time hop test, side hop endurance test (30s), single leg vertical jump
- Measurement of sagittal and rotational knee laxity
- Use of scoring systems : IKDC, KOOS
- Landing strategies: 3 force plate, 2D/3D video analysis
- Kinematics: 3D motion analysis on a treadmill

4. Criteria-based rehabilitation strategies

(Myer GD, Paterno V, Hewett T, Journal of Strength and Conditioning Research 2008)

Guidelines for the end stage of rehabilitation and athletic development training.

Entrance criteria:
- Minimum of post-op period (e.g. 12 weeks)
- IKDC score > 70
- Negative pivot shift
- No post-surgery giving way
- Minimum defined strength knee extension (peak torque/bodyweight) >40% (male), 30% (female) at 300°/s

Stage I *Functional balance and core strengthening*
allows the athlete to reduce excessive force, maintain balance and generate force in the desired positive direction.

Minimum progression criteria:
- single limb squat symmetry
- no visual asymmetry in foot strike patterns during running
- acceptable single limb balance score

Stage II *Functional strengthening*
Balance board proprioceptive training should be utilized well past the acute postsurgical rehabilitation phase for secondary prevention.

Minimum progression criteria:
- side-to-side symmetry in PT knee flexion and extension(<15%) and hip abduction PT (<15%)
- symmetry during weight bearing squat to 90° of kn ee flexion
- landing force symmetry (< 10%)

Stage III *Power development*
The power phase is a program of challenging, multidirectional strength and power exercises. Training should include double and single leg plyometrics.

Minimum progression criteria:
- single leg hop for distance
- 6 m single leg time hop test
- single leg vertical jump
- side hop endurance test (30s)
- all hop tests < 15% of the uninvolved leg

Stage IV *Sports-specific symmetry*
The final level of the training is the high torque landing and cutting, incorporating unanticipated cutting.
Minimum progression criteria: - symmetry in drop vertical jump landing (<15%)
- agility test

5. Conclusion

Because of the high sensitivity of test batteries the clinician is recommended to use them in the decision-making process when deciding whether and when athletes can safely return to sports activities.
ACL injured and reconstruction should not end an athletic career. The evolution of surgical techniques, the restoration of the complete anatomy of the knee and the evidence-based accelerated rehabilitation protocol can bring an athlete back to a baseline functional level. Progressive multi-phase return-to-play neuromuscular training that bridges the gap from the clinic to the playing field should allow the athlete to safely return to competitive play

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