POST-OPERATIVE ACL RECONSTRUCTION PROTOCOL
Mr Mathias Nagy, Specialist Knee Surgeon
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Ensure patient achieves milestone prior to progression.

No return to contact sports prior to 6 months post-op.

Return to gentle non-contact, non-competitive sports at physiotherapist's discretion but must be over 5 months post-op.

PHASE 1: Post ACL reconstructive surgery. Day 1 to day 10.

Goal	Treatment	Milestone to Progress
Minimise swelling and pain	• Use of ice • Ensure adequate pain relief • Elevate leg • Use of crutches	• Minimal or no effusion • Full or nearing full extension • 90° knee flexion • SLR with no lag (10 reps) • Normal, symmetrical gait pattern with or without crutches
Regain full range of extension/hyperextension (compare to non-operative knee)	• Extension exercises: static quads, heel props, prone hanging • Passive stretching	
Increase knee flexion as pain allows	• Active flexion exercises • Passive flexion over edge of bed • Patella mobilisations	
Improve quads control and hamstring strength	• Static quads, SLRs. **Ensure patient can SLR with no lag** • Co-contraction quads and hams • Hamstring curls	
Ensure flexibility	• Hamstring and calf stretches	
Restoration of normal gait pattern	• Gait re-ed with elbow crutches, WB as pain allows • Weight transferring	

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PHASE 2: Upon achievement of phase 1 goals. Approximately day 10 to 6 weeks.

Goal	Treatment	Milestone to Progress
Minimise swelling and pain (ensure no swelling before progression) Prevent anterior knee pain	• Continue as above, as necessary • Patella mobilisations	• Minimal/no effusion • Full range of extension • Normal gait pattern without crutches • Full range of flexion • Single leg stand eyes shut at least 5 seconds • Bilateral squat, thighs parallel to floor with even, symmetrical weight bearing
Regain/maintain full range of extension/hyperextension (compare to non-operative knee)	• Extension exercises as above • Passive stretching	
Restoration of normal gait pattern	• Ensure FWB, wean off crutches	
Regain full range of flexion	• Active flexion exercises • Progress to quads stretch	
Improve quads, hamstring and general lower limb strength	• CKC – wall slide squats with gym ball, squats, lunges, leg press, dips etc. • Hamstring curls, bridging • Calf raises, hip extensions, hip abd/add, glut med/max	
Increase aerobic capacity	• Exs bike • Treadmill walking • Step ups • Cross trainer • Rower	
Improve proprioception	• Single leg stand eyes open/eyes closed • Wobble board • Sitfit • Trampette	
Neuromuscular control	• Core stability work • Knee alignment/prevent valgus – squats, lunges, step ups (ensure good hip/knee/ankle alignment)	

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PHASE 3: Upon achievement of phase 2 goals. Approximately week 6 to week 12.

Goal	Treatment	Milestone to progress
Control activity related swelling and pain	• Use of cryotherapy post exercise if knee swells with increased activity	• Minimal/no activity related effusion • Full ROM • Normal gait and stair pattern – good alignment and control • 10 x single leg squats to 60° with good biomechanical alignment and control (i.e. no valgus and good hip/knee/ankle alignment)
Regain/maintain full range of movement	• Continue stretches	
Normalise gait and stair pattern	• Treadmill walking – forward/backward/incline	
Improve quads, hamstring, and general lower limb strength	• Continue CKC – double & single leg press, squats, lunges, increase weight • Hamstring curls – double & single leg, increase weight • Calf, gluteals, adductors, VMO strengthening	
Increase aerobic capacity	• Exs bike • Treadmill walking • Step ups • Cross trainer • Rower • Pool walking/running	
Improve proprioception	• Single leg stand eyes closed • Wobble board • Sitfit • Trampette	
Neuromuscular control	• Core stability work • Knee alignment/prevent valgus as above – add trunk rotation	
Commence bilateral load acceptance/ early plyometrics	• Bilateral drop jumps • Jumps with symmetrical squat landing • Progress to straight line jogging when good load acceptance	

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PHASE 4: Upon achievement of phase 3 goals.

Goal	Treatment	Milestone to progress
No swelling or pain	• Continue as above if necessary	• Normal straight line running pattern • Single leg press >75% body weight • Single leg stand eyes shut >80% unaffected leg • Hop tests >85% LSI: single hop, triple hop, cross over hop, 6m timed hop, side to side hop
Normal straight line running pattern without pain and in full control	• Progress from jogging to running • Increase speed/distance • Change surface/incline • Forward running/backward running	
Increase muscle strength and endurance	• Increase load on strengthening exs (60-80% 1RM) • Single leg press – push for >75% x body weight • Commence open chain quads and gradually increase resistance	
Improve proprioception	• Increase dynamic proprioception	
Progress bilateral load acceptance/commence unilateral load acceptance/plyometrics	• Tuck jumps with stable landing • Squat jumps, forward/ back/ rotational • Bilateral plyometric static and multi-plane exs • Single leg hop with controlled landing • Forward, side hops/ drops from step with controlled single leg landing • Unilateral plyometric static and multi plane activities	

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PHASE 5: SPORTS SPECIFIC. Upon achievement of phase 4 goals.

Goal	Treatment	Milestone to progress
Increase muscle strength and endurance	• Increase load on resistance work	• Symptom free sports specific training • Hop tests >90% LSI : single hop, triple hop, cross over hop, 6m timed hop, side to side hop • Single leg stand eyes shut, equal to unaffected side
Progress unilateral load acceptance and work to fatigue	• As above – increase speed/intensity to fatigue	
Commence sports specific running agility drills	• Sprinting • Cutting and pivoting • Acceleration/deceleration	
Commence sports specific skills	• Ball skills • Dribbling • Boxing • Kicking • Sports specific activity with controlled opposition e.g. one on one practice drills	
Neuromuscular control following fatigue	• Ensure ability to control alignment under random practice and after fatigue	
Return to non-contract sports (only when nearing 6months post-op)	• Golf/swimming/gentle racquet sports	

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PHASE 6: FULL UNRESTRICTED SPORTS TRAINING. Upon achievement of phase 5 goals. MUST BE AT LEAST 6 MONTHS POST-OP

Goal	Treatment
Symptom free training	• Full, unrestricted training
ROM and muscular flexibility equal to other side	• Continue stretching
Good results of all functional testing	• Functional tests prior to returning to contact sports
Return to full unrestricted, confident activity	• Progress to uncontrolled practice situations and competition

References

Escamillia, R, Macleod, T, Wilk, K, Paulos, L, Andrews, J (2012) Anterior cruciate ligament strain and tensile forces for weight-bearing and non-weight-bearing exercises: a guide to exercise selection. *Journal of Orthopaedic & Sports Physical Therapy*, 42 (3) 208-220

Glass, R, Waddell, J, Hoogenboom, B (2010) The effects of open versus closed kinetic chain exercises on patients with ACL deficient or reconstructed knees: a systematic review. *North American Journal of Sports Physical Therapy*, 5 (2), 74-84

Herrington, L, Myer, G, Horsley, I (2013) Task based rehabilitation protocol for elite athletes following Anterior Cruciate Ligament reconstruction: a clinical commentary. *Physical Therapy in Sport*, 14, 188-198

Imwalle, L, Myer, G, Ford, K, Hewett, T (2009) Relationship between hip and knee kinematics in athletic women during cutting manoeuvres: a possible link to noncontact anterior cruciate ligament injury and prevention. *J Strength Cond Res*, 23 (8), 2223-2230

Kruse, L, Gray, B, Wright, R (2012) Rehabilitation after anterior cruciate ligament reconstruction. *Journal Bone Joint Surg Am.,* 94, 1737-1748

Mikkelsen, C, Werner, S, Eriksson, E (2000) Closed kinetic chain alone compared to combined open and closed kinetic chain exercises for quadriceps strengthening after anterior cruciate ligament reconstruction with respect to return to sports: a prospective matched follow-up study. *Knee Surg, Sports Traumatol, Arthrosc*, 8, 337-342

Morrissey, M, Drechsler, W, Morrissey, D, Knight, P, Armstrong, P, McAuliffe, T (2002) Effects of distally fixated versus non-distally fixated leg extensor resistance training on knee pain in the early period after anterior cruciate ligament reconstruction. *Physical Therapy*, 82 (1), 35-43

Morrissey, M, Hudson, Z, Drechsler, W, Coutts, F, Knight, P, King, J (2000) Effects of open versus closed kinetic chain training on knee laxity in the early period after anterior cruciate ligament reconstruction*. Knee Surg, Sports Traumatol, Arthrosc*, 8, 343-348

Myer, G, Ford, K, Brent, J, Hewett, T (2007) Differential neuromuscular training effects on ACL injury risk factors in “high-risk” versus “low risk” athletes. *BMC Musculoskeletal Disorders*, 8 (39), 1-7.

Myer, G, Ford, K, Brent, J, Hewett, T (2012) An integrated approach to change the outcome part 2: Targeted neuromuscular training techniques to reduce identified ACL injury risk factors. *The Journal of Strength and Conditioning research*, 26 (8) 2272-2292

Myer, G, Paterno, M, Ford, K, Hewett, T (2008) Neuromuscular training techniques to target deficits before return to sport after anterior cruciate ligament reconstruction. *Journal of Strength and Conditioning research*, 22 (3), 987-1014

Narducci, E, Waltz, A, Gorski, K, Leppla, L, Donaldson, M (2011) The clinical utility of functional performance tests within one-year post-ACL reconstruction: A systematic review. *The International Journal of Sports Physical Therapy*, 6 (4), 333-342

Perry, M, Morrissey, M, King, J, Morrissey, D, Earnshaw, P (2005) Effects of closed versus open kinetic chain knee extensor resistance training on knee laxity and leg function in patients during the 8 to 14 week post-operative period after anterior cruciate ligament reconstruction. *Knee Surg Sports Traumatol Arthrosc*, 13, 357-369

Reid, A, Birmingham, T, Statford, P, Alcock, G, Giffen, J (2007) Hop testing provides a reliable and valid outcome measure during rehabilitation after anterior cruciate ligament reconstruction. *Physical Therapy*, 87 (3), 337-349

Risberg, M, Holm, I, Myklebust, G, Engebrestsen, L (2007) Neuromuscular training versus strength training during first 6 months after anterior cruciate ligament reconstruction: a randomized clinical trial. *Physical Therapy*, 87 (6), 737-750

Risberg, M, Lewek, M, Snyder-Mackler, L (2004) A systematic review of evidence for anterior cruciate ligament rehabilitation: how much and what type? *Physical Therapy in Sport* 5 125-145

Silvers, H, Mandelbaum, B (2007) Prevention of anterior cruciate ligament injury in the female athlete. *Br J Sports Med*, 41 (Suppl 1), 52-59

Thomeé, R, Kaplan, Y, Kvist, J, Myklebust, G, Risberg, M, Theisen, D, Tsepis, E, Werner, S, Wondrasch, B, Witvrouw, E (2011) Muscle strength and hop performance criteria prior to return to sports after ACL reconstruction. *Knee Surg Sports Traumatol Arthrosc*, 19, 1798-1805

Thomeé, R, Neeter, C, Gustavsson, A, Thomeé P, Augustsson, J, Eriksson, B, Karlsson, J (2012) Variability in leg muscle power and hop performance after anterior cruciate ligament reconstruction. *Knee Surg Sports Traumatol Arthrosc*, 20, 1143-1151