NHS Worcestershire Acute Hospitals NHS Trust

Post-operative Physiotherapy Pathway Anterior Cruciate Ligament (A.C.L) Reconstruction

Owner:	Michael Mundy, Clinical Lead Physiotherapy Outpatients
Approved by	Therapies Clinical Governance Group
Approval Date	25th July 2023
Review Date	25th July 2026

Key Amendments

Date	Amendments	Approved by:
25th January 2023	Document extended to 30th June 2023 whilst under review.	Dr J Trevelyan/ Benjamin Thomas
23rd June 2023	Document extended for another 3 months whilst under review.	Benjamin Thomas
25/7/23	General Comments: • Changes made to post-op instructions (All agreed by consultants – Mr Malik section added) • Rewording of active straight leg raise (ASLR) precaution in phase 1. • Open kinetic chain quads (OKCQ) now allowed from 4/52 agreed by all consultants (see protocol for full details)	Mr Pearse/Mr Malik/Mr Mathur/Mr Aslam/M.Mundy/B.Thomas

Consultant post-op instructions – please check operation notes/referral for any variation in protocol			
Mr Pearse **All:** Brace for 4/52 (0-90°) No Cyclical load 6/52 **ACLR +/- Meniscal repair:** Non weight bearing (NWB) 1/52 → Full weight bearing (FWB) as tolerated. **ACLR + Root repair:** NWB 2/52 → Partial weight bearing (PWB) for further 4/52 Restriction of loaded squatting >70deg for 4/12.	Mr Aslam **ACLR:** FWB, No Brace	Mr Mathur **ACLR only:** FWB, No Brace **ACLR + meniscal repair (including root repairs):** 2/52 toe touch weigh bearing (TTWB) → PWB for further 4/42	Mr Malik **ACLR only:** FWB, No brace **ACLR with LET:** If has significant hyperextension (>15°) then brace 0-full flexion 6/52 & FWB. If no significant hyperextension no brace required and FWB. **ACLR + meniscal repair:** Brace 0-45° for 6/52 (0-90° for ROM work when not ambulating), FWB. **ACLR + root repair:** NWB for 6/52 Brace 0-60° for 6/52 (even in supine)

PHASE	GOALS	MANAGEMENT	PRECAUTIONS	PROGRESSION CRITERIA
1	Restore ROM Reduce Swelling Muscle Activation Gait re-education	Range of Movement (ROM) Heel slides, Patella mobility Swelling management Elevation, Compression, Ice, Circulation Exercises Muscle Activation Static Quads (through variety of ranges), Static Hamstrings, Static Glutes, Prone Hamstring Curl, Prone Inner Range Quads (IRQ)	No open Kinetic Chain Quads (OKCQ) for 4/52. See phase 2 for advice from 4/52. Graded reloading of hamstrings following hamstring graft Active Straight Leg Raise (ASLR) initially as an assessment only – not as an exercise unless no quads lag. Do not force hyper-extension.	Passive Knee Flexion >125° Negative Sweep Test (swelling) <5° Lag ASLR Supine Full Knee Extension Normal, symmetrical gait Active hamstring flexion in standing 90° x10 Bilateral short lever bridge x10

		Seated Calf Raises, Bridging Maintain Strength of Non-Operated Limb <u>Weight Bearing</u> Weight transfer / load acceptance, step practice, standing theraband IRQ (closed chain), bilateral mini squat, standing bilateral heel raises <u>Gait Re-Education</u> Non-antalgic – Wean support as permitted	Avoid post exercise swelling (<1cm increase in circumference)	
2	Regain Muscle Strength Regain Sagittal Load Control Regain Single Leg Balance	<u>Overall Approach</u> Progress from bilateral to unilateral load and strength Increase difficulty by varying range, surface, load, perturbations Bilateral Static → Bilat dynamic → Unilateral static → Unilat dynamic <u>Strength Exercises Examples</u> **Quads**: Through Range Quads (TRQ) (limited range initially), Bilateral Sit To Stand (STS)/Squat, Step Up/Down, Leg Press **Hams**: Prone Through Range Hamstrings (TRH), Prone Drop & Catch / Swimmer Kicks, Hamstring Bridge, Good Morning / Dead Lift (DL) **Glutes**: Hip Thrust, Sumo Squat, Band Walks **Calf**: Soleus & Gastroc **Core** Maintain Strength of Non-Operated Limb <u>Sagittal Load Examples</u> Lunge, Step Down, Bulgarian Split Squat (BSS) Footwork Drills, Bunny Hops, Step & Stop, Drop Down, Step/Box Jump <u>Single Leg Balance Examples</u> Narrow Base Of Support (BOS) → Tandem Stand → Single Leg Stand (SLS) → Foot Flat & Heel Raised → Y-Excursion / Challenge outside of BOS. Incorporate BOSU / Balance Pad <u>Gym Cardio</u> Bike (>6/52 for Mr Pearse), Cross-Trainer, Rower (as knee flexion permits), Swimming (Front/Back Stroke), Graded Walk/Jog Program	Commence OKCQ 90-45° from 4/52 with a graded increase in range and weight as able. Return to running criteria (good quality) - SL Squats x 5 - Single Leg (Sit to Stand) STS x 10 - SL Hamstring Bridge x 20 - 30sec Side Plank each side - 20 SL Heel Raises - SLS 45sec Prior to group exercise class, ensure good Neuromuscular Control (Qualitative Analysis Of Single Leg Squat - QASLS) of sagittal load and passed return to running criteria	Full Prone Passive Knee Extension Single Leg (SL) Step Down - QASLS (0-1) SL Bridges >85% compared with other side SL Calf Raises >85% compared with other side Side Plank >85% compared with other side SL Squat >85% compared with other side SLS (10sec) - 5°, 45°, 90° knee flexion Bilateral Drop Test (30cm) QASLS (0-1) Tuck Jump Test x3 QASLS (0-3)
3	Regain Full Strength & Balance Complete Agility Programme	<u>Overall Approach</u> Progress strength to increase ROM, Load, Speed. Programme as per Strength and Conditioning (S&C) principles Incorporate lateral & multi-directional load	Ensure QASLS (0-1) to maintain quality of movement control, compare to un-operated leg for limb symmetry Hurdle Requirements - SL Bridge >20 reps - SL Calf Raises >20 reps	Single Hop Test >95% compared to other side Triple Hop Test >95% compared to other side Triple Crossover Hop Test >95% compared to other side Side Hop Test >95% compared to other side

	Restore Hopping Performance	<u>Strength Examples</u> **Quads**: Weighted Squats, Weighted Box Step-Up, BSS (Weighted or Explosive), Leg Press, Leg Extension, Lateral Lunge **Hams**: Gym Ball Curl, Hamstring Curl, Nordics, Dead Lift Variations <u>Agility Programme Examples</u> Progress footwork to incorporate obstacles, change direction, distractions & perturbations. e.g. Lateral Shuffles, Hurdle / Ladder Dills, T-Run, Cone Runs, Acceleration / Deceleration, Sprint Drills, Figure 8. <u>Hopping Performance</u> Progress 2 → 1 foot, Multidirectional, Controlled → Uncontrolled Environment / Perturbation / Reactive e.g. Jumps (Distance, Height, Change Direction), Hops (Distance, Obstacle, Change Direction), Hop Downs, Skater Lunge, Bosu on/off <u>Cardio</u> Continue to progress Cardiovascular (CV) Fitness	- Side Plank >30 secs - SL Squat >10 reps each leg Consider Tampa Scale of Kinesiophobia	SL Squat >22 repetitions Star Excursion >95% compared to other side Vertical Hop Test >95% compared to other side Tuck Jump Test x3 QASLS (0-1)
4	Return to Sport - Physical - Psychological	<u>Overall Approach</u> Highly individualised and sport / activity specific. Improve athlete's work capacity in order to tolerate return to sport. Includes unilateral load acceptance, in multiple planes of movement, with a reactive random element. <u>Sport Specific</u> Recreate loads and tasks that would be expected to achieve successful return to play. Incorporate decision making and technical elements. Incorporate elements of sports specific injury prevention guidelines. e.g. Rugby – introduce tackling pad work, side step players → 2v1, running attacking lines e.g. Netball – Player marking drills, Landing from bosu take off whilst catching ball, perturbation on landing e.g. Javelin – Running drills, rapid deceleration work for the planted foot, technique with tennis ball <u>Strength</u> Continue to progress S&C Programme Progress Power/Loaded Plyometrics e.g. Clean & Jerk, Dynamic Barbell BSS <u>Agility / Speed</u> Progress to increased levels of speed and agility in line with sport demands	Consider video analysis to ensure QASLS <1 Consider Sports specific fitness tests e.g. Bleep Test, Illinois Agility Test, T-Test Advised no return to sport until >9/12 and completed all outcome measures Guide patient through graded return to training and eventually return to play within the limits of their ability.	Functional Testing Under Fatigue - Single Hop - Triple Hop - Triple crossover hop - Side Hop Test ACL- Return To Sport After Injury (RSI) Questionnaire >90%

		e.g. Running drills, Explosive Skipping, Broad Jumps e.g. Football – Ladder drills with ball at feet, Cone runs for time +/- ball at feet, flying sprints <u>Cardiovascular Endurance</u> Ensure patient has sufficient CV Fitness to complete training / return to play without loss of control e.g. testing under fatigue, speed endurance training. <u>Player Opposition</u> Anticipated → Unanticipated → Contact Elements 1 v 1 → 2 v 2 → Game Situation e.g. Player mirroring / Tag, Heading ball with opposition		
5	Prevention of Re-Injury	<u>Aim</u> Prevention programmes aim to improve neuromuscular control and reduce the risk of re-injury. <u>Key Components</u> - Plyometric, Balance, Strengthening - Session should be performed for at least 10 minutes before every training session and game - The programme is ongoing - Minimum of 6 weeks	Highly recommended that athletes continue with an ongoing ACL injury prevention program whilst they continue to play sports.	Ensure patient aware of ACL Prevention programme appropriate to sport. e.g. Netball – KNEE Programme Rugby – PEP / FootyFirst Programme Football – FIFA 11+

References

BEYNNON, B.D., JOHNSON, R.J., FLEMING, B.C., KANNUS, P., KAPLAN, M., SAMANI, J. and RENSTRÖM, P. (2002). ANTERIOR CRUCIATE LIGAMENT REPLACEMENT: COMPARISON OF BONE-PATELLAR TENDON-BONE GRAFTS WITH TWO-STRAND HAMSTRING GRAFTS. *The Journal of Bone and Joint Surgery-American Volume*, 84(9), pp.1503–1513. doi:https://doi.org/10.2106/00004623-200209000-00001.

Bizzini, M., Hancock, D., & Ellizzeri, F. (2012). Suggestions from the field for return to sports participation following anterior cruciate ligament reconstruction: soccer. Journal of Orthopaedic and Sports Physical Therapy, 42, 304e312.

Bizzini, Mario & Junge, Astrid & Dvorak, Jiri. (2013). Implementation of the FIFA 11+ football warm up program: How to approach and convince the Football associations to invest in prevention. British journal of sports medicine. 47. 10.1136/bjsports-2012-092124.

Brinlee, A.W., Dickenson, S.B., Hunter-Giordano, A. and Snyder-Mackler, L. (2021). ACL Reconstruction Rehabilitation: Clinical Data, Biologic Healing, and Criterion-Based Milestones to Inform a Return-to-Sport Guideline. *Sports Health: A Multidisciplinary Approach*, 14(5), p.194173812110568. doi:https://doi.org/10.1177/19417381211056873.

Cavanaugh, J.T. and Powers, M., 2017. ACL rehabilitation progression: where are we now?. *Current reviews in musculoskeletal medicine*, *10*(3), pp.289-296.

Cooper, R., Hughes, M. (2019) *Melbourne ACL Rehabilitation Guide 2.0.*

Escamilla, R.F., Macleod, T.D., Wilk, K.E., Paulos, L. and Andrews, J.R. (2012). ACL Strain and Tensile Forces for Weight Bearing and Non—Weight-Bearing Exercises After ACL Reconstruction: A Guide to Exercise Selection. *Journal of Orthopaedic & Sports Physical Therapy*, 42(3), pp.208–220. doi:https://doi.org/10.2519/jospt.2012.3768.

Gustavsson, Alexander, et al. "A test battery for evaluating hop performance in patients with an ACL injury and patients who have undergone ACL reconstruction."_*Knee Surgery, Sports Traumatology, Arthroscopy*_14.8 (2006): 778-788.

Herrington, Lee & Myer, Gregory & Horsley, Ian. (2013). Task based rehabilitation protocol for elite athletes following Anterior Cruciate ligament reconstruction: A clinical commentary. Physical therapy in sport : official journal of the Association of Chartered Physiotherapists in Sports Medicine. 14. 10.1016/j.ptsp.2013.08.001.

Kotsifaki, R., Korakakis, V., King, E., Barbosa, O., Maree, D., Pantouveris, M., Bjerregaard, A., Luomajoki, J., Wilhelmsen, J. and Whiteley, R. (2023). Aspetar clinical practice guideline on rehabilitation after anterior cruciate ligament reconstruction. *British Journal of Sports Medicine*, [online] 57(9). doi:https://doi.org/10.1136/bjsports-2022-106158.

Lentz, T., Zeppieri, G., Tillman, S., Indeucato, P., Moser, M., George, S., et al. (2012). Return to preinjury sports participation following anterior cruciate ligament reconstruction: contributions of demographic, knee impairment, and self-reported measures. Journal of Orthopaedic and Sports Physical Therapy, 42, 893e901.

Mikkelsen, C., Werner, S. and 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 Surgery, Sports Traumatology, Arthroscopy*, *8*(6), pp.337-342.

Perriman, A., Leahy, E. and Semciw, A.I. (2018). The Effect of Open- Versus Closed-Kinetic-Chain Exercises on Anterior Tibial Laxity, Strength, and Function Following Anterior Cruciate Ligament Reconstruction: A Systematic Review and Meta-analysis. *Journal of Orthopaedic & Sports Physical Therapy*, 48(7), pp.552–566. doi:https://doi.org/10.2519/jospt.2018.7656.

Steffen, Kathrin, et al. "High adherence to a neuromuscular injury prevention programme (FIFA 11+) improves functional balance and reduces injury risk in Canadian youth female football players: a cluster randomised trial."_*Br J Sports Med*(2013): bjsports-2012.

Sugimoto, Dai, et al. "Specific exercise effects of preventive neuromuscular training intervention on anterior cruciate ligament injury risk reduction in young females: meta-analysis and subgroup analysis."_*Br J Sports Med*_(2014): bjsports-2014.

Wilk, K.E., Arrigo, C.A., Bagwell, M.S. and Finck, A.N. (2021). Considerations with Open Kinetic Chain Knee Extension Exercise Following ACL Reconstruction. *International Journal of Sports Physical Therapy*, 16(1). doi:https://doi.org/10.26603/001c.18983.

Wilk, Kevin & Macrina, Leonard & Cain, E & Dugas, Jeffrey & Andrews, James. (2012). Recent Advances in the Rehabilitation of Anterior Cruciate Ligament Injuries. The Journal of orthopaedic and sports physical therapy. 42. 153-71. 10.2519/jospt.2012.3741.

Woby, Steve R., et al. "Psychometric properties of the TSK-11: a shortened version of the Tampa Scale for Kinesiophobia."_*Pain*_117.1-2 (2005): 137-144.