CORIEL ORTHOPAEDIC GROUP

Rehabilitation Guideline for Patients Undergoing Conservative or Surgical Management of Anterior Cruciate Ligament (ACL) Injury

Scope

- The information given in this document is a guideline for treatment. It applies to BPTB (bone patella tendon bone) and hamstrings graft, qualified as necessary
- The phases have times associated as a suggestion, these are not prescriptive and professional judgement should be used for need to prolong any phase or even regress to a previous phase. Potential reasons to do this are given.

There are a number of surgical factors which may change the protocol significantly, such as:

- Additional meniscal/meniscal root repair
- Additional ligamentous injury/reconstruction
- Graft type used

The post-operative note should **always** be reviewed for any specific changes, and if in doubt, discuss with the surgical team.

This guideline applies to both the conservatively managed patient, and the patient having reconstruction. For those conservatively managed, none of the restrictions for graft choice or additional injury apply, unless a brace is being used to manage a further ligament injury, in which case specific instruction should be given from the surgical team on first referral.

Conservatively managed patients may be able to progress more quickly through the phases, providing the milestones for progression are met.

ACL Rehabilitation Protocol – Initial + Inpatient

Pre-Operative/Immediate Post-Injury Phase				
Goal	**Action**			
Improve ROM (0->120º)	AROM and AAROM exercises	Gravity Assisted Passive Stretch (GAPS) to increase extension		Stretches (gastric/soleus/hamstring/quads)
Improve strength (>80% LSI)	SLR (provided no extension lag)	Static quads contractions	Active knee flexion/extension	Calf raises
Proprioception	Weight transference forward/back/side to side in standing			
Independence	Ensure self-efficacy and engagement in rehabilitation (if unable to engage then less likely to be a surgical candidate)			

Inpatient Rehabilitation Phase (0-1 days)				
Goals	Safe independent mobilisation with a walking aid, adhering to weightbearing status			
	Achieve 0-90º ROM (unless additional procedure precludes this)			
	Independence with home exercise program			
	Understanding of self-management/monitoring (skin sensation, colour, swelling, temperature, circulation, elevation and icing)			
Restrictions	No open kinetic chain exercises			
	Additional restrictions per post-op note (usually only if additional procedure undertaken)			
Treatment	**Pain relief**	Ensure adequate analgesia **(applies to all phases)**		
	Advice/Education	Teach how to monitor sensation, colour, circulation, temperature and swelling **(applies to all phases)**		
	Swelling management	Advice per **Appendix 1 (applies to all phases)**		
	Exercises	Isometric quads, glutes, hamstrings		
		Regain flexion/extension	0-90º AROM and AAROM exercises	
			GAPS to increase extension	
			Stretches	Avoid hamstring stretches for HS graft
	Brace	Not routinely used	Check op note for additional procedures Follow post-op instruction for other procedure if more restrictive	
		If required	Ensure well-fitting and patient understands how to don and doff as appropriate	
	Mobility	Ensure independent with transfers and mobility including stairs if necessary		
Discharge requirement	Independent and safe mobilising and with transfers			
	Independent with swelling management			
	Outpatient physiotherapy within 10 days			
	Has GP/district nurse review of wounds at 10-14 days post-op			

ACL Rehabilitation Protocol – Phase 1

Initial/Protective (0-2 weeks)			
Goals	ROM	0 – 120º approx.	Unless additional procedure precautions (eg meniscal repair) – review post-op instructions

	FWB with aids	Independence Progressing to walking without aids if able		
	Full quadriceps activation			
	Minimal effusion			
Restrictions	No OKC work			
	If hamstring graft	No resisted hamstring exercises (due to risk of sudden overload)		
	If meniscal repair	Follow meniscal protocol/post-op instructions		
	If additional ligamentous reconstruction	Follow post-op instructions		
Treatment	**Check for complications**	Review for wound problems, sensory disturbance, DVT **(applies to all phases)**		
	Stretches	Assess and treat tight structures as appropriate	HS graft: avoid hamstring stretches first 2 weeks	
	Exercises	ROM	Ensure achieving full extension	GAPS SLR – supported with other leg if unable to achieve independently
			Progression with flexion	Heel slides AROM/AAROM 0-90º
		Strength	Isometric quads, glutes, hamstrings exercises	
			Strengthen knee stabilisers	CKC quads (Wall squat up to 30º)
			Prone OKC hamstrings	Avoid in hamstring graft up to 6 weeks
			Isometric and eccentric hip flexion/extension/abduction if appropriate	
			Standing single and double calf raises	
	Brace	If used review op-note/protocol for additional procedure		
	Proprioception	Continue pre-op weight transference exercises		
	Mobility	Ensure independence		
		Progress to full weightbearing (without aids ASAP if able and good control)		
Milestones for Progression	Good ROM	0-120º approx.		
	Minimal effusion			
	Full quads activation	Full isometric contraction and no extension lag on active SLR		
	FWBing	With or without aids		

ACL Rehabilitation Protocol – Phase 2

Intermediate Protective (2-6 weeks)		
Goals	Achieve and maintain full ROM	
	Progression with quads activity, proprioception	
	Begin dynamic exercise where appropriate	
	Bilateral CKC squat with knee valgus control	
Restrictions	OKC quads	Not to be commenced in this phase
	CKC quads	0-60º restriction
	Work	If sedentary employment may be able to return from 2 weeks

	Driving	Manual	May be able to return at 6 weeks if FROM, able to perform emergency stop	If educated and understands pacing of driving and general activities to manage pain/swelling
		Automatic	May be able to return sooner if left leg surgery	
Treatment	**Stretches**	Assess and manage tight structures as appropriate	Can stretch hamstring for HS graft	
	Exercises	Ensure achieving/maintaining full ROM		
		Quads	Assisted squats increasing range/resistance	
			Wall squats up to 60º flexion	
			Leg press to 70% body weight	
		Hamstrings	Prone assisted OKC	BPTB graft: With resistance as tolerated
				HS graft: Without resistance to 6 weeks
		Static bike	From 2 weeks	Low resistance and cadence providing sufficient ROM to complete revolution without pain, high saddle
		Swimming	Once satisfactory wound healing No breast-stroke leg kick	
		Knee stabilisers	Progressing resistance with Theraband/weights and/or COG shift as appropriate	
		Core stability and gluteal work		
	Proprioception	Progressing to unstable BOS and COG shift as appropriate		Gait re-education, wobble board with double limb support
	Brace	If used for ACL only, wean once sufficient proprioceptive control		
		Otherwise review op note/appropriate protocol for timing and ROM		
Milestones for Progression	Maintenance of full ROM and good patella mobility			
	Minimal activity related effusion			
	Bilateral CKC squat with good valgus control			
	Unassisted FWB			
	Progression of exercises without worsening pain/effusion			

ACL Rehabilitation Protocol – Phase 3

Recovery/Functional strengthening (6-12 weeks)						
Goals	No effusion, maintain ROM					
	Minimal patellofemoral symptoms					
	Unilateral CKC squat with good control					
	Symmetrical single leg stance with eyes open					
Restrictions	Jogging	Not until >12 weeks as requires good proprioceptive control on an uneven surface and when leaping, and good unilateral valgus control				
	Work	Manual workers can return to light duties				No activity requiring lifting/moving of objects
						Can perform standing activity using tools
Treatment	**Exercises**	Quads	Increase CKC to full range			
			OKC	8-10 weeks	90-45º	BPTB – with resistance

				10-12 weeks	90-30º	HS – without resistance
				>12 weeks	90-0º	
			No OKC quads in <18s until 12 weeks minimum			
			Rowing machine/stepper/elliptical trainer		Increasing resistance as tolerated	
			Single leg squats and low resistance jumping		**From 9 weeks**	
			Static bike	Progressive duration/resistance		
		Hamstrings	Resisted hamstring curls	All graft types		
		Core stability and gluteal work				
	Proprioception	Single leg wobble board		+ sit to stand		
		Walking pace direction changes				
		Single leg hops		Slow and emphasis on landing technique		
	Review LL biomechanics and kinetic chain					
	Biofeedback may be useful if altered muscle sequencing					
	Manual therapy	Soft tissue techniques and joint mobilisations as appropriate				
	Consider suitability for referral to appropriate rehabilitation class. DRI Early legs and BDGH/Retford Lower Limb Circuit Class. Consider ongoing 1:1 needs as appropriate					
Milestones for Progression	Unilateral CKC squat with good valgus control					
	Step up with good valgus control					
	Single leg stance with eyes open					

ACL Rehabilitation Protocol – Phase 4

Final Rehabilitation – RTS/Discharge (12-26 weeks)				
Goals	Graded return to sport specific training from 6 months			
	Establish long term maintenance programme			
	Assess return to sport/functional discharge			
Restrictions	No sport for minimum 6 months			
		No contact sport until minimum 9 months		
		<18 cannot return to sport until 12 months		Expect will be slower to get to this phase
	Caution with introduction of twisting exercises			
Treatment	Ongoing advice/education		Stretches as appropriate	
			Cautioning on risks of early RTS	
	Exercises	These become a sample and can be adjusted to patient motivation and specific goals		
		Quads	OKC exercise per previous phase	
				HS – commence resistance from 14 weeks
				<18 years – begin from 90-45º at this point
		Hamstrings	Hamstring curls	
			Nordic work	
		Jogging	Introduce with slow acceleration/deceleration in straight line	

				Progressing speed and change of direction from 4 months as appropriate using arc runs/Fig-8/Y-runs/T-runs
		Swimming	Introduce breast-stroke from 4 months	Adults only, avoid until 6 months in children
		Plyometric	As able progression	
				Squat drops/jumps
				Step/box jumps
				Consider landing control in all planes
		Agility	Speed and ladder drills	
			Speed, Agility and Quickness (SAQ)	
		Continue core stability and gluteal work		
	Proprioception	Single leg wobble board		± External challenge (eg. Ball)
		Trampette		
		Lunges/1 leg hops with Theraband		
Milestones for discharge	Non-RTS goals	Achieves Functional Discharge Criteria (Appendix 2)		
	RTS goals	Achieves RTS Criteria (Appendix 3)		
		Establish a programme for gradual build up towards RTS date		
	Establish long term maintenance programme – ACL injury prevention (including above exercises)			
Failure to meet milestones	If appropriate goals and still progressing/engaging			Continue with outpatient physio
	Failing to progress/engage			Discuss with surgical team

Appendix 1 – Failure To Progress

Possible problem	Action
Swelling	• Ensure elevating leg regularly • Use ice if normal skin sensation and no contraindications • Decrease amount of time on feet • Pacing • Use walking aids • Circulatory exercises • Modify exercise programme as appropriate – should continue isometric work at all times • If decreases overnight, monitor closely • If does not decrease over a few days, refer back to surgical team
Pain	• Decrease activity • Ensure adequate analgesia • Elevate regularly • Decrease WB and use walking aids as appropriate • Pacing • Modify HEP as appropriate • If persists, refer back to surgical team
Breakdown of wound e.g. inflammation, bleeding, infection	• Refer to surgical team
Recurrent Instability	• Refer back to surgical team • Ensure exercise progressions are at a suitable level for patient

	• Address core stability
Numbness/altered sensation	• Review immediate post op status if possible • Ensure swelling under control • If new onset or increasing refer back to surgical team • If static, monitor closely, but inform surgical team and refer back if deteriorates or if concerned
Failing to activate quadriceps	• Consider NMES use and/or discussion with surgical team

Appendix 2

Functional Discharge Criteria – Phase 5 (6 months onwards)

Discuss with Band 6 physiotherapist regarding patient suitability for test battery, and if number of hop tests can be reduced to just 'single hop for distance' based on individual patient circumstances

Marker/ Measure	Description	Score / Result		Result
Symmetrical Knee ROM	Symmetrical Knee flexion and extension both Active and Passively assessed by clinical assessment.			
KOOS Score	Ask the patient to complete the KOOS questionnaire.			
Single Hop for Distance (Logerstedt et al., 2012)	The single hop for distance is performed with the patient standing on the leg to be tested, hopping as far as possible, and landing on the same leg. The landing must be on 1 limb and stable.	Operated	Non-Operated	LSI >80%
Triple hop for distance (Logerstedt et al., 2012)	The triple hop for distance was performed with the patient standing on 1 leg and performing 3 consecutive hops as far as possible. The landing must be on 1 limb and stable.	Operated	Non-Operated	LSI >80%
6 Metre timed hop (Logerstedt et al., 2012)	The 6-m timed hop, patients stood on 1 leg, then hopped as fast as possible over a marked distance of 6 meters. The landing must be on 1 limb and stable. Record the time the patient's heel leaves the floor and stop when the patient crosses the finish line.	Operated	Non-Operated	LSI >80%
Triple Cross Over Hop Test (Logerstedt et al., 2012)	The crossover hop for distance, patients stand on the leg to be tested, hop as far as possible forward 3 times while alternately crossing over a 15cm marked strip on the floor. The landing must be on 1 limb and stable. The total distance hopped forward is recorded.	Operated	Non-Operated	LSI >80%
Lower Limb Strength (5 repetition max) (Van Melick, 2016)	Complete 5-repetition max calculation for the following 3 exercises. Increase weight on each exercise until the patient cannot complete 5 repetitions in good form. Note the maximum weight (in Kilograms) completed in good form for 5 repetitions for each leg. • **Single leg press** • **If patient unwilling to perform single leg press consider oxford grading or single leg squat**	**Single Leg Press**		LSI >80%
		Operated	Non-Op	

Appendix 3

Return to Sport Discharge Criteria – Phase 5 (9 months onwards)

Discuss with Band 6 physiotherapist regarding patient suitability for test battery

Marker/ Measure	Description	Score / Result		Result
Symmetrical Knee ROM	Symmetrical Knee flexion and extension both Active and Passively assessed by clinical assessment.			
KOOS Score	Ask the patient to complete the KOOS questionnaire.			
Single Hop for Distance (Logerstedt et al., 2012)	The single hop for distance is performed with the patient standing on the leg to be tested, hopping as far as possible, and landing on the same leg. The landing must be on 1 limb and stable.	Operated	Non-Operated	LSI >90%
Triple Cross Over Hop Test (Logerstedt et al., 2012)	The crossover hop for distance, patients stand on the leg to be tested, hop as far as possible forward 3 times while alternately crossing over a 15cm marked strip on the floor. The landing must be on 1 limb and stable. The total distance hopped forward is recorded.	Operated	Non-Operated	LSI >90%
Triple hop for distance (Logerstedt et al., 2012)	The triple hop for distance was performed with the patient standing on 1 leg and performing 3 consecutive hops as far as possible. The landing must be on 1 limb and stable.	Operated	Non-Operated	LSI >90%
6 Metre timed hop (Logerstedt et al., 2012)	The 6m timed hop, patients stood on 1 leg, then hopped as fast as possible over a marked distance of 6 meters. The landing must be on 1 limb and stable. Record the time the patient's heel leaves the floor and stop when the patient crosses the finish line.	Operated	Non-Operated	LSI >90%
Lower Limb Strength (5 repetition max) (Van Melick, 2016)	Complete 5-repetition max calculation for the following 3 exercises. Increase weight on each exercise until the patient cannot complete 5 repetitions in good form. Note the maximum weight (in Kilograms) completed in good form for 1 repetition for each leg. ● **Single leg press** ● **Single leg knee extension (90-45 degrees flexion)** ● **Single leg hamstring curl (45-90 degrees flexion)**	**Single Leg Press** Operated **Single Leg Knee Extension** Operated **Single Leg Hamstring Curl** Operated	Non-Op Non-Op Non-Op	LSI >90%

Note Leg Symmetry Index (LSI) = Op/Non-op x100

Complications to be aware of

The following are potential complications of surgery, which are important to be aware for signs of on patient reviews:

General	ACL specific
Infection	**Persistent/recurrent pain**
Bleeding	**Graft failure**
Nerve injury Mostly skin numbness around a scar but small risk of more significant nerve injury	**Recurrent mechanical symptoms** Locking, swelling, instability
DVT	**Patella fracture** For BPTB graft
PE	**Persistent/recurrent joint crepitus**