

Guideline

ACL Reconstruction Rehabilitation Guidelines for Physiotherapists

Children's Health Queensland

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Author/custodian	Director of Physiotherapy			Review date	17/10/2022
Supercedes	New				
Applicable to	Physiotherapists treating adolescent ACL patients				
Authorisation	Executive Director Clinical Services (LCCH)				

Purpose

These rehabilitation recommendations are a guide for clinicians treating paediatric and adolescent patients who have undergone an anterior cruciate ligament (ACL) reconstruction.

Related documents

Procedures, Guidelines, Protocols

- [CHQ-WI-65671-Post-Operative Management and Patient Flow of Patients Following ACL Reconstruction](#)
- CHQ ACL Reconstruction Rehabilitation Guidelines for Patients

Guideline

Rates of ACL re-rupture are much higher in the paediatric population (Clare L Ardern et al., 2018), so additional caution is required in the management of this patient group. Ensure sound clinical reasoning is used and only progress your patient when you feel confident in their ability.

General Guidelines:

- Rehabilitation in this population is *slower* than in adults.
- Rehabilitation includes five phases and continues for 12 months following surgery.



- Exercise bike can commence at three months.
- Swimming with a pool buoy can commence at four months and progress to kicking at five months.
- Swimming with flippers can commence at six months.
- Running in a straight line can commence at four-six months.
- Return to sport is not recommended before 12 months.

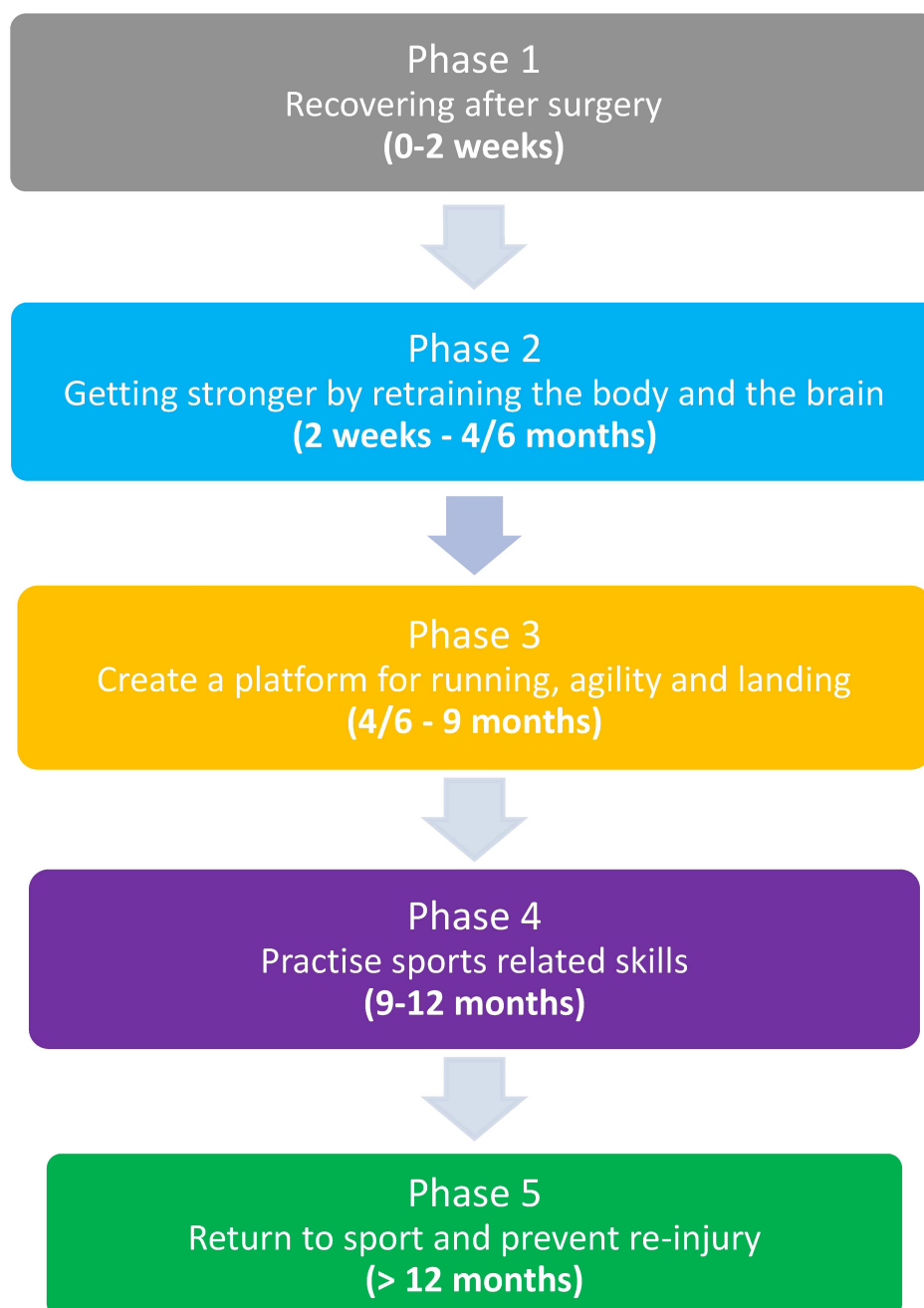
Do

- Ensure to individualise each patients program based on surgeon's recommendations.
 - Meniscal repairs will have period of Non-Weight Bearing (NWB) (generally six weeks post-op) and therefore be behind standard milestones.
 - Slow to progress or non-compliant patients should be encouraged but not progressed beyond where they are capable, irrespective of amount of time post-op.
 - Over-enthusiastic/impatient patients may require additional counselling to avoid them returning to dynamic activities and sports prematurely.
- Encourage swelling and pain management initially; this will impact the longer-term rehabilitation outcomes.
- Give patients and parents advanced knowledge of length and expectations of the rehabilitation; this should be part of the informed consent process.
- Aim to see the patient regularly in the first six months and at least monthly thereafter.
- Contact surgeon or LCCH Physiotherapy Department with any concerns, queries or difficulties

Don't

- Discharge the patient to progress on their own prior to 12 months. If you cannot provide this level of service, please refer back to CHQ.
- Progress the patient based purely on the protocol. If the knee is not stable or strong enough for an activity, utilise extra exercise/therapy to achieve this.
- Commence open chain weighted exercises.

The Five Phases of ACL Rehabilitation



Phase 1 Recovering after surgery (0-2 weeks)

- Knee extension/Richards splint to be worn at all times in these initial two weeks. Depending on surgeon preference the brace may be straight or bent to 30°, either way exercises are to be performed on top of the brace.
- Patient allowed to WBAT (if no meniscal repair) but advise crutch use until two-week post-op review.
- Dressings can be debulked Day 1 prior to discharge depending on wound ooze. Replace dressings with double layer Tubigrip®.

In this phase, the emphasis should be on swelling control and normalising gait with crutches.

Exercise suggestions

- static quads
- static hamstrings
- co-contractions quads/hamstrings
- glute squeezes
- heel slides

Outcome measures to guide progression to Phase 2

Patient outcomes at 2 weeks	Physiotherapist review at 2 weeks
• ↓↓swelling	• stroke test (Sturgill, Snyder-Mackler, Manal, & Axe, 2009) 0 - 1+
• straight knee	• knee extension = 0°
• knee flexion ≥ 90°	• knee flexion = 90-100°
	• quadriceps lag test = 0° to 5°

(Cooper, 2015)

Early Phase 2

Getting stronger by retraining the brain and the body (2- 6 weeks)

The graft is at its **weakest** 6-10 weeks post-op (C. L. Ardern, Webster, Taylor, & Feller, 2011). It is particularly important during this period that the patient adheres to recommended guidelines.

Exercise suggestions

<p>Range of motion</p> <ul style="list-style-type: none"> heel slides prone assisted knee bend stretches prone knee hangs hamstring and calf stretches 	<p>Manual therapy</p> <ul style="list-style-type: none"> patello-femoral mobilisations <p>Balance and proprioception</p> <ul style="list-style-type: none"> balance: single leg stance → wobble board gluteus medius activation in standing
<p>Cardiovascular exercises</p> <ul style="list-style-type: none"> gentle hydrotherapy; exercise in the pool is optional once surgical wounds have healed. This may comprise of walking in water, mini squats, calf raises, lunges, and stretches. <p>DO NOT commence swimming</p>	<p>Strength</p> <ul style="list-style-type: none"> VMO activation co-contractions of quads/hamstrings in isolation and with weight bearing exercises bridging calf raises (bilateral progressing to unilateral) wall sits step ups hamstring wobbles hamstring curls (unresisted) mini squats → progressed as able mini lunges → progressed as able

(Cooper, 2015)

Outcome measures to guide progression to Later Phase 2

<ul style="list-style-type: none"> no knee joint effusion 	
<ul style="list-style-type: none"> knee flexion 	125+ degrees, still maintain full knee extension
<ul style="list-style-type: none"> calf raises 	10x minimal support, knee fully extended
<ul style="list-style-type: none"> balance testing 	Able to hold terminal knee extension during single leg stance

Later Phase 2

Getting even stronger by retraining the brain and the body (6 weeks – 4/6 months)

Exercise suggestions

<p>Strength</p> <p>6 weeks</p> <ul style="list-style-type: none"> • step ups/downs • seated knee curls with TheraBand® • squats and lunges with light weights • single leg squats • eccentric hamstring drills • core stability exercises <p>8 weeks (aim for full range of motion)</p> <ul style="list-style-type: none"> • increase depth squats/lunges • over edge of bed flicks and wobbles • chair bridging (bilateral) <p>10-12 weeks</p> <ul style="list-style-type: none"> • split squats • walking lunges and weight • lower limb stretches 	<p>Gym program</p> <ul style="list-style-type: none"> • leg press (avoid resisted knee extension exercises - this loads the graft) • incline leg press • seated hamstring curls → prone hamstring curls <p>Gym program guidelines (Lloyd et al., 2014)</p> <ul style="list-style-type: none"> • should be always supervised to ensure correct technique • remember equipment is designed for adult sizes and have weight increments that can be too large for younger adolescents. Free weights are preferable in this situation. • explosive and rapid lifting of weights is not recommended • strength-training for adolescents should begin with low-resistance exercises until proper technique is perfected. When 8 to 15 repetitions can be performed, it is reasonable to add weight in 10% increments. • for strength gains workouts need to be at least 20 to 30 minutes long, take place 2 to 3 times per week, and continue to add weight or repetitions as strength improves.
<p>Balance and proprioception</p> <ul style="list-style-type: none"> • Single Leg Stance (SLS), wobble board etc • flicks and wobbles • single leg rebounder balance 	
<p>Cardiovascular exercises</p> <ul style="list-style-type: none"> • exercise bike with increasing resistance (after 3months) • pool running with vest or flotation belt • CV training- intervals • rower • stepper/versa-climber (90' only, not meniscal repairs) 	

(Cooper, 2015)

Phase 3

Create a platform for running, agility and landings (4/6 - 9 months)

Outcome measures to guide progression to Phase 3	
• single leg bridge test (repetitions)	80% of other leg
• single leg calf raises on a step (repetitions)	80% of the other leg
• side bridge endurance test (side plank) (hold time)	80% of other leg
Functional alignment test • single leg squat test- 5x squats on 20cm step with crossed arms	Can be rated 'good', 'fair', 'poor'
Unipedal stance test • SLS with other leg raised and arms crossed	• Eyes open = 43 seconds • Eyes closed = 9 seconds

Returning to running is often one of the patient's greatest goals, however it embodies a high-risk. Rehabilitation must be thorough, and individualised to the child's physiological and psychological maturity to achieve successful outcomes. Emphasise exercises that facilitate dynamic lower limb alignment and biomechanically sound movement patterns and don't be afraid to slow children down if you do not think they are meeting milestones.


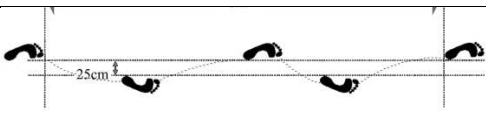
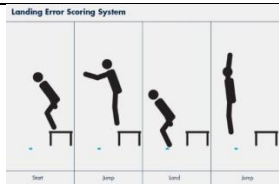
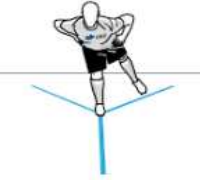
Exercise suggestions

Continued from previous Continue with lower limb strengthening and core exercises: <ul style="list-style-type: none"> • walking lunges and weight • clock lunges • single leg squats, progress to weighted • hamstring curls (TheraBand or weights) • single leg bridging-on ball pluhamstring curls • forward and side planks 	Balance and proprioception <ul style="list-style-type: none"> • rebounder jogs and stops (two pillows at home)
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<p>Agility and plyometric exercises</p> <ul style="list-style-type: none"> • jumping on spot • jumping forwards/backwards • jumping side-to-side <p><i>Progress to</i></p> <ul style="list-style-type: none"> • 90 degree turns • hopping drills (jump-stop, hop-stop, from 10cm to 20cm etc) • obstacle hopping, grid hopping • step running • ladder running • box jumps <p><i>Progress to</i></p> <ul style="list-style-type: none"> • single leg landings with perturbations 	<p>Pool program</p> <ul style="list-style-type: none"> • can start freestyle with pool buoy at 3 months, kicking with freestyle at 4 months and then progress to kicking with flippers at 6 months <p>Cardiovascular exercises</p> <ul style="list-style-type: none"> • as before plus bike work with cleats can be introduced on a wind trainer
<p>Running type activities</p> <ul style="list-style-type: none"> • running on mini tramp <p><i>Progress to</i></p> <ul style="list-style-type: none"> • running in clinic towards mirror <p><i>Progress to</i></p> <ul style="list-style-type: none"> • treadmill running <p><i>Progress to</i></p> <ul style="list-style-type: none"> • field jogging in combination with walking (i.e. walk 30m, jog 30m) • gradually increase jog component once have confidence in straight line • progress speed • progress surface/incline • progress to shuttle runs 	

(Cooper, 2015)

Outcome measures to guide progression to Phase 4

<ul style="list-style-type: none"> • single leg bridge test (repetitions) 	
<ul style="list-style-type: none"> • single leg calf raises on a step (repetitions) 	90% of the opposite leg
<ul style="list-style-type: none"> • side bridge endurance test (side plank) (hold time) 	
<ul style="list-style-type: none"> • single leg press (if doing gym program) 1 Repetition-Maximum (1RM) 	
<p>Single hop test</p> <p>Subjects stand on one leg and hop as far as possible and land on the same leg. Two valid hops are performed. A limb symmetry index is calculated by dividing the mean distance in cms of the involved limb by the mean distance of the non- involved limb then multiplying by 100.</p> 	90% of the opposite leg With adequate strategy and movement quality/fluidity. <i>Focus on four factors:</i> <ol style="list-style-type: none"> 1. Hip rotational control 2. Knee flexor control 3. Postural stability 4. Frontal plane knee mechanics (Reid, Birmingham, Stratford, Alcock and Giffin, 2007)
<p>Triple cross over hop test</p> <p>The test is performed over a 15cm-wide and 6-metre-long marking strip on floor. Patients are required to hop three consecutive times on one foot, crossing the strip on each hop. The total distance is measured. Two valid hops are performed. A limb symmetry index is calculated by dividing the mean distance in cms of the involved limb by the mean distance of the non-involved limb then multiplying by 100.</p> 	<ol style="list-style-type: none"> 1. Hip rotational control 2. Knee flexor control 3. Postural stability 4. Frontal plane knee mechanics (Reid, Birmingham, Stratford, Alcock and Giffin, 2007)
<p>Modified landing error score system (less)</p> <p>Subjects jump off a 30cm box onto the ground at a distance which is 50% of their height. They then immediately jump vertically as high as possible. The patient performs these multiple times until assessor has observed and marked all of the criteria.</p> 	See Appendix 1 for scoring sheet (Padua et al., 2009) (Ithurburn, Paterno, Ford, Hewett, & Schmitt, 2015)
<p>Y-balance test</p> <p>This is performed in anterior, posterolateral and posteromedial directions. The patient stands with one leg in the middle and hands on hips. A composite score for all 3 directions is obtained for each leg. A limb symmetry index is calculated by dividing the mean distance in cm of the involved limb by the mean distance of the non-involved limb and then multiplying by 100.</p> <p>(Gribble et al, 2012)</p> 	95% of opposite leg (Gribble, Hertel, & Plisky, 2012)

Phase 4

Getting ready to return to sport; practise sports related skills (9-12 months)

Dynamic, multi-joint neuromuscular control is the primary focus of ACL rehabilitation in children and adolescents. Phase 4 is important to developing the necessary control and awareness for effective return to sport in stage 5 with appropriate and safe technique. This may mean allowing the child to return to training with specific guidelines, therefore maintaining the social benefits of remaining involved with the team. Providing modified restrictions to the coach or school teacher, ensuring the patient has excellent insight and recruiting the parent/guardian as an active participant can minimise the risks associated with this.

Exercise suggestions

- hopping and jump drills continue
- figure 8 running
- diagonal running
- change of direction drills
- slalom running
- sport specific drills and skills (from 26 weeks +) from restricted to unrestricted with game play
- sport specific cardiovascular training

(Cooper, 2015)

Outcome measures to guide progression to Phase 5

• hop tests (as previously described in Phase 3)	>90%
• muscle strength tests	90% symmetry
• performed gradual increase in sport-specific training without pain and swelling	
• confidence in knee function and psychological readiness to return to sport	>80%
• knowledge of high injury risk knee position and ability to maintain low-risk knee positioning in advanced sport specific actions.	

Phase 5

Return to sport and prevent re-injury (12 months and onwards)

At 12 months post-surgery the patient will be reviewed at LCCH orthopaedic by their surgeon and a physiotherapist. Final outcome measures will be taken and, all going well, return to sport clearance provided.

Data from international registries shows that children/adolescents are much more prone to secondary ACL rupture, including the contralateral leg. According to the [2018 Olympic Committee Paediatric ACL consensus Statement](#), a comprehensive injury prevention program, emphasising biomechanical alignment and landing/cutting technique should be integrated for all paediatric ACL patients post rehabilitation.

Prevention programs should

- incorporate plyometric, balance, strengthening exercises and education/feedback on proper technique.
- be performed more than once/week
- last greater than 6 weeks
- also include other items such fitness and warm up

Examples

- PEP program: 15-minute training session that replaces the traditional warm up in soccer players
- FIFA 11+ - Soccer
- Netball KNEE Program (Netball Australia)
- KIPP (Knee Injury Prevention Program) for high school basketball and soccer players
- Footy First: for AFL players (+18 years)

Links

- [PEP \(Prevent injury and Enhance Performance\) Program](#)
- [FIFA 11+](#)
- [Netball Knee Program](#)
- [KIPP \(Knee Injury Prevention Program\)](#)
- [Footy First \(AFL\)](#)

Consultation

Key stakeholders who reviewed this version:

- Linda Camilleri (Physiotherapist- Advanced, QCH)
- Dr David Bade (Director of Orthopaedics, QCH)
- Kylie Bradford (Orthopaedic Physiotherapy Clinical Lead, QCH)
- Natasha Weaver (Physiotherapist, QCH)

References and suggested reading

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Audit/evaluation strategy

Level of risk	Low
Strategy	Audit Protocol Bi-yearly
Audit/review tool(s) attached	N/A
Audit/Review date	October 2020
Review responsibility	HP5 Advanced OPSC MSK Physiotherapist

Guideline revision and approval history

Version No.	Modified by	Amendments authorised by	Approved by
1.0	Advanced Physiotherapist	A/Divisional Director, Clinical Support	Executive Directors, Clinical Services (LCCH)

Keywords	Paediatric, ACL reconstruction, rehabilitation, physiotherapy, 65031
Accreditation references	NSQHS Standards (1-10): 1, 2, 6

Appendix 1 - Outcome Measures

- [Modified Landing Error Score System \(LESS\)](#)

Appendix 2 - Preventative Programs

- [PEP \(Prevent injury and Enhance Performance\) Program](#)
- [FIFA 11+](#)
- [Netball Knee Program](#)
- [KIPP \(Knee Injury Prevention Program\)](#)
- [Footy First \(AFL\)](#)