ACL repair post-operative protocol

This protocol is designed to be guideline for rehabilitation, it is important to note that progression is dependent upon soft issue healing times as well as the clinician's evaluation.

Pre-habilitation for ACL deficient patients prior to surgery (Pre surgery)

Aims

- Psychological and physiological preparation for surgery (education).
- Regain as much muscle strength as possible before surgery.

Goals to be achieved before surgery

- Understanding the surgical procedure and rehabilitation outline
- Full range of motion, particularly into extension.
- Full quadricep activation
- <5% strength difference on SRM
- Minimal effusion
- Normal walking pattern (gait)

Rehabilitation outline

- Effusion control
- AROM + PROM Knee FLX /EXT
- Closed kinetic chain strengthening (CKC)
- Education about the injury, surgery and post-surgical rehabilitation
- Appropriate use of language (pain science)

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Early Post-Operative Phase 1 (ACL repair 0-4 weeks)

Appointments - Post operative evaluation should be performed 3-5 days following surgery. Follow up appointments should be 1-2x per week. Dependent on the patient's progressions and goals.

Rehabilitation Goals

- Decrease pain levels
- Gain full extension week 1-2
- Restore quadriceps function, leg control and muscle tone
- Control Effusion
- Adherence to home exercise program (HEP) and precautions focusing on AROM/PROM
- Goal of 0-90 degree within 1 week, moving toward full flexion (120+ degrees) after first 2 weeks
- Full WB after 2 weeks. Crutch WB progression until that point

Precautions

- **IMPORTANT: Monitor wound**
    - **If you have any concerns about your wound immediately contact us on:**
        - **OS group: 0203 397 7779**
    - This would include any of the below symptoms or observations;
        - wound leakage – blood or discharge
        - redness around the area
        - excessive or worsening pain
        - raised temperature
- **IMPORTANT: DVT awareness**
    - **If you have any concerns that you may have developed a DVT (deep vein thrombosis) immediately contact us on this number:**

- **WARD (please insert):**
- **OS group: 0203 397 7779**

- This would include any of the below symptoms or observations;
  - sudden calf pain and swelling
  - pain, swelling and tenderness in one of your legs (usually your calf)
  - a heavy ache in the affected area.
  - warm skin in the area of the clot.
  - red skin, particularly at the back of your leg below the knee.
  - shortness of breath and chest pain (very rare)

- **Manage swelling**

  - Cryotherapy is advised
  - **PHYSIOLAB portable S1 device** is the preferred cryo-pneumatic device of OS group. See Appendix B for contact details.

- **Reduce mobility**
  - Rest as much as possible
  - Limited walking to around the house
  - If using crutches please see appendix A for instructions on advice on their use.

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1. No testing of repaired or reconstructed ligaments (Lachman's, Anterior/Posterior Drawer, Varus or Valgus stress) prior to 12 weeks.
2. WB as tolerated with crutches

Rehabilitation outline

- Cryotherapy
- Emphasis on quadricep, hamstring & calf activation – Static quads (no lag)
- Neuromuscular stim if voluntary activation of the above is not possible
- Restore patella mobility (mobilizations Medial – lateral/ superior inferior translations)
- Static cycling low resistance (only when knee reaches 100degrees FLX)

- Bilateral short and long leaver bridges
- Flexibility as appropriate
- Basic neuromuscular training
- Ambulation with appropriate joint loading without obvious gait deviation
- Weight shifting, SL balance
- Patellar mobilization
- CKC strengthening within ROM 0-60 degrees

Early Home Exercises

- **Knee Extension –** Using a rolled towel under the foot so back of the client's leg is off of the bed, then squeeze the knee down into the bed.
- **Straight Leg raises** – Slowly keeping the leg straight in supine raise the leg hold for 2 seconds before controlling the movement back down to a neutral position.
- **Prone hangs –** Both legs from the knee below hanging off of the end of the bed, become relaxed and let the legs hang over the edge of the bed.
- **Heel slides –** laying supine but both feel on the bed begin to move the effected leg closer to your body then in the same controlled way slide the heel down the bed away from you.
- **Quads/ hamstring/calf isometrics –** Without moving the lower limb below the knee resist against force (Either a wall or using TheraBand).

Criteria to progress to middle phase of Rehabilitation (4-12 weeks)

- ✔ **ROM** - Must be greater or equal to 0-120 degrees
- ✔ **Strength -** Quadriceps set with normal superior patellar translation, SLR x 10seconds without extensor lag. Hamstring, calf, adductor, abductor activation
- ✔ **Goals- (These do not limit progression to the next phase however should be addressed with interventions)**
- ✔ **WB –** Near normal gait without crutches (2 weeks) + open chain leg control
- ✔ **Effusion –** Minimal knee effusion

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Middle phase of rehabilitation (ACLR 4-12 Weeks)

This phase should begin when all Phase 1 criteria to progress is achieved. Important to note the graft is at its weakest between 8-10 weeks.

Appointments- 1/2x per week in addition to 2-3 days HEP.

Rehabilitation Goals

- Normalize gait
- Develop and asses movement patterns
- Progressive limb loading – closed skill bilateral landing and jogging (6 weeks plus)
- Adherence to HEP
- Progress muscle strengthening, hypertrophy and endurance.
- Progression from bilateral limb loading to unilateral WB activities.

Precautions

1. Protection of graft while in its weakest (8-10 weeks)
2. Avoid overloading the knee
3. Open chain knee extension
    - Initiate submaximal leg extension 90-45degrees
    - Initiate active knee ROM 0-90 degrees (modify if painful)

Rehabilitation Outline

- Bilateral squat to parallel (thighs relative to the floor) even symmetry WB without knee valgus.
- Double leg WB balance drills
- SEBT – anterior and posterior balance reach (only after bilateral weight baring activities are progressed to unilateral approx. 6 weeks plus)
- Cryotherapy and compression to reduce pain and effusion
- Neuromuscular re-education using electrical stim at 60-degree knee flexion (if strength training is difficult)
- Multi-angle knee isometrics from 60-90 degrees for patients unable to tolerate (high-intensity muscle stim)

- Progress WB quadriceps and hamstring exercises with emphasis on proper LE mechanics
- Progress single leg balance
- Calf muscle work capacity – Unilateral heel raise straight knee (x25 + no >5 rep difference between sides)
- Endurance: low impact - treadmill walking (6 weeks)
- Calf muscle work capacity – Unilateral heel raise in 20˚ knee flexion (x25 + no >5 rep
- difference between sides)
- Gluteal muscle work capacity – unilateral short lever bridge on box (hip 45˚) (x25 + each leg
- no >5 rep difference between sides)
- Hamstring muscle work capacity – unilateral long lever bridge on box (hip 45˚) (x25 + each
- leg no >5 rep difference between sides)

Home Exercises

- **Weight acceptance and control** - shallow squat with lateral shifting.
- **Double leg heel raises –** using balance support (hand against the wall) slowly raise up onto your toes hold for 3 seconds and control the movement back down.
- **Double leg squats–** squatting with good for to thighs are parallel to the floor.
- **Bridging –** laying supine on the floor with your feel flat to the floor slowly begin to lift your pelvis of off the ground while keeping your back straight and glutes engaged hold this position before controlling the movement back down to the floor then repeat.

Criteria to progress to next stage of rehabilitation

- ✔ **ROM -** Maintain full, pain free AROM including PF mobility
- ✔ **Effusion-** No reactive effusion after exercise that last more than 12 hours
- ✔ **Strength** - Isometric or isokinetic quadriceps and hamstrings strength >/= 80%
- ✔ **WB -** Able to tolerate unilateral loading, including waking to jogging progression, without increased pain

✔ **Neuromuscular Control**- Demonstrates proper lower extremity mechanics with all therapeutic exercises (bilaterally).

IMPORTANT

Release of internal brace

Depending on age and presentation of the patient there may be a requirement to surgically release the internal brace around 3-4 months post ACL repair.

At this point rehabilitation should begin again from the initial post-surgical phase and continue accordingly in line with this protocol's guidance and under the supervision of the surgeon.

Late Phase of Rehabilitation (ACLR 12weeks – Return to sport)

This stage of rehabilitation will only be appropriate when all of the middle phase criteria has been achieved and the practitioner is comfortable with the progression.

Appointments – 1/2x per week with progressions on HEP.

Rehabilitation Goals

- Maintain full patellofemoral and tibiofemoral range of motion
- No Knee swelling, stiffness or meaningful pains
- To progress the athlete from bilateral load acceptance activities to full unilateral load
- Acceptance activities in multiple planes of movement
- To continue to develop strength, hypertrophy, power and endurance
- Continue to assess and develop whole body motor control and movement patterns

Precautions

1. Criteria to initiate hopping
   - ❖ Full, pain free ROM
   - ❖ 80% isometric strength symmetry (hamstrings and quadriceps)
2. Hop downs with appropriate landing mechanics (with above criteria achieved)
3. Audible rhythmic strike patterns and no gross visual compensation
4. Knee must be symmetrical to contralateral limb, and pain free with overpressure

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Rehabilitation Outline

- ➢ Performance of the quadriceps, hamstrings and trunk dynamic stability
- ➢ Muscle power generation and absorption via plyometrics
- ➢ Sport and position specific activities (Psychological)
- ➢ Begin agility exercises between 50-75% effort (utilize visual feedback to improve mechanics as needed)
- ➢ Movement control exercise beginning with low velocity, single plane activities and progressing to higher velocity, multi-plane activities
- ➢ Hip strengthening - especially oriented at neuromuscular control in prevention of hip adduction at landing and stance
- ➢ Core strength and stabilization - especially orientated at preventing frontal plane trunk lean during landing and single leg stance
- ➢ Single-leg hop downs from increasing height (up to 12" box), Single-leg hop-holds
- ➢ Single-leg squats on BOSU with manual perturbation to trunk or legs, Single-leg BOSU
- ➢ Balance, single-leg BOSU Romanian deadlift
- ➢ Deadlifts/RDL's, lunges – progressive to multidirectional

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Home Exercises

Squats- Double + single leg (progressive) (goblet/front/back)
LL Strengthening progression- Leg extension, leg curl, leg press,
Trunk and core - Rotational trunk exercises on static and dynamic surfaces, PWB to FWB
Open kinetic chain (OKC)- Quadriceps with resistance from 12weeks+
Deadlifting – Progressive form bar to adding weight (hip hinge patterning)

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Criteria to progress to Return to Sport (Fitness training before full exposure to desired sport)

- ✔ **ROM:** full (150 degrees) pain free knee ROM, symmetrical with the uninvolved limb
- ✔ **Strength:** Hamstrings strength 90%+ of contra-lateral side / Quadriceps strength 90%+ of contra-lateral side
- ✔ **Effusion:** No reactive effusion with sport-specific activity.
- ✔ **WB:** normalized gait and jogging mechanics
- ✔ **Neuromuscular control**: appropriate mechanics and force production with high level agility, plyometrics, and high impact movements
- ✔ **Functional Hop Testing**: LSI 90% or greater for all tests
- ✔ **Practitioners Clearance**

Additional stages

Stage four – 12-16 weeks

- Begin rehabilitation towards sports
- Full range isokinetic
- Knee extension machine with low weight high reps progressing isokinetic quads to full extension.

Stage Five – 16 weeks to 6 months

- Begin plyometric program
- Concentrate on agility training
- Begin to introduce gentle sport specific drills

Stage six – After 6 months

- Return to recreational sports if full range of motion 150+degrees
- Hamstring strength superior to 90% of no inured
- Quads superior to 85% + agility training completed.
- Aim to delay contact sport for a further six weeks.
- Maintenance of HEP 2-3 times per week.

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Suggested outcome measures tests to be used to monitor progression throughout the rehabilitation

Bilateral Drop Jump Test

- Participant stands on a 30cm box
- Jump two footed off the box landing with feet either side of a line 30cm from the box
- Immediately attempt to undertake a maximum vertical jump reaching up to touch a target held above the line
- Score a zero if the appropriate strategy is used and one for inappropriate movements. (Best overall score is 0 and worse is 10 points)

Qualitative Analysis of Drop Jump Landing

Date. Patient: Condition:

Left Right Bilateral

		Left	Right
Trunk Alignment	Leaning in any direction from midline		
Foot on Landing	Initial foot contact not symmetrical (timing)		
	Initial foot contact not symmetrical (foot landing away from mark)		
	Significant ground contact time		
	Foot not neutrally aligned (facing forwards)		
	Failure to land on mid foot		
Limb on Landing	Thigh pelvis angle <90deg		
	Stiff upright landing		
	Patella pointing towards 2nd toe (noticeable valgus)		
	Patella pointing past inside of foot (significant valgus)		
	Total		

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Tuck Jump Test

- Subjects stand in a 30cm box marked on floor
- Undertake tuck jump continuously for 10 seconds
- Must attempt to raise the knees above the hips each time and land and take off within the box
- Score a zero if the appropriate strategy is used and one for inappropriate movements. (Best overall score is 0 and worse is 10 points)

Tuck Jump Test Score Sheet

Date:

Patient:

Condition:

Left:

Right:

Bilateral:

	Score
Knee and Thigh Motion	
1. Knee valgus on landing	
2. Thighs not reaching parallel (peak of jump)	
3. Thighs not equal side to side (during flight)	
Foot position during landing	
4. Foot placement not shoulder width apart	
5. Foot placement not parallel (front to back)	
6. Foot contact timing not equal	
7. Does not land in same foot print	
8. Excessive landing contact noise	
Plyometric technique	
9. Pause between jumps	
10. Technique declines prior to 10 seconds	

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Qualitative Analysis of Single Leg Loading

(Single leg squat)

(Single leg step down)

(Single leg hop for distance)

- See page 14 for test descriptions
- Score a zero if the appropriate strategy is used and one for inappropriate movements. (Best overall score is 0 and worse is 10 points)

Date: Patient: Condition:

Left Right Bilateral

QASLS		Left	Right
Arm strategy	Excessive arm movement to balance		
Trunk alignment	Leaning in any direction		
Pelvic plane	Loss of horizontal plane		
Thigh motion	WB thigh moves into hip adduction		
Knee position	Patella pointing towards 2nd toe (noticeable valgus)		
	Patella pointing past inside of foot (significant valgus)		
Steady stance	Touches down with NWB foot		
	Stance leg wobbles noticeably		
	Total		

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Qualitative Analysis of Single Leg Loading - Test Descriptions

Single leg step down

- Participant stands on a 30cm box
- Instructed to step off the box onto a mark, 30cm from the box and 5cm on the contra-lateral side to the mid line

Single leg hop for distance

- Participant stands on mark at side of standard tape measure
- Hands resting on iliac crests
- Attempts to hop as far as possible staying parallel to the tape.

Cross Over Hop Test

- Subject stands by two parallel lines 20cm apart extending at least 5m
- Undertakes four consecutive hops without pause crossing the grid lines each time.

Star Excursion Balance Test

- Subject stands on leg to be tested in centre of star. Keep heel down.
- Instructed to reach as far as possible down the line without taking undue support from the reaching leg or stepping over onto that leg
- 4 practices then test 5 repetitions

General notes

- All landings for single leg step down and single leg hop for distance must be held for 3 seconds, emphasis during task instruction must be placed on this
- Evaluate all landings using the QASLS scoring system
- For single leg hop for distance also include the distance hopped and the leg length
- Position camera a minimum of 2m from the landing position, zoom in to maximise the size of the subject within the frame
- Allow the subject a minimum of two practice attempts (continuing until they are able to do tasks appropriately) then record a single attempt.

Appendix A - Crutches

- When standing up and sitting down, make sure you take your arms out of the crutches and hold them in one hand. This will help to avoid any shoulder injuries.
- When walking with the crutches, keep the handles pointing forwards and your arms close to your sides.
- Place both crutches forwards together with enough space in between them to step into.
- If you are advised that you are not allowed to put any weight through your injured leg (non-weight bearing), place your crutches forwards together. Now lean through your arms as you hop your uninjured leg up to the same level as the crutches. The foot on your injured leg must stay off the floor at all times when walking.
- If you are advised that you are allowed to weight bear, place the crutches forwards together and then step your injured leg up to the crutches. Now lean through your arms as you step you uninjured leg forwards to the same level.
- When climbing stairs, try to use a banister or rail in one hand and a crutch in the other (you can also carry the extra crutch in this hand):
- GOING UP: Good leg, bad leg, crutch
- GOING DOWN: Crutch, bad leg, good leg.
- Check the rubber stoppers regularly. If they are worn down, bring them back to the Physiotherapist will replace them.

Appendix B - Physiolab

Link for hire	https://physiolab.com/products/to-rent/s1-portable.html
Website	www.physolab.com