

PCL-BASED MULTILIGAMENT RECONSTRUCTION PROTOCOL APPROPRIATE FOR COMBINED PCL + MEDIAL AND/OR LATERAL KNEE RECONSTRUCTIONS

PHASE 1

NB: if the ACL is also reconstructed, please liaise with consultant regarding required brace

Monitor for evidence of:

- Infection: if patient develops a temperature $>38^{\circ}$, refer urgently to the operating surgeon. If the surgeon is unavailable, advise patient to attend A&E to exclude wound infection or septic arthritis
- Distal neurovascular deficit (*AECS*, *CPN* or *SN* involvement, *DVT*)

Goals:

- Protect the grafts
- Control pain and swelling/effusion
- Restore/preserve range of motion
- **Muscle activation**

Initial precautions:

- Brace locked at 0° , transferring to PCL brace **ASAP** once swelling allows and dressings removed
- NWB until **6 weeks**, WBAT thereafter aiming for FWB with normal gait by **8-9 weeks**
- Passive knee flexion $\leq 90^{\circ}$ until **2 weeks**
- Knee flexion exercises performed in prone position only until **6 weeks**
- Avoid excessive hyperextension until **12 weeks**
- Avoid open chain isolated hamstrings exercises and CKC knee flexion $>70^{\circ}$ until **16 weeks**
- PCL brace to be worn for **6 months** at all times except when showering and changing clothes

Pain, effusion and ROM:

- **PEACE* protocol for the management of pain and swelling/effusion
- NB: cryotherapy only influences pain, not drainage
- Terminal extension **ASAP**, patella mobilisation if required
 - In prone only, passive ROM $0-90^{\circ}$ for **2 weeks**, FROM thereafter (avoiding hyperextension)
 - Ankle and hip ROM ex's if required (e.g. calf stretches, Thomas test stretch)

Muscle activation and strength:

- TAQ's, IRQ's, SLR
- Consider electrostimulation if unable to voluntarily contract quadriceps
- Once able to SLR without extension lag, initiate OKC knee extension
 - Add resistance to OKC knee extension as symptoms allow
 - OKC hip maintenance ex's (e.g. side lying abduction, prone extension)

Criteria for progressing to Phase 2:

- Closed wound
- No/minimal pain with phase 1 exercises
- No/minimal synovitis/effusion
- Normal patellofemoral mobility, tibiofemoral ROM $\geq 0-120^{\circ}$
- Able to SLR without extension lag
- Minimum **6 weeks** since surgery

AECS: acute extremity compartment syndrome

CPN: common peroneal nerve

DVT: deep vein thrombosis

PEACE: Protection, Elevation, Avoid anti-inflammatories, Compression, Elevation

SN: Saphenous nerve

PCL-BASED MULTILIGAMENT RECONSTRUCTION PROTOCOL – PHASE 2

Goals:

- **Protect the grafts**
- Full patellofemoral and tibiofemoral ROM
- **Initiate weight bearing and encourage normal gait pattern**
- **Initiate weight bearing strengthening exercises**

Precautions:

- Avoid excessive hyperextension until **12 weeks**
- Avoid open chain isolated hamstrings exercises and CKC flexion $>70^\circ$ until **16 weeks**
- PCL brace to be worn until **6 months** at all times except when showering and changing clothes

Pain, effusion and ROM:

- Monitor for increasing pain, effusion or localised temperature and modify rehabilitation accordingly
If required, consider NSAIDs
- Knee flexion exercises can now be performed in supine
- Maintain full extension, patella mobility and regain full/symmetrical flexion

Strength:

- Double leg CKC ex's $\leq 70^\circ$ knee flexion until **16 weeks**
- Hamstrings bridging with knees fully extended on a gym ball to support the proximal tibia
- OKC knee extension with resistance
- Gluteal and calf muscle strengthening
- Progressively decrease repetitions and increase resistance for all strength exercises

Neuromuscular training:

- Proprioceptive ex's (e.g. Bosu balance trainer)
- Correct alignment of trunk and lower limb during exercises and gait

Cycling:

- Static bike with no resistance if sufficient ROM, increasing time as able

Criteria for progressing to Phase 3:

- No/minimal pain with phase 1 exercises
- No/minimal synovitis/effusion
- Full/symmetrical knee ROM
- FWB with normal gait pattern on even surfaces
- Able to tolerate 25 minutes standing/walking
- Minimum **12 weeks** since surgery

PCL-BASED MULTILIGAMENT RECONSTRUCTION PROTOCOL – PHASE 3

Goals:

- Protect the grafts
- Progressive strengthening through increasing range of knee motion
- Initiate OKC hamstrings work

Precautions:

- Avoid open chain isolated hamstrings exercises and CKC flexion >70° until **16 weeks**
- PCL brace to be worn until **6 months** at all times except when showering and changing clothes

Strength/power:

- Progress OKC and CKC ex's to single leg
- Progress CKC ex's beyond 70° from **week 16**
- OKC hamstrings and single leg bridging exercises from **week 16**
- Progressively increase resistance and decrease repetitions for all strengthening exercises

Neuromuscular training:

- Increase difficulty of double leg proprioceptive ex's (e.g. perturbations, two motoric tasks)
- Increase intensity of perturbation, progressing to single leg once able
- Correct alignment of trunk and lower limb during exercises and walking

Cycling and other cardiovascular exercise

- Static bike with resistance
- Elliptical trainer
- Treadmill walking

Criteria for progressing to Phase 4:

- No/minimal pain with phase 3 rehabilitation
- Correct qualitative performance of phase 3 exercises
- Minimum **6 months** since surgery

PCL-BASED MULTILIGAMENT RECONSTRUCTION PROTOCOL – PHASE 4

Goals:

- Wean off PCL brace
- Return to running or physically demanding work
- Sports specific drills and gradual return to play program

Post-operative time-based restrictions:

- Do not commence running until patient has fulfilled return to running criteria

Running:

- Start running if:
 - full ROM
 - pain ≤ 2 VAS and no effusion despite adequate loading
 - limb symmetry index (LSI) $\geq 70\%$ for quadriceps and hamstrings strength
- Graduated running programme: start with 4-minute walk, 1-minute run (4:1) for 20 minutes
Decrease walking time and increase running time by 1 minute each week (3:2, 2:3, 1:4, 0:5)
Patient should be able to run for 20 minutes after 5 weeks.
- Once running programme complete, introduce backwards and sideways running
- Progress running from single to multi-plane specific agility drills

Strength/power:

- Continue progressive loading for strengthening exercises
- Sports-specific progressions e.g. power development, jumping and landing

Neuromuscular training:

- Increase difficulty of neuromuscular and perturbation training (e.g. single legged jumps)
- Introduce reactive/unanticipated movements
- Emphasise sports specific movements
- Maintain quality of movement/performance during strength and sports exercises

Sports-specific training

- Increase intensity of agility training (e.g. cutting, pivoting)
- Build sports specific load regarding energy expenditure (aerobic, anaerobic)
- Build sports specific load regarding surface (grass, court etc.)
- Restart training with patient's team

Criteria for returning to play:

- No knee pain with sports specific activities
- Successfully weaned off PCL brace
- No giving way or fear of giving way during sports specific activities
- Active dynamic gait pattern and symmetrical jogging pattern
- Correct quality of performance with all sports-specific activities
- Limb symmetry index (LSI) $>90\%$ for quads and hamstrings strength
- LSI $>90\%$ for hop battery tests
- Patient psychologically ready/confident to return to sports
- Restoration of posterior stability confirmed by clinical examination
- Expected return between 7-9 months since surgery

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Date last reviewed: October, 2020

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