

PCL RECONSTRUCTION

Lance E. LeClere, MD • Professor of Orthopaedic Surgery · Chief, Orthopaedic Sports Medicine · Vanderbilt University Medical Center

These guidelines are a **framework** for post-operative rehabilitation after posterior cruciate ligament (PCL) reconstruction. Progression is **criterion-based** and depends on soft tissue healing, patient demographics and clinical evaluation — the time frames below are approximate for the average patient and are **not** a schedule for the individual patient. These guidelines do not substitute for restrictions determined by the operating surgeon. **PCL reconstruction is rarely an isolated procedure; review the operative note for concomitant pathology and post-operative precautions before beginning rehabilitation.**

BACKGROUND

The PCL restricts posterior translation of the tibia and restricts internal rotation at **90° of knee flexion or greater**. It comprises two bundles — the anterolateral (ALB) and posteromedial (PMB). PCL injuries are rare in isolation and commonly occur with other injuries, most often the **MCL** and the **posterolateral corner (PLC)**. A thorough review of the operative report is necessary to determine the optimal post-surgical course.

PHASE 1

WEEKS 0–6

Protection

PHASE 2

WEEKS 6–10

Loading

PHASE 3

MONTHS 3–5

Strength & power

PHASE 4

MONTH 6–RTS

Return to sport

PRECAUTIONS

- ◆ **No knee flexion >90°** for 4 weeks
- ◆ **No resisted** open kinetic chain knee flexion × 16 weeks
- ◆ Typically weight bearing with TROM open 1–2 weeks prior to discharge
- ◆ **No active hamstring flexion** exercises × 8 weeks
- ◆ WBAT with brace **locked in extension** for the first 6 weeks
- ◆ **No hop testing** prior to 6 months

GRAFT PROTECTION

Prevent **hyperextension** and **posterior tibial translation** throughout rehabilitation to protect the healing PCL graft from elongating. Concomitant collateral ligament intervention may change the weight-bearing and ROM progression — refer to the “post-op plan” section of the operative note or contact the surgical team.

WEIGHT BEARING

- ◆ WBAT with brace locked in extension × 6 weeks
- ◆ Discharge brace by 8 weeks
- ◆ Open brace at 6 weeks

RISK FACTORS

- ◆ PCL reconstruction requires extensive rehabilitation and can exhaust insurance-approved PT visits — consider decreasing frequency during the middle phase
- ◆ PCL reconstruction has a tendency toward laxity — be cautious not to “over-stretch”

OUTCOME TOOLS

- ◆ Collect the **LEFS** at each visit
- ◆ May add IKDC, KOOS, ACL-RSI, Tegner or other questionnaires specific to the patient

STRENGTH TESTING

- ◆ Isometric testing: 8 weeks
- ◆ Isokinetic testing: 4, 6, 9 and 12 months
- ◆ Hop testing: at 6 months *and* once 80% LSI on isokinetic testing is achieved
- ◆ **RTS expectation: 6–12 months**

PROUD MEDICAL TEAM FOR





MCL REPAIR

CONCOMITANT PROCEDURE

- ◆ Proximal / femoral repair trends toward **stiffness** → more aggressive ROM
- ◆ Distal / tibial repair trends toward **laxity** → more cautious ROM progression

LCL / POSTEROLATERAL CORNER REPAIR

CONCOMITANT PROCEDURE

- ◆ **No extension past neutral × 12 weeks** (no hyperextension)
- ◆ Use slight valgus force during PROM flexion × 12 weeks
- ◆ Ensure no hyperextension or varus thrust when returning to ambulation

RED FLAGS

IMMEDIATE RE-EVALUATION

- ◆ Signs of DVT — **refer directly to the emergency department**
 - Localized tenderness along the distribution of the deep venous system
 - Entire lower extremity swelling
 - Calf swelling >3 cm compared with the asymptomatic limb
 - Pitting edema
 - Collateral superficial veins
- ◆ Lack of full knee extension by 4 weeks post-op → refer to surgeon
- ◆ Mechanical block or clunk → refer to surgeon
- ◆ Reported episode of instability → refer to surgeon

YELLOW FLAGS

MODIFY PLAN OF CARE

- ◆ Persistent reactive effusion or pain following therapy or ADLs
 - Decrease the intensity of rehabilitation interventions
 - Continue effusion management
 - Educate the patient on activity modification until symptoms resolve

1

PROTECTION PHASE · POST-OP – WEEK 6

GOALS Restore ROM and minimize effusion and pain while adhering to all post-operative precautions

PAIN & EFFUSION

- ◆ Effusion management strategies: cryotherapy and compression as appropriate

WEIGHT BEARING

- ◆ WBAT with brace locked in extension × 6 weeks
- ◆ Open brace at 6 weeks
- ◆ **Concomitant collateral ligament intervention may change this progression** — refer to the operative note or contact the surgical team

ROM PRINCIPLES

- ◆ Prevent hyperextension and posterior tibial translation to protect the healing PCL graft from elongating
- ◆ Use varus / valgus force during PROM to protect an MCL or LCL repair if appropriate

WEEKS 0–2

PROM ONLY

- ◆ Achieve terminal knee extension; **stop at 0°** — do not push into hyperextension
- ◆ Flexion **0–90°** using PROM strategies
 - PROM in prone with clinician support
 - Using the uninvolved leg or a stretch strap
 - Heel slides with constant anterior pressure in the popliteal fossa to decrease tension through the PCL

WEEKS 2–6

PROM → AAROM

- ◆ Achieve terminal knee extension; **stop at 0°** — do not push into hyperextension
- ◆ Progress flexion from PROM to AAROM
 - Knee flexion in seated position using the uninvolved limb for support
- ◆ **Week 3:** upright bike may begin for **ROM only** (no resistance)





SUGGESTED INTERVENTIONS

- ◆ Ankle pumps
- ◆ Quadriceps, hamstring and gluteal isometrics
- ◆ Diaphragmatic breathing
- ◆ Effusion management strategies, including RICE
- ◆ Prone TKE
- ◆ SLR (4-way) with brace on; emphasis on eliminating extensor lag
 - Perform without brace once able to complete 3×10 without extensor lag
- ◆ Patellar mobilization in all directions
- ◆ Gait training as appropriate
- ◆ Extension ROM: seated towel stretch, prone hang, bag hang — stop at 0°
- ◆ Flexion ROM: see ROM precautions above
- ◆ SAQ
- ◆ Clamshell / side steps
- ◆ **Week 2:** LAQ through protected ROM (90–45°)
- ◆ **Week 2:** shuttle press (0–45°)
- ◆ NMES in long sitting

NMES PARAMETERS

APPENDIX B

- ◆ Pads are placed on the **proximal and distal quadriceps**
- ◆ Patient seated in long sitting (knees extended); progress to seated with the knee in at least 60° flexion, shank secured with a strap, back support with thigh strap preferred. The ankle pad / belt should be two finger widths superior to the lateral malleoli
- ◆ The patient relaxes while the e-stim generates at least **50% of maximal volitional quadriceps contraction**, or maximal tolerable amperage without knee joint pain
- ◆ **20 seconds on / 50 seconds off × 15 minutes**

BLOOD FLOW RESTRICTION TRAINING

APPENDIX D

- ◆ May be initiated **as soon as sutures are removed**
- ◆ Ensure no contraindications; if any precautions apply or the patient is at risk for DVT, clear with the physician before initiating
- ◆ Twice weekly for up to 10 weeks; 2–3 exercises per session
- ◆ Any exercise safe for the patient at that point post-op (e.g. 4-way SLR, prone TKE). **Never during a plyometric exercise**
- ◆ Load 20–40% 1RM · limb occlusion pressure 80%
- ◆ 4 sets of 30–15–15–15 (75 reps) with 30-second rest between sets; cuff inflated for the duration of each exercise, deflated between exercises or every 8 minutes

GOALS TO PROGRESS TO PHASE 2

- 1 Strong isometric quadriceps contraction (full tetany with superior patellar glide)
- 2 SLR with no extensor lag
- 3 PROM 0–90°
- 4 Reduced and well-controlled post-operative pain and edema
- 5 Proficiency with the prescribed home exercise program

2

LOADING PHASE · WEEKS 6–10

GOALS Normalize ROM and gait · improve quadriceps, gluteal and core strength

WEIGHT BEARING

- ◆ WBAT with brace locked in extension × 6 weeks
- ◆ Discharge brace by 8 weeks
- ◆ Open brace at 6 weeks

RANGE OF MOTION

- ◆ ROM goal: **0–130°**
- ◆ Achieve terminal knee extension; **stop at 0°** — do not push into hyperextension
- ◆ **Week 6:** begin stationary bike with minimal to moderate resistance
- ◆ **Week 8:** may begin active heel slides and active prone knee flexion for ROM only
- ◆ Continue patellar mobilizations

PROUD MEDICAL TEAM FOR





SUGGESTED INTERVENTIONS

NO ACTIVE OKC RESISTIVE
HAMSTRING WORK

- ◆ Continue Phase 1 interventions and effusion management
- ◆ SLR-flexion progressions
 - Semi-reclined or seated
 - Add external rotation
 - Perform with eyes closed (cortical training)
 - Speed
 - Isometric holds at end range
- ◆ Single-leg balance interventions
- ◆ Multi-angle isometrics
- ◆ Mini squats (start 0-45°, progress flexion angle as control improves)
- ◆ Step-ups · heel taps
- ◆ Trunk stability: TrA progression, prone / side planks (modified → full)
- ◆ Continue BFR, adding appropriate exercises

TIMED ADDITIONS

PHASE 2

- ◆ **Week 8:** Swiss ball bridges with knees extended
- ◆ **Weeks 8-12:** initiate active hamstring contraction / OKC flexion **without resistance**
- ◆ **Week 10:** cycling (no toe clips)
- ◆ **Week 12:** elliptical

CRITERIA TO DISCHARGE NMES

PHASE 2

- ◆ <20% quadriceps deficit on isometric testing
- ◆ **Or**, if testing equipment is not available, all of: 10 SLR without quad lag · normal gait · 10 heel taps to 60° with good quality · 10-rep max on leg press with similar effort bilaterally · inability to break quadriceps MMT

GOALS TO PROGRESS TO PHASE 3

- 1 AROM 0-130° — communicate with the surgeon if not achieved
- 2 Tolerates therapeutic exercise without pain or reactive effusion
- 3 ≤1+ joint effusion (Appendix C)
- 4 Normal gait pattern
- 5 Proficiency with the prescribed home exercise program

3

STRENGTH & POWER PHASE · MONTHS 3-5

GOALS Increase lower extremity strength and power · normalize lower extremity mechanics during functional movements

STATUS

- ◆ **Pain & effusion:** monitor reactive effusion as progressive loading is performed
- ◆ **ROM:** symmetrical and pain-free, with no pain during end-range overpressure
- ◆ **Weight bearing:** full, with a normalized gait pattern

STRENGTH TESTING

- ◆ Isometric testing: 8 weeks and beyond
- ◆ Isokinetic testing: 4 months and beyond
- ◆ **No hop testing prior to 6 months**

SUGGESTED INTERVENTIONS

STRENGTH & POWER

- ◆ **No active OKC resistive hamstring exercises until week 16**
- ◆ Closed chain knee flexion may progress past 70° after 16 weeks
- ◆ **Quadriceps, hamstring and trunk dynamic stability:** squats, leg extension, leg curl, leg press, deadlifts, multi-directional lunges, crunches, rotational trunk exercises on static and dynamic surfaces, monster walks
- ◆ Single-leg squats on BOSU with manual perturbation to trunk or legs · single-leg BOSU balance · single-leg BOSU Romanian deadlift

ONCE STRENGTH CRITERIA ARE MET

PROGRESSION

- ◆ Partial body weight jumping on the shuttle (double leg → single leg)
- ◆ Full body weight jumping progression
- ◆ Walk-jog program

PROUD MEDICAL TEAM FOR





GOALS TO PROGRESS TO PHASE 4

- 1 Normalized gait mechanics without an assistive device
- 2 ROM within normal limits
- 3 Completion of exercises without exacerbation of symptoms or reactive effusion
- 4 ≤1+ joint effusion
- 5 No dynamic knee valgus with squat to 90°

4

RETURN TO SPORT · MONTH 6 – RTS

GOALS Resume all normal functionality and continue to progress toward return to sport

STATUS

- ◆ **Pain & effusion:** effusion may increase with activity — ≤1+ and/or non-reactive effusion is required to progress plyometrics
- ◆ **ROM:** symmetrical and pain-free, with no pain during end-range overpressure
- ◆ **Weight bearing:** full, with a normalized gait pattern

STRENGTH TESTING

- ◆ Isokinetic testing: 4, 6, 9 and 12 months
- ◆ Hop testing: appropriate at 6 months and after 80% symmetry is achieved on isokinetic testing — single-leg hop for distance, triple hop, cross-over hop, timed 6-metre hop
- ◆ *Functional strength testing and hop testing should be reserved for patients returning to high-level activity*

AGILITY

PHASE 4

- ◆ Begin agility exercises at **50–75% effort**; use visual feedback to improve mechanics as needed
- ◆ Advance plyometrics: bilateral → single leg; progress by altering surfaces, adding ball toss, 3D rotations
- ◆ Side shuffling, carioca, figure 8, zig-zags, resisted jogging (sports cord) in straight planes, backpedaling

PLYOMETRICS & SPORT-SPECIFIC TRAINING

PHASE 4

- ◆ Single-leg hop downs from increasing height (up to a 12" box)
- ◆ Single-leg hop-holds
- ◆ Double- and single-leg hopping onto an unstable surface
- ◆ Double- and single-leg jump turns
- ◆ Repeated tuck jumps
- ◆ Continue progressive strength training per the previous phases

CRITERIA TO DISCHARGE THE ASSISTIVE DEVICE

CHECKPOINT

- ◆ **ROM:** full active knee extension; no pain on passive overpressure
- ◆ **Strength:** strong quadriceps isometric with full tetany and superior patellar glide, and able to perform 20 SLR without quad lag
- ◆ **Effusion:** 1+ or less preferred (2+ acceptable if all other criteria are met)
- ◆ **Weight bearing:** pain-free ambulation without visible gait deviation

CRITERIA TO DISCHARGE NMES

CHECKPOINT

- ◆ <20% quadriceps deficit on isometric or isokinetic testing (handheld dynamometry acceptable for isometric testing)
- ◆ **Or**, if testing equipment is not available, all of: 20 SLR without quad lag · normal gait · 10 heel taps to 60° with good quality · 10-rep max on leg press with similar effort bilaterally · inability to break quadriceps MMT

PROUD MEDICAL TEAM FOR





CRITERIA TO INITIATE RUNNING & JUMPING

CHECKPOINT

- ♦ **ROM:** full, pain-free knee ROM, symmetrical with the uninvolved limb
- ♦ **Strength:** isokinetic testing $\geq 80\%$ for hamstring and quadriceps at $60^\circ/\text{sec}$ and $300^\circ/\text{sec}$
- ♦ **Effusion:** $\leq 1+$
- ♦ **Weight bearing:** normalized gait and jogging mechanics
- ♦ **Neuromuscular control:** pain-free hopping in place

CRITERIA FOR RETURN TO SPORT

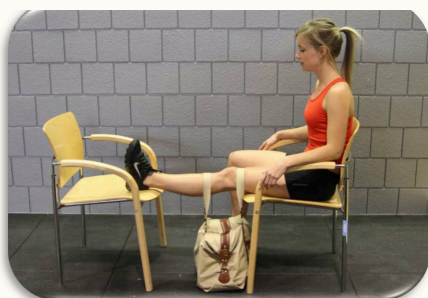
- ♦ **ROM:** full, pain-free knee ROM, symmetrical with the uninvolved limb
- ♦ **Strength:** isokinetic testing $\geq 90\%$ for hamstring and quadriceps at $60^\circ/\text{sec}$ and $300^\circ/\text{sec}$
- ♦ **Effusion:** no reactive effusion, $\leq 1+$ with sport-specific activity
- ♦ **Weight bearing:** normalized gait and jogging mechanics
- ♦ **Neuromuscular control:** appropriate mechanics and force attenuation strategies with high-level agility, plyometrics and high-impact movements
- ♦ **Functional hop testing:** LSI $\geq 90\%$ for all tests
- ♦ **Physician clearance**

APPENDIX A & B · BAG HANG AND NMES SET-UP

BAG HANG

APPENDIX A

- ♦ Emphasis on **low load, long duration** stretching
- ♦ Goal: **60 minutes** of bag hang time total per day
- ♦ Ideally 4×15 minutes (or greater) per day



NMES SET-UP

APPENDIX B

- ♦ A 2-pad or 4-pad set-up is appropriate; pads are placed on the proximal and distal quadriceps
- ♦ Patient seated with the knee in at least 60° flexion, shank secured with a strap; back support with thigh strap preferred. The ankle pad / belt should be two finger widths superior to the lateral malleoli
- ♦ The patient relaxes while the e-stim generates at least 50% of maximal volitional contraction against a fixed resistance, or maximal tolerable amperage without knee joint pain
- ♦ **10–20 seconds on / 50 seconds off $\times 15$ minutes**



PROUD MEDICAL TEAM FOR

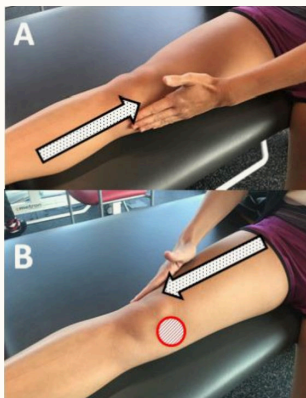
APPENDIX C · STROKE TEST & SWELLING ASSESSMENT

The stroke test allows the patient to assess swelling independently; the result guides which exercises are appropriate that day.

PERFORMING THE TEST

APPENDIX C

- ♦ **A.** Using one hand, gently sweep the inside portion of the knee 2–3 times, pushing toward the hip joint.
- ♦ **B.** On the outside portion of the knee, immediately sweep downward toward the ankle. Watch the inside portion of the knee for a wave of fluid to appear during the downstroke.



GRADING SYSTEM

TEST RESULT	GRADE
No wave produced on downstroke	Zero
Small wave on inside aspect of knee with downstroke	Trace
Large bulge on inside aspect of knee with downstroke	1+
Swelling spontaneously returns to the inside aspect after upstroke (no downstroke necessary)	2+
So much fluid that the swelling cannot be moved out of the inside aspect of the knee	3+

Grading table adapted from Sturgill L, et al. *J Orthop Sports Phys Ther.* 2009.

INDICATIONS FOR ACTIVITY

RED LIGHT

3+ OR 2+

- ♦ No running, jumping, cutting or heavy lifting until swelling decreases to 1+ or less
- ♦ Do not progress the program until you speak with your therapist
- ♦ Use swelling management strategies (ice, compression, elevation, NSAIDs)

YELLOW LIGHT

1+

- ♦ Proceed with caution
- ♦ May participate in running, jumping and a normal lifting routine
- ♦ Check effusion before and after workouts
- ♦ Use swelling management strategies

GREEN LIGHT

TRACE OR ZERO

- ♦ May participate in running, jumping and a normal lifting routine without restriction
- ♦ Continue to monitor swelling after activity

PROUD MEDICAL TEAM FOR





APPENDIX D · BLOOD FLOW RESTRICTION TRAINING

PRECAUTIONS

PHYSICIAN PERMISSION REQUIRED

- ◆ Poor circulatory systems (shining or scaly skin, brittle dry nails, extremity hair loss, increased capillary filling time, varicose veins)
- ◆ Obesity or loose limb tissue · arterial claudication · abnormal clotting times
- ◆ Diabetes · sickle cell trait · tumor · general infection · hypertension
- ◆ Cardiopulmonary conditions · renal compromise · clinically significant acid–base imbalance · atherosclerotic vessels · anti-hypertensive medications

CONTRAINDICATIONS

- ◆ Venous thromboembolism · impaired circulation or peripheral vascular compromise · previous revascularization · dialysis access in the extremity
- ◆ Acidosis · sickle cell anemia · extremity infection · tumor distal to the tourniquet · medications or supplements known to increase clotting risk
- ◆ Open fracture · increased intracranial pressure · open soft tissue injuries · severe crushing injuries · severe hypertension
- ◆ Skin grafts · secondary or delayed procedures after immobilization · vascular grafting lymphectomies · cancer

EXERCISE PRESCRIPTION

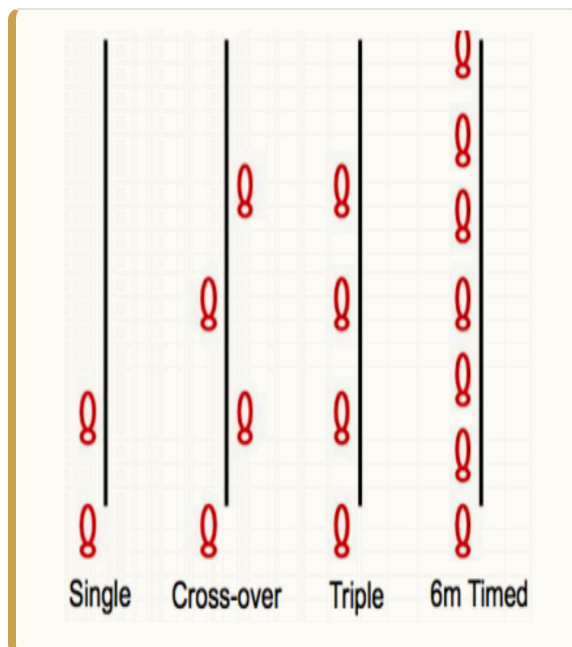
- ◆ Training intensity 20–40% 1RM, or use the Omnibus Resistance Exercise Scale (patient selects a resistance corresponding to 2–3)
- ◆ **75 repetitions completed:** continue training; reassess intensity within 1–3 sessions and increase as strength improves
- ◆ **60–74 repetitions:** continue, but extend the rest period between sets 3 and 4 to 45 seconds until 75 repetitions are completed
- ◆ **45–59 repetitions:** continue, but extend the rest period between all sets to 45–60 seconds
- ◆ **<44 repetitions:** reduce load by approximately 10% until the repetitions are achieved
- ◆ If the patient must stop before 75 repetitions due to pain, soreness or discomfort under the cuff, reduce tourniquet pressure by 10 mmHg each session until cuff tolerance is achieved; ramp back up by 10 mmHg toward target limb occlusion pressure as tolerated

APPENDIX E · SINGLE-LEG HOP SERIES

TEST BATTERY

$$LSI = \text{INVOLVED} / \text{UNINVOLVED} \times 100\%$$

- ◆ **Single hop for distance:** the patient lines their heel up with the zero mark of the tape measure wearing athletic shoes, then hops as far as they can, landing on the same push-off leg for at least 3 seconds. Arms may move freely. Allow 2 practice hops on each leg, then 2 testing trials; record each distance from the starting point to the back of the heel and average per limb.
- ◆ **Cross-over hop for distance:** the patient hops 3 times on one foot, crossing fully over the center line each time, going as far forward as possible; only the total distance is recorded.
- ◆ **Triple hop for distance:** the patient hops 3 times on one foot as far forward as possible; only the total distance hopped is recorded.
- ◆ **Timed 6-metre hop:** the patient hops, on cue, as fast as they can the length of the 6-metre tape. LSI uses involved limb time / uninvolved limb time × 100%.



APPENDIX F · ISOKINETIC DATA INTERPRETATION

MEASURE	GOAL / CLINICAL IMPACT	WHAT TO DO
Peak torque (ft-lbs)	Peak torque during repetitions; the basis of the symmetry criteria	If <80%, continue unilateral, high-resistance strength training
Coefficient of variance (%)	Between-repetition variability — goal <15%	If >15%, consider a retest
Total work (ft-lbs)	Torque over all repetitions; possible indicator of fatigue	If >10%, consider high-volume training
Agonist / antagonist ratio (%)	Hamstring : quadriceps ratio — goal >60%	If <60%, ensure a 1:1 quadriceps-to-hamstring exercise ratio
Limb symmetry	Strength relative to the involved limb — goal <10% asymmetry in either direction	If <80%, continue NMES in addition to strength training; if <90%, continue emphasizing unilateral over bilateral training

TESTING ALTERNATIVES

- ◆ **Isokinetic dynamometry** — the gold standard; 60°/sec for strength and power, 300°/sec for speed and endurance
- ◆ **Handheld dynamometry with static fixation at 90°** — appropriate alternative; may overestimate quadriceps strength symmetry
- ◆ **Single-leg 1RM knee extension, 90–45°** — appropriate alternative; limits patellofemoral stress; may overestimate symmetry
- ◆ **Single-leg 1RM leg press** — fair alternative; significantly overestimates quadriceps symmetry because of compensation from other muscle groups
- ◆ **Single-leg 1RM knee extension, 90–0°** — fair alternative; may be uncomfortable or inappropriate due to patellofemoral stress

REFERENCES

1. Bedi A, et al. Management of posterior cruciate ligament injuries: an evidence-based review. *J Am Acad Orthop Surg*. 2016; 24: 277–289.
2. Cavanaugh J, et al. Postoperative rehabilitation after posterior cruciate ligament reconstruction and combined PCL–posterolateral corner surgery. *Oper Tech Sports Med*. 2015; 23: 372–384.
3. Cury R, et al. Rehabilitation protocol after isolated posterior cruciate ligament reconstruction. *Rev Bras Ortop*. 2012; 47(4): 421–427.
4. Edson C. Postoperative rehabilitation of the multiple–ligament reconstructed knee. *Oper Tech Sports Med*. 2003; 11(4): 294–301.
5. Escamilla R, et al. Cruciate ligament loading during common knee rehabilitation exercises. *Proc Inst Mech Eng H*. 2012; 226(9): 670–680.
6. Denti M, et al. Combined chronic anterior cruciate ligament and posterior cruciate ligament reconstruction: functional and clinical results. *Knee Surg Sports Traumatol Arthrosc*. 2015; 23: 2853–2858.
7. Lunden J, et al. Current concepts in the recognition and treatment of posterolateral corner injuries of the knee. *J Orthop Sports Phys Ther*. 2010; 40(8): 502–516.
8. Lynch A, et al. Current concepts and controversies in rehabilitation after surgery for multiple ligament knee injury. *Curr Rev Musculoskelet Med*. 2017; 10: 328–345.
9. Kim J, et al. Rehabilitation after posterior cruciate ligament reconstruction: a review of literature and theoretical support. *Arch Orthop Trauma Surg*. 2013; 133: 1687–1695.
10. Pache S, et al. Posterior cruciate ligament: current concepts review. *Arch Bone Jt Surg*. 2018; 6(1): 8–18.
11. Pierce C, et al. Posterior cruciate ligament tears: functional and postoperative rehabilitation. *Knee Surg Sports Traumatol Arthrosc*. 2013; 21: 1071–1084.
12. Schweller E, et al. Posterolateral corner knee injuries: review of anatomy and clinical evaluation. *J Am Osteopath Assoc*. 2015; 115(12): 725–731.
13. Senese M, et al. Rehabilitation following isolated posterior cruciate ligament reconstruction: a literature review of published protocols. *Int J Sports Phys Ther*. 2018; 13(4): 737–751.
14. Skendzel JG, et al. Diagnosis and management of the multiligament-injured knee. *J Orthop Sports Phys Ther*. 2012; 42(3): 234–242.
15. Taylor ED, et al. Posterior cruciate ligament injuries: the University of Virginia experience. *Oper Tech Sports Med*. 2009; 17: 135–140.
16. Vaquero-Picado A, et al. Isolated posterior cruciate ligament tears: an update of management. *EFORT Open Rev*. 2017; 2: 89–96.
17. Sinacore JA, et al. Diagnostic accuracy of handheld dynamometry and 1-repetition–maximum tests for identifying meaningful quadriceps strength asymmetries. *J Orthop Sports Phys Ther*. 2017; 47(2): 97–107.
18. Yenchak AJ, et al. Criteria-based management of an acute multistructure knee injury in a professional football player: a case report. *J Orthop Sports Phys Ther*. 2011; 41(9): 675–686.

Adapted from the *Posterior Cruciate Ligament (PCL) Reconstruction Clinical Practice Guideline*, Ohio State Sports Medicine / The Ohio State University Wexner Medical Center. Author: Michelle Calvin, PT, DPT, OCS. Reviewers: Caroline Brunst, PT, DPT; Robert Durr, MD; Robert Magnussen, MD; David Flanigan, MD; Christopher Kaeding, MD. Updated April 2023.

PROUD MEDICAL TEAM FOR

