Physical Therapy And Sports Rehabilitation

UNIVERSITY ORTHOPEDICS

Affiliated entity of BROWN Alpert Medical School

University Orthopedics MPFL Protocol: A Criterion-Based Approach- Supplemental educational content and exercise demonstration videos available at https://universityorthopedics.com/therapy/videos.html. Hyperlinks included in the document.

Phases and Criteria to Enter	Principles
Criteria to enter phase 1 of Early Stage Rehab 0-2 weeks ▪ Administer Tampa Kinesiophobia Scale ▪ Physician Clearance ▪ No red flags ▪ WBAT in full extension with crutches if needed for optimal gait (pending physician recommendation) ▪ **Criteria to Unlock and Wean/Discharge Brace** ▪ Full active knee extension ▪ Able to maintain SLR for 10 repetitions without extensor lag ▪ Good quad control in stance ▪ Symmetrical loading in stance phase	▪ Protect the repair and/or graft ▪ Swelling Management ▪ Restore knee ROM and prevent stiffness ▪ Restore patella mobility (avoid lateral patellar mobilization) ▪ Normalize gait ▪ Achieve and maintain quad activation ▪ Minimize arthrogenic muscle inhibition at involved LE's: knee, hip, ankle ▪ Patient education to manage expectations ▪ **NMES suggested parameters:** 10-15 secs on: 30-50 secs off in full knee extension ▪ Wound care safety
Criteria to enter Phase 2 of Early Stage Rehab 2-4 weeks ▪ Progressive decrease in Swelling ▪ AROM 0-90 degrees ▪ WBAT with crutch(es) if needed for optimal gait ▪ May need one crutch to promote normal mechanics ▪ Quad contraction with superior patella glide and full active extension ▪ Able to perform SLR without lag	▪ Protect the graft and/or repair ▪ Swelling Management ▪ Maintain full extension ▪ Restore full flexion ▪ Normalize gait ▪ Discontinue brace when gait is normalized ▪ Minimize arthrogenic muscle inhibition ▪ **NMES suggested parameters:** 10-15 secs on: 30-50 secs off, may progress from full knee extension to isometric in 60-90 degrees as ROM and symptoms allow ▪ Utilize Blood Flow Restriction training (BFR):

	▪ **Recommended Criteria and Parameters for BFR:** Minimum 2 weeks post op pending incision healing, no red flags, can complete in conjunction with NMES (SLR). Utilize with low intensity CKC loading start with body weight, no greater than 30% 1RM. Literature suggests initial set of 30, then 3 sets of 15-30 repetitions. 30 second rest period. Aim for 75-90 reps directed at the quadriceps. Reps may be lower 40-50 if sets are taken to failure. Sets to failure are to be taken for muscle groups distal to cuff application. Should be used as a complementary treatment, continue until strength is equal between LE's. Encouraged to be carried into future stages as a supplement to treatment. ▪ Patient education to manage expectations ▪ Balance and proprioception
Criteria to enter phase 1 of Mid Stage Rehab 4-10 weeks (strengthening/neuromuscular control) • Administer Tampa Kinesiophobia Scale upon entrance and exit of phase • No wave produced on a stroke test[1] • At least 120 degrees knee flexion[2] • Symmetrical knee extension[3] • Full quadriceps activation- no quadriceps sag on a single leg raise through 10 repetitions[4] • Normal symmetrical independent gait pattern[4] • Quadriceps strength 60% or greater than contralateral side (isometric test at 60 degrees of knee flexion)[5]	• Low to moderate load OKC exercises 60-90 degrees, CKC exercise 12-20 RM, muscle endurance, hypertrophy through metabolic stimuli supplement with BFR and NMES • Hamstring methods are dependent upon graft type, introduce hip dominant movements with greater loads, knee dominant with lighter loads • Discontinue brace when gait is normalized • Incorporate rotational control • Closed chain strengthening on 12-20 RM • Optimize motor patterning of: ○ Squat https://www.youtube.com/watch?v=LI4VnIgwkG8 ○ Split Squat https://www.youtube.com/watch?v=Du4-l2q3N8Q ○ 2 LE Hinge https://www.youtube.com/watch?v=CCxNb1u_pLI ○ 1 LE Hinge https://www.youtube.com/watch?v=I8qH9g7fDqM ○ Lunge https://www.youtube.com/watch?v=izVPg6ot6TA ○ Step up https://www.youtube.com/watch?v=izVPg6ot6TA

	○ Carry https://www.youtube.com/watch?v=wpKBXAaex1s&t=38s • Bed based progressive to weight bearing to weighted plantar flexion activities • Non WB and WB muscle re-activation activities for gluteal muscles • Low load core stabilization to re-activate local core muscles • Short to long lever activities for adductor strengthening • Restore hip flexor strength • Utilize manual therapy and muscle release techniques as needed • Continue with stretching for muscle flexibility • Restore static and dynamic balance in stance • Aerobic fitness activities focusing on continuous moderate intensity • Incorporate upper body strengthening outside of PT on recovery days when appropriate, non-weight bearing upper body strengthening
Criteria to enter Phase 2 of mid stage rehab 10-16 weeks • Administer Tampa Kinesiophobia Scale upon entrance and exit of phase • No pain and no effusion on a stroke test[1] • Full knee ROM[2] • Quadriceps bilateral comparison 75%[5] • Equal bilateral hamstring strength[5] • Extensor flexor ratio of 70-75%[5] • Limb symmetry index >70%[5] • Subjective knee scoring (modified Noyes system) 80 points or better[5] **criteria to begin jogging[5]** • IKDC score of 90	• Moderate load OKC and CKC exercises 50-90 degrees, 8-12 RM, muscle hypertrophy through mechanical stimuli supplement with BFR and NMES • Hamstring strengthening in isometric, isotonic, and isokinetic knee and hip dominant exercises 8-12 RM • Progress anti-rotation control • Closed chain strengthening on 8-12 RM • Optimize motor patterning of: ○ Squat https://www.youtube.com/watch?v=LI4VnIgwkG8 ○ Split Squat https://www.youtube.com/watch?v=Du4-I2q3N8Q ○ 2 LE Hinge https://www.youtube.com/watch?v=CCxNb1u_pLI ○ 1 LE Hinge https://www.youtube.com/watch?v=I8qH9g7fDqM ○ Lunge https://www.youtube.com/watch?v=izVPg6ot6TA ○ Step up https://www.youtube.com/watch?v=izVPg6ot6TA

• CKRS score of 10 • 30 step and holds without loss of balance outside of the sagittal plane • 10 consecutive single leg squats 0-60 degrees without loss of balance outside of the sagittal plane • > or equal to 70% 1RM leg press involved/non-involved • Fast treadmill walking for 15 minutes with normal gait **Criteria to begin low level agility drills**[5] • IKDC score of 90 • CKRS score of 10 • 10 consecutive single leg squats 0-60 degrees without loss of balance outside of the sagittal plane while holding weight >75% • > or equal to 80% 1RM leg press involved/non-involved • Normal running pattern on a treadmill • Greater than 85% LSI hop tests Involved/non involved • Cross over hop • Triple hop • 6 meter hop for time • Single hop for distance	○ Carryhttps://www.youtube.com/watch?v=wpKBXAaex1s&t=38s • Single leg plantar flexion activities with an emphasis on eccentric control • Mix of WB and non WB exercises gluteal muscles • Progress core stabilization and Integrate into functional movements • Short to long lever activities for adductor strengthening • Loaded hip flexor activities • Shift away from manual therapy if appropriate to more self-sustaining strategies such as foam rolling and self-massage • Continue with stretching for muscle flexibility, optimize mobility in hip, knee, and ankle for deceleration requirements • Unilateral dynamic balance • Bilateral to unilateral landing drills • Aerobic fitness activities focusing on continuous moderate intensity and interval high intensity activities • Incorporate upper body strengthening outside of PT on recovery days when appropriate, include weight bearing lifts
Criteria to enter Phase 1 of late stage rehab 16+ weeks • Administer Tampa Kinesiophobia Scale upon entrance and exit of phase • No effusion produced on a stroke test[1] • Full knee ROM[2] • Limb symmetry index >80% for flexors and extensors[6]	• Continue to restore muscle strength • Restore deceleration and landing capabilities, consult PT prior to beginning and progressing • Pre-planned linear situations at different velocities focusing on deceleration mechanics, consult PT prior to beginning and progressing • High load machine-based strengthening 5RM

• Leg press strength at least 125% body mass for 8 reps or 1.5Xbody mass of predicted 1 rep max[7] • Single leg bridge test greater than 20 reps and within 5 reps of each side with no cramping of the hamstring or adductor[8] • Single leg calf raises greater than 20 reps within 5 repetitions versus other side[9] • Single leg balance eyes open 43 seconds, eyes closed 9 seconds (normative data 18-39 years old)[10] • Single leg squat test to at least 60 degrees of flexion for 10 reps with minimal trunk rotation, minimal pelvic motion, and no hip adduction or internal rotation[11] • 80% LSI on triple hop scoring[5] • **Good unilateral landing control and deceleration in frontal and sagittal plane[13,14]** no dynamic knee valgus, minimal trunk lean, and no pelvic drop • **Running assessment[6,12]** • **Qualitative**- good frontal plane alignment (minimal dynamic knee valgus, lateral trunk lean, pelvic drop) good sagittal plane loading (optimal triple flexion angles, no knee avoidance • **Quantitative**- sufficiently normalized running gait and ability to run for >10 minute for 5 miles per hour • subjective knee scoring modified Noyes greater than or equal to 90 points or better[5] • **Criteria to Begin Jumping[5]** • IKDC score of 90 • CKRS score of 8	• Moderate load functional activities 8-12RM (squat, hinge, lunge) • Plyometrics, consult PT for appropriate progression • Core stabilization • Off-feet cardiovascular fitness

• 10 consecutive single leg squats 0-60 degrees without loss of balance outside of the sagittal plane while holding weight >85% • > or equal to 85% 1 RM leg press involved/non-involved • Normal running pattern on a treadmill and no compensatory patterns on declaration agility drills • Greater than 85% LSI hop tests involved/non-involved • Cross over hop • Triple hop • 6 meter hop for time • Single hop for distance	
Criteria to enter Phase 2 of Late stage rehab • Administer Tampa Kinesiophobia Scale upon entrance and exit of phase • Same as above, begin multi directional coordination with explosive pre-planned sport specific drills[13,14] • **Criteria to begin Cutting[5]** • IKDC score of 90 • CKRS score of 8 • 10 consecutive single leg squats 0-60 degrees without loss of balance outside of the sagittal plane while holding weight >90% • > or equal to 90% 1 RM leg press involved/non-involved • No genu valgus when loading into or landing from jumps and equal weight distribution when initiating and landing the jumps • Greater than 90% LSI hop tests involved/non-involved	• Introduce multidirectional coordination • Maximize strength • Cultivate explosive strength and power • Pre-planned multi directional situations at different velocities focusing on acceleration and deceleration, consult PT prior to beginning and progressing • High speed linear based running • High load machine based strengthening 5RM • Moderate load functional activities 8-12RM (squat, hinge, lunge) • Plyometrics, consult PT for appropriate progression • Core stabilization • Off-feet cardiovascular fitness

• Cross over hop • Triple hop • 6 meter hop for time • Single hop for distance	
Criteria to enter Phase 3 of Late Stage Rehab ▪ Administer Tampa Kinesiophobia Scale upon entrance and exit of phase ▪ No pain/swelling[1] ▪ Symmetrical ROM[2] ▪ Knee flexor and extensor Limb symmetry index >90 %[12] ▪ Triple hop test >90% Limb Symmetry index >90%[15,16] ▪ Single leg press >2x body mass[7] ▪ Rate of force development Limb symmetry index >80%[12]	▪ Introduce re-active movement ▪ Speed and change of direction ▪ Maximize strength ▪ Cultivate explosive strength and power ▪ Pre-planned multi directional situations at different velocities focusing on acceleration and deceleration ▪ High speed pre planned multi directional running ▪ Lower body strength (6-8 RM) and power training (1-5 RM) ▪ Core stabilization ▪ Off-feet cardiovascular fitness
Criteria to enter stage 4 of Late Stage rehab ▪ Administer Tampa Kinesiophobia Scale upon entrance and exit of phase ▪ Satisfactory Progression through stage 3 on field activity with reactive multidirectional movement[12] ▪ Optimal Physical conditioning[12]	▪ Introduce sport specific movement and sport skill retraining ▪ Speed and change of direction with sport specific drills ▪ Sport specific skills program ▪ Cultivate explosive strength and power ▪ Reactive situations at different velocities focusing on acceleration and deceleration ▪ High speed reactive multi directional running ▪ Lower body strength (6-8 RM) and power training (1-5 RM) ▪ Core stabilization ▪ Off-feet cardiovascular fitness
Criteria to enter stage 5 of late stage rehab ▪ Administer Tampa Kinesiophobia Scale upon entrance and exit of phase ▪ Satisfactory progression though sport specific skill training and sport specific conditioning[12]	▪ Sport simulation and game reconditioning ▪ Speed and change of direction with sport specific drills ▪ Sport specific skills program ▪ Cultivate explosive strength and power

	▪ Reactive situations at different velocities focusing on acceleration and deceleration ▪ High speed reactive multi directional running ▪ Lower body strength (6-8 RM) and power training (1-5 RM) ▪ Core stabilization ▪ Off-feet cardiovascular fitness
Criteria to Return to Sport [5] ▪ Administer Tampa Kinesiophobia Scale upon entrance and exit of phase ▪ Physician, Physical Therapist, Athletic Trainer, Strength & Conditioning Coach and most importantly Athlete come to a mutual decision of clearance ▪ IKDC score of 90 ▪ CKRS score of 8 ▪ Achieves greater than or equal to 90% of all strength assessment ▪ Displays a normal running gait that does not increase pain ▪ Has practiced and displays no hesitation or compensatory strategies during change of direction activities in particular deceleration movements when activities are performed at 100% effort ▪ Has practiced and has displayed normal loading and no genu valgus as well as soft athletic landings from all jumps and hops ▪ 10 consecutive single leg squats 0-60 degrees without loss of balance outside of the sagittal plane while holding weight >85% ▪ Rate of force development Limb symmetry index >90%[12]	

▪ Greater than 90% LSI hop tests involved/non-involved ▪ Cross over hop ▪ Triple hop ▪ 6 meter hop for time ▪ Single hop for distance	