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

Phases and Criteria to Enter	Principles
<p>Criteria to enter phase 1 of Early Stage Rehab 0-2 weeks</p> <ul style="list-style-type: none"> ▪ Administer Tampa Kinesiophobia Scale ▪ Administer The ALC-RSI at beginning of phase ▪ Physician Clearance ▪ No red flags ▪ Criteria to Discharge Brace ▪ Full active knee extension ▪ Able to maintain SLR for 10 repetitions without extensor lag ▪ Good quad control in stance ▪ Discontinue brace after first post-op visit pending above criteria have been met 	<p>Principles</p> <ul style="list-style-type: none"> ▪ Protect the Graft ▪ Swelling Management ▪ Restore knee ROM and prevent stiffness ▪ Normalize gait ▪ Achieve and maintain quad activation ▪ Restore patella mobility ▪ Minimize arthogenic muscle inhibition ▪ Patient education to manage expectations ▪ Swelling Management

<p>Criteria to enter Phase 2 of Early Stage Rehab 2-4 weeks</p> <ul style="list-style-type: none"> ▪ Progressive decrease in Swelling ▪ AROM 0-90 degrees ▪ WBAT with crutches if needed for optimal gait ▪ Quad contraction with superior patella glide and full active extension ▪ Able to perform SLR without lag ▪ May need one crutch to promote normal mechanics 	<ul style="list-style-type: none"> ▪ Protect the graft ▪ Swelling Management ▪ Maintain full extension ▪ Restore full flexion ▪ Normalize gait ▪ Minimize arthogenic muscle inhibition ▪ NMES suggested parameters: 10-15 secs on: 30-50 secs off ▪ Utilize Blood Flow Restriction training (BFR): ▪ Recommended Criteria and Parameters for BFR: Minimum 2 weeks post op, no red flags, can complete in conjunction with NMES (SLR, 90-45 degree extension). 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
<p>Criteria to enter phase 1 of Mid Stage Rehab 4-10 weeks (strengthening/neuromuscular control)</p> <ul style="list-style-type: none"> • Administer Tampa Kinesiophobia Scale upon entrance and exit of phase • No wave produced on a stroke test¹ • At least 120 degrees knee flexion² • Symmetrical knee extension³ 	<ul style="list-style-type: none"> • Low to moderate load OKC exercises 45-90 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 • Incorporate rotational control • Closed chain strengthening on 12-20 RM

<ul style="list-style-type: none"> • Full quadriceps activation- no quadriceps sag on a single leg raise through 10 repetitions⁴ • Normal symmetrical independent gait pattern⁴ • Quadriceps strength 60% or greater than contralateral side (isometric test at 60 degrees of knee flexion)⁵ 	<ul style="list-style-type: none"> • Optimize motor patterning of: <ul style="list-style-type: none"> ○ Squat https://www.youtube.com/watch?v=LI4VnlgwkG8 ○ 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=l8qH9g7fDqM ○ 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
<p>Criteria to enter Phase 2 of mid stage rehab 10-16 weeks</p> <ul style="list-style-type: none"> • Administer Tampa Kinesiophobia Scale upon entrance and exit of phase • Administer The ALC-RSI at end of phase • No pain and no effusion on a stroke test¹ • Full knee ROM² • Quadriceps bilateral comparison 75%⁵ 	<ul style="list-style-type: none"> • 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

- Equal bilateral hamstring strength⁵
- Extensor flexor ratio of 70-75%⁵
- Limb symmetry index >70%⁵
- Subjective knee scoring (modified noyes system) 80 points or better⁵

criteria to begin jogging⁵

- IKDC score of 90
- 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 drills⁵

- 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

- Optimize motor patterning of:
 - Squat <https://www.youtube.com/watch?v=LI4VnlgwkG8>
 - 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=l8qH9g7fDqM>
 - 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>
- 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 16-22 weeks

- Administer Tampa Kinesiophobia Scale upon entrance and exit of phase
- Administer The ALC-RSI at end of phase
- No effusion produced on a stroke test¹
- Full knee ROM²
- Limb symmetry index >80% for flexors and extensors⁶
- Leg press strength at least 125% body mass for 8 reps or 1.5Xbody mass of predicted 1 rep max⁷
- Single leg bridge test greater than 20 reps and within 5 reps of each side with no cramping of the hamstring or adductor⁸
- Single leg calf raises greater than 20 reps within 5 repetitions versus other side⁹
- 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 rotation¹¹
- 80% LSI on triple hop scoring⁵
- **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)

- 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
- Moderate load functional activities 8-12RM (squat, hinge, lunge)
- [Bilateral plyometrics](#), consult PT for appropriate progression
- [Core stabilization](#)
- Off-feet cardiovascular fitness

<ul style="list-style-type: none"> • 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 better⁵ • Criteria to Begin Jumping⁵ • 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 >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 	
<p>Criteria to enter Phase 2 of Late stage rehab 22-28 weeks</p> <ul style="list-style-type: none"> • Administer Tampa Kinesiophobia Scale upon entrance and exit of phase • Administer The ALC-RSI at end of phase • Same as above, begin multi directional coordination with explosive pre-planned sport specific drills^{13,14} • Criteria to begin Cutting⁵ • IKDC score of 90 • CKRS score of 8 	<ul style="list-style-type: none"> • 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)

<ul style="list-style-type: none"> • 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 • Cross over hop • Triple hop • 6 meter hop for time • Single hop for distance 	<ul style="list-style-type: none"> • Bilateral plyometrics, consult PT for appropriate progression • Core stabilization • Off-feet cardiovascular fitness
<p>Criteria to enter Phase 3 of Late Stage Rehab 28-34 weeks</p> <ul style="list-style-type: none"> ▪ Administer Tampa Kinesiophobia Scale upon entrance and exit of phase ▪ Administer The ALC-RSI at end of phase ▪ No pain/swelling¹ ▪ Symmetrical ROM² ▪ Knee flexor and extensor Limb symmetry index >90%¹² ▪ Triple hop test >90% Limb Symmetry index >90%^{15,16} ▪ Single leg press >2x body mass⁷ ▪ Rate of force development Limb symmetry index >80%¹² 	<ul style="list-style-type: none"> ▪ 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
<p>Criteria to enter stage 4 of Late Stage rehab 34-40 weeks</p> <ul style="list-style-type: none"> ▪ Administer Tampa Kinesiophobia Scale upon entrance and exit of phase ▪ Administer The ALC-RSI at end of phase 	<ul style="list-style-type: none"> ▪ 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

<ul style="list-style-type: none"> ▪ Satisfactory Progression through stage 3 on field activity with reactive multidirectional movement¹² ▪ Optimal Physical conditioning¹² 	<ul style="list-style-type: none"> ▪ 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
<p>Criteria to enter stage 5 of late stage rehab 40-46 weeks</p> <ul style="list-style-type: none"> ▪ Administer Tampa Kinesiophobia Scale upon entrance and exit of phase ▪ Administer The ALC-RSI at end of phase ▪ Satisfactory progression though sport specific skill training and sport specific conditioning¹² 	<ul style="list-style-type: none"> ▪ 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
<p>Criteria to Return to Sport 46-52 weeks⁵</p> <ul style="list-style-type: none"> ▪ Administer Tampa Kinesiophobia Scale upon entrance and exit of phase ▪ Administer The ALC-RSI at end 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 	

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| <ul style="list-style-type: none">▪ 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 | |
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