
<table>
<thead>
<tr>
<th>Phases and Criteria to Enter</th>
<th>Principles</th>
</tr>
</thead>
</table>
| **Criteria to enter phase 1 of Early Stage Rehab 0-2 weeks** |  ▪ 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 |
| ▪ 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 |
| **Criteria to enter Phase 2 of Early Stage Rehab 2-4 weeks** |  ▪ 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): |
| ▪ 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 |
### 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)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Details</th>
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<tbody>
<tr>
<td>Administer Tampa Kinesiophobia Scale upon entrance and exit of phase</td>
<td></td>
</tr>
<tr>
<td>No wave produced on a stroke test¹</td>
<td></td>
</tr>
<tr>
<td>At least 120 degrees knee flexion³</td>
<td></td>
</tr>
<tr>
<td>Symmetrical knee extension    ³</td>
<td></td>
</tr>
<tr>
<td>Full quadriceps activation- no quadriceps sag on a single leg raise through 10 repetitions⁴</td>
<td></td>
</tr>
<tr>
<td>Normal symmetrical independent gait pattern⁴</td>
<td></td>
</tr>
<tr>
<td>Quadriceps strength 60% or greater than contralateral side (isometric test at 60 degrees of knee flexion)⁵</td>
<td></td>
</tr>
</tbody>
</table>

## 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=LI4VnlgwkG8](https://www.youtube.com/watch?v=LI4VnlgwkG8) |
| Split Squat [https://www.youtube.com/watch?v=Du4-I2q3N8Q](https://www.youtube.com/watch?v=Du4-I2q3N8Q) |
| 2 LE Hinge [https://www.youtube.com/watch?v=CCxNb1u_pLI](https://www.youtube.com/watch?v=CCxNb1u_pLI) |
| 1 LE Hinge [https://www.youtube.com/watch?v=l8qH9g7fDqM](https://www.youtube.com/watch?v=l8qH9g7fDqM) |
| Lunge [https://www.youtube.com/watch?v=izVPg6ot6TA](https://www.youtube.com/watch?v=izVPg6ot6TA) |
| Step up [https://www.youtube.com/watch?v=izVPg6ot6TA](https://www.youtube.com/watch?v=izVPg6ot6TA) |
| Criteria to enter Phase 2 of mid stage rehab 10-16 weeks | • 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:  
  o Squat [https://www.youtube.com/watch?v=LI4VnlgwkG8](https://www.youtube.com/watch?v=LI4VnlgwkG8)  
  o Split Squat [https://www.youtube.com/watch?v=Du4-I2q3N8Q](https://www.youtube.com/watch?v=Du4-I2q3N8Q)  
  o 2 LE Hinge [https://www.youtube.com/watch?v=CxNb1u_pLi](https://www.youtube.com/watch?v=CxNb1u_pLi)  
  o 1 LE Hinge [https://www.youtube.com/watch?v=l8qH9g7fDgM](https://www.youtube.com/watch?v=l8qH9g7fDgM)  
  o Lunge [https://www.youtube.com/watch?v=izVp6ot6TA](https://www.youtube.com/watch?v=izVp6ot6TA)  
  o Step up [https://www.youtube.com/watch?v=izVp6ot6TA](https://www.youtube.com/watch?v=izVp6ot6TA) |
|---|---|
| • Administer Tampa Kinesiophobia Scale upon entrance and exit of phase  
• No pain and no effusion on a stroke test\(^1\)  
• Full knee ROM\(^2\)  
• Quadriiceps 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 |
<table>
<thead>
<tr>
<th>Criteria to begin low level agility drills&lt;sup&gt;5&lt;/sup&gt;</th>
<th>Criteria to enter Phase 1 of late stage rehab 16+ weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>• CKRS score of 10</td>
<td>• Administer Tampa Kinesiophobia Scale upon entrance and exit of phase</td>
</tr>
<tr>
<td>• 30 step and holds without loss of balance outside of the sagittal plane</td>
<td>• No effusion produced on a stroke test&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>• 10 consecutive single leg squats 0-60 degrees without loss of balance outside of the sagittal plane</td>
<td>• Full knee ROM&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>• &gt; or equal to 70% 1RM leg press involved/non-involved</td>
<td>• Limb symmetry index &gt;80% for flexors and extensors&lt;sup&gt;6&lt;/sup&gt;</td>
</tr>
<tr>
<td>• Fast treadmill walking for 15 minutes with normal gait</td>
<td>• Continue to restore muscle strength</td>
</tr>
</tbody>
</table>

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<sup>1</sup>
- Full knee ROM<sup>2</sup>
- Limb symmetry index >80% for flexors and extensors<sup>6</sup>

Criteria to begin low level agility drills<sup>5</sup>

- 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

- 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

Notes:
- <sup>1</sup> Stroke test: A neurological test used to assess the patellar reflex in the knee joint.
- <sup>2</sup> Full knee ROM: Range of motion of the knee joint.
- <sup>5</sup> Agility drills: Exercises designed to improve balance, coordination, and reaction time.
- <sup>6</sup> Limb symmetry index: A measurement of limb symmetry in individuals with asymmetry.

Video for Single Leg Plantar Flexion Activities:
- [https://www.youtube.com/watch?v=wpKBXaex1s&t=38s](https://www.youtube.com/watch?v=wpKBXaex1s&t=38s)
<table>
<thead>
<tr>
<th>Criteria</th>
<th>Details</th>
</tr>
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<tbody>
<tr>
<td>Leg press strength</td>
<td>at least 125% body mass for 8 reps or 1.5Xbody mass of predicted 1 rep max</td>
</tr>
<tr>
<td>Single leg bridge test</td>
<td>greater than 20 reps and within 5 reps of each side with no cramping of the hamstring or adductor</td>
</tr>
<tr>
<td>Single leg calf raises</td>
<td>greater than 20 reps within 5 repetitions versus other side</td>
</tr>
<tr>
<td>Single leg balance eyes open</td>
<td>43 seconds, eyes closed 9 seconds (normative data 18-39 years old)</td>
</tr>
<tr>
<td>Single leg squat test</td>
<td>to at least 60 degrees of flexion for 10 reps with minimal trunk rotation, minimal pelvic motion, and no hip adduction or internal rotation</td>
</tr>
<tr>
<td>80% LSI on triple hop scoring</td>
<td></td>
</tr>
<tr>
<td>Good unilateral landing control and deceleration in frontal and sagittal plane</td>
<td>no dynamic knee valgus, minimal trunk lean, and no pelvic drop</td>
</tr>
<tr>
<td>Running assessment</td>
<td></td>
</tr>
<tr>
<td>Qualitative</td>
<td>good frontal plane alignment (minimal dynamic knee valgus, lateral trunk lean, pelvic drop) good sagittal plane loading (optimal triple flexion angles, no knee avoidance)</td>
</tr>
<tr>
<td>Quantitative</td>
<td>sufficiently normalized running gait and ability to run for &gt;10 minute for 5 miles per hour</td>
</tr>
<tr>
<td>Subjective knee scoring</td>
<td>modified Noyes greater than or equal to 90 points or better</td>
</tr>
<tr>
<td>Criteria to Begin Jumping</td>
<td></td>
</tr>
<tr>
<td>IKDC score</td>
<td>90</td>
</tr>
<tr>
<td>CKRS score</td>
<td>8</td>
</tr>
</tbody>
</table>

- 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

<table>
<thead>
<tr>
<th>Criteria to enter Phase 2 of Late stage rehab</th>
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<tbody>
<tr>
<td>• Administer Tampa Kinesiophobia Scale upon entrance and exit of phase</td>
</tr>
<tr>
<td>• Same as above, begin multi directional coordination with explosive pre-planned sport specific drills$^{13,14}$</td>
</tr>
<tr>
<td>• <strong>Criteria to begin Cutting</strong>$^5$</td>
</tr>
<tr>
<td>• IKDC score of 90</td>
</tr>
<tr>
<td>• CKRS score of 8</td>
</tr>
<tr>
<td>• 10 consecutive single leg squats 0-60 degrees without loss of balance outside of the sagittal plane while holding weight &gt;90%</td>
</tr>
<tr>
<td>• &gt; or equal to 90% 1 RM leg press involved/non-involved</td>
</tr>
<tr>
<td>• No genu valgus when loading into or landing from jumps and equal weight distribution when initiating and landing the jumps</td>
</tr>
<tr>
<td>• Greater than 90% LSI hop tests involved/non-involved</td>
</tr>
</tbody>
</table>

| • 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 | 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 |

- 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%\(^3\)  
- Triple hop test >90% Limb Symmetry index >90%\(^4,5\)  
- Single leg press >2x body mass\(^6\)  
- Rate of force development Limb symmetry index >80%\(^7\)  

| Criteria to enter stage 4 of Late Stage rehab | 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 |

- Administer Tampa Kinesiophobia Scale upon entrance and exit of phase  
- Satisfactory Progression through stage 3 on field activity with reactive multidirectional movement\(^8\)  
- Optimal Physical conditioning\(^9\)  

| Criteria to enter stage 5 of late stage rehab | Sports simulation and game reconditioning  
|                                            | Speed and change of direction with sport specific drills  
|                                            | Sport specific skills program  
|                                            | Cultivate explosive strength and power |

- Administer Tampa Kinesiophobia Scale upon entrance and exit of phase  
- Satisfactory progression though sport specific skill training and sport specific conditioning\(^10\)  

|                                            | Sports 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  
- 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