

### Appendix for ACL Reconstruction Guideline

Phase	Recommendations	
Weeks 0-2	Motion	<ul style="list-style-type: none"> <li>• Up to 0-90 degrees</li> <li>• Attain full extension with gradual progression of flexion</li> <li>• Extension stretch               <ul style="list-style-type: none"> <li>○ Long sitting with heel prop</li> <li>○ Gastrocnemius strap stretch</li> <li>○ Manual stretching</li> <li>○ Low-load long duration</li> </ul> </li> <li>• Flexion stretching               <ul style="list-style-type: none"> <li>○ Seated heel slide</li> <li>○ Wall slide</li> <li>○ Supine heel slide with belt</li> </ul> </li> <li>• Patellar mobilizations</li> </ul>
	Modalities	<ul style="list-style-type: none"> <li>• Cryotherapy</li> <li>• NMES as needed</li> </ul>
	Treatment guide based on tolerance	<ul style="list-style-type: none"> <li>• Quad set</li> <li>• Straight leg raise (assisted until no extension lag)</li> <li>• Quad isometrics (60-90 degrees)</li> <li>• Hip abduction, extension, external rotation strengthening</li> <li>• Calf raises</li> <li>• Gait training</li> </ul>
Weeks 2-6	• Motion	<ul style="list-style-type: none"> <li>• Progress and maintain flexion and extension ROM</li> <li>• May use leg press for knee flexion ROM</li> </ul>
	• Modalities	<ul style="list-style-type: none"> <li>• Cryotherapy</li> <li>• NMES as needed</li> <li>• Initiate BFR               <ul style="list-style-type: none"> <li>○ Must have minimal extension leg and within 5 degrees of full extension</li> </ul> </li> </ul>
	• Treatment guide based on tolerance	<ul style="list-style-type: none"> <li>• Gait drills (hurdles, cones, retro walking, marching, side step, etc.)</li> <li>• Step up -&gt; retro step down -&gt; lateral step down -&gt; forward step down</li> <li>• Leg press (progress depth as tolerated)               <ul style="list-style-type: none"> <li>○ Double leg</li> <li>○ Eccentric</li> </ul> </li> <li>• Bridge</li> <li>• Band walks</li> <li>• Single leg calf raises</li> <li>• Hamstring curl (if applicable)               <ul style="list-style-type: none"> <li>○ Standing, seated or prone</li> </ul> </li> <li>• Progress single leg balance (uneven surfaces, basic reactive drills, vision or vestibular challenge)</li> <li>• Walking program (6 weeks)</li> </ul>
Weeks 6-12	• Motion	<ul style="list-style-type: none"> <li>• Maintain extension and flexion ROM</li> </ul>
	• Modalities	<ul style="list-style-type: none"> <li>• NMES as needed</li> </ul>
	• Treatment guide based on tolerance	<ul style="list-style-type: none"> <li>• Progress from BFR to hypertrophy training               <ul style="list-style-type: none"> <li>○ Moderate-high volume, 8-15 reps, 45-60 sec rest breaks (3x/week)</li> </ul> </li> <li>• Aerobic training (2x/wk)</li> <li>• Squats (progress load)               <ul style="list-style-type: none"> <li>○ Goblet, split squat with dumbbell or barbell, back squat with barbell, front squat with barbell</li> </ul> </li> <li>• Step up and lateral step down (progress with height and load)</li> <li>• Lunges (progress from body weight to load)               <ul style="list-style-type: none"> <li>○ Forward, reverse, lateral, diagonal directions</li> </ul> </li> </ul>

		<ul style="list-style-type: none"> <li>○ Rear foot elevated</li> <li>● RDLs</li> <li>● Deadlift <ul style="list-style-type: none"> <li>○ Dumbbell/kettlebell, Trap bar, Straight bar</li> </ul> </li> <li>● Eccentric quad exercise <ul style="list-style-type: none"> <li>○ Lateral step down, reverse sliding lunge, eccentric leg press, etc</li> </ul> </li> <li>● Seated knee extension (see guideline details)</li> <li>● Progress monster walks</li> <li>● Progress calf strengthening</li> <li>● Progress hamstring curls</li> <li>● Progress single leg balance and proprioception <ul style="list-style-type: none"> <li>○ Bosu squats, lunge to airex/bosu, step up bosu, etc</li> </ul> </li> </ul>
Weeks 12-16	<ul style="list-style-type: none"> <li>● Motion</li> <li>● Modalities</li> <li>● Treatment guide based on tolerance</li> </ul>	<ul style="list-style-type: none"> <li>● Maintain extension and flexion ROM</li> <li>● NMES as needed</li> <li>● Perform return to run criteria to determine readiness</li> <li>● Progress from hypertrophy to strength training <ul style="list-style-type: none"> <li>○ Moderate volume, 2-8 reps, 2-3 minutes rest breaks (2-3x/week)</li> <li>○ Load at 60-85% 1-RM</li> </ul> </li> <li>● Aerobic training (2x/wk – see running progression)</li> <li>● Progress quadriceps and lower extremity training</li> <li>● Lunges – multiple planes</li> <li>● Progress single leg balance and proprioception</li> </ul>
Months 4-6	<ul style="list-style-type: none"> <li>● Motion</li> <li>● Modalities</li> <li>● Treatment guide based on tolerance</li> </ul>	<ul style="list-style-type: none"> <li>● Maintain extension and flexion ROM</li> <li>● Continue NMES as needed</li> <li>● Continue with high-intensity strength training <ul style="list-style-type: none"> <li>○ Load at 60-85% 1-RM</li> <li>○ Barbell squats, deadlifts, KB swings, sled push/pull</li> </ul> </li> <li>● Progress plyometrics (see below)</li> <li>● Progress movements/agility under PT/ATC supervision (planned to reactive) <ul style="list-style-type: none"> <li>○ Lunge push back -&gt; 3 step deceleration -&gt; deceleration tasks at various speeds</li> <li>○ Lateral lunge -&gt; 3 step shuffle</li> <li>○ If excellent form, shallow cuts jogging (&lt; 45 degrees)</li> </ul> </li> <li>● Aerobic training (2x/wk – see running progression)</li> <li>● Progress single leg balance and proprioception</li> </ul>
Months 6-9	<ul style="list-style-type: none"> <li>● Treatment guide based on tolerance</li> </ul>	<ul style="list-style-type: none"> <li>● Perform return to participation assessment</li> <li>● Continue with high-level strength training <ul style="list-style-type: none"> <li>○ Include strength coach if available</li> </ul> </li> <li>● Continue with plyometric/movement training</li> <li>● Progress agility progressions (planned -&gt; reactive) <ul style="list-style-type: none"> <li>○ Shallow cuts</li> <li>○ Deceleration to lateral cuts</li> <li>○ Deceleration to 90 degrees cut</li> <li>○ Increase cutting angles as required for sport</li> </ul> </li> <li>● Increase sport specific training</li> </ul>
Months 9-12	<ul style="list-style-type: none"> <li>● Treatment guide based on tolerance</li> </ul>	<ul style="list-style-type: none"> <li>● Perform return to sport assessment</li> <li>● Continue with high-level strength training</li> <li>● Continue with aerobic conditioning</li> <li>● Return to competition phases <ul style="list-style-type: none"> <li>○ Non-contact practice</li> <li>○ Small side contact practices (1v1, 2v2)</li> <li>○ Full practice</li> <li>○ Return to competition with restricted workload</li> <li>○ Return to competition unrestricted</li> </ul> </li> </ul>

This guideline is not meant to be prescriptive but a recommendation to the rehabilitation process. Progress may vary based on specifics of injury and procedure.

## Running Program

(Adapted from Brinlee et al and UD ACL group)

Running Progression		
	Treadmill	Track
<b>Level 1</b>	0.1 mile walk / 0.1 mile jog, repeat 10 times	Jog straights / walk curves (2 miles)
<b>Level 2</b>	0.1 mile walk / 0.2 mile jog - 2 miles total	Jog straights / jog 1 curves every other lap (2 miles)
<b>Level 3</b>	0.1 mile walk / 0.3 mile jog - 2 miles total	Jog straights / jog 1 curve every lap (2 miles)
<b>Level 4</b>	0.1 mile walk / 0.4 mile jog - 2 miles total	Fast walk 1 $\frac{3}{4}$ lap / walk curve (2 miles)
<b>Level 5</b>	Jog full 2 miles	Jog full 2 miles
<b>Level 6</b>	Increase workout to 2 $\frac{1}{2}$ miles	Increase workout to 2 $\frac{1}{2}$ miles
<b>Level 7</b>	Increase workout to 3 miles	Increase workout to 3 miles
<b>Level 8</b>	Alternate between running/jogging every $\frac{1}{4}$ mile	Increase speed on straights / jog curves
<b>Instructions:</b> <ul style="list-style-type: none"><li>- Mandatory 2-day rest between workouts for first two week</li><li>- Do not advance more than 2 levels per week</li><li>- Two days rest mandatory between levels 1, 2, and 3 workouts</li><li>- One day rest mandatory between levels 4-8 workouts</li></ul>		
<b>Soreness Rules:</b> <ul style="list-style-type: none"><li>- If sore during warm-up, take 2 days off and drop down 1 level</li><li>- If sore during workout, take 1 day off and drop down 1 level</li><li>- If sore after workout, stay at same level</li></ul>		
<b>Specific Considerations:</b> <ul style="list-style-type: none"><li>- Non-endurance athletes: must successfully complete level 4 of progression before advancement to sprinting</li></ul>		

## Plyometric Program

(Adapted from Buckthorpe et al)

- ⇒ Pass RTR criteria
- ⇒ Ability to squat 1.5-2.5 times body weight OR squat body weight + 0.6 times body weight 5 times in under 5 seconds
- ⇒ Start with 40 contacts, increase as tolerated
- ⇒ Remain between 80-120 contacts per session

Plyometric Program				
	Phase 1	Phase 2	Phase 3	Phase 4
<b>Criteria to enter stage</b>	See above	Ability to run > 10 minutes Good BL landing mechanics Good SL squat mechanics Closed-chain strength > 1.25 times body weight Isokinetic/Isometric LSI knee extensor and flexor > 80%	Good BL drop jump mechanics Good SL landing control Closed chain strength > 1.5 times body weight	Isokinetic/Isometric strength > 90% Closed chain strength > 1.5 times body weight Good pre-planned movement quality (UL landing/ deceleration/ BL and UL drop jump/ COD mechanics)
<b>Plyometric task</b>	Lunge push back Impact step up Step off landing from box (6-8 in box) Squat jump (SJ) to box Countermovement jump (CMJ) to box Pogo hops (in place, in-out, scissors) Skips in place Step and hold (forward)	Bilateral (BL) SJ (in place, forward) BL CMJ (in place, forward) BL drop jump (12 inch step) Split jump (same leg land) Split jump (alternating) Step and land (forward, lateral) Step-land-push-back (forward, lateral) Deceleration drills	Unilateral (UL) SJ/CMJ to BL landing UL SJ/CMJ to box Rotational jump and land Lateral step-jump-back Tuck jump Hop single -> multiple (in place/ forward/lateral/45°/90°) SL drop jump (box/in place/ lateral to box) Agility and COD drills	CMJ (hurdles) SJ/CMJ weighted BL/UL DJ (increased height to box) Lateral hop (band/rope/med ball) SL 90 lateral drop jump Step cut (perturbation) Progress Agility and COD drills

# Sprinting Program

(Adapted from Lorenz et al)

- ⇒ To be performed after completion of a four week walk-jog program for 30 minutes
- ⇒ Strength testing of quadriceps and hamstring at least 80% LSI
- ⇒ Hop testing within 80% LSI
- ⇒ Each step performed after at least 1 rest day between

<b>Stage 1. 50% Intensity (1:3 work to rest ratio)</b>			
<i>Objective: Build work capacity for anaerobic conditioning/endurance</i>			
<u>Step 1</u>	<u>Step 2</u>	<u>Step 3</u>	<u>Step 4</u>
20 yd x 3 untimed	20 yd x 4 untimed	20 yd x 3	20 yd x 3
40 yd x 2 untimed	40 yd x 3 untimed	40 yd x 4	40 yd x 4
60 yd x 2 untimed	60 yd x 2 untimed	60 yd x 2	60 yd x 2
80 yd x 2 untimed	80 yd x 2 untimed	80 yd x 2	80 yd x 2
100 yd x 1 untimed	100 yd x 1 untimed	100 yd x 1	100 yd x 2
80 yd x 2 untimed	80 yd x 2 untimed	80 yd x 2	80 yd x 1
60 yd x 2 untimed	60 yd x 2 untimed	60 yd x 2	60 yd x 2
40 yd x 2 untimed	40 yd x 3 untimed	40 yd x 4	40 yd x 4
20 yd x 3 untimed	20 yd x 4 untimed	20 yd x 3	20 yd x 3
19 runs @ 940 yds	23 runs @ 1060 yards	23 runs @ 1100 yds	23 runs @ 1120 yds
<b>Stage 2. 75% Intensity (1:5 work to rest ratio)</b>			
<b>Criteria to start: Completion of stage 1, all strength and functional testing &gt; 85%, pull passive flexion.</b>			
<i>Objective: Speed development, improve technique, and build repeated sprint ability</i>			
<u>Step 1</u>	<u>Step 2</u>	<u>Step 3</u>	<u>Step 4</u>
20 yd x 3	20 yd x 3	20 yd x 2	20 yd x 2
40 yd x 2	40 yd x 2	40 yd x 2	40 yd x 2
60 yd x 2	60 yd x 1	60 yd x 1	60 yd x 2
80 yd x 2	80 yd x 1	80 yd x 1	80 yd x 1
100 yd x 1	100 yd x 1	100 yd x 1	60 yd x 2
80 yd x 2	80 yd x 1	80 yd x 1	40 yd x 2
60 yd x 2	60 yd x 1	60 yd x 1	20 yd x 2
40 yd x 2	40 yd x 2	40 yd x 2	
20 yd x 3	20 yd x 3	20 yd x 2	
17 runs @ 780 yds	15 runs @ 660 yds	13 runs @ 620 yds	13 runs @ 560 yds
<b>Stage 3. 90-100% Intensity (1:7 work to rest ratio)</b>			
<b>Criteria to start: Complete stage 2, all strength and functional testing 90% or better, no effusion or pain.</b>			
<i>Objective: Achieve maximum effort. Work: rest ratio should replicate sport demands in step 3 and 4</i>			
<u>Step 1</u>	<u>Step 2</u>	<u>Step 3</u>	<u>Step 4</u>
20 yd x 6	10 yd x 3	10 yd x 3	10 yd x 2
40 yd x 2	20 yd x 4	20 yd x 3	20 yd x 3
60 yd x 1	40 yd x 2	30 yd x 2	30 yd x 2
40 yd x 2	60 yd x 1	40 yd x 2	40 yd x 1
20 yd x 6	40 yd x 2	60 yd x 1	60 yd x 1
10 yd x 3	30 yd x 1	30 yd x 2	40 yd x 1
	20 yd x 1	20 yd x 3	30 yd x 2
	10 yd x 2	10 yd x 3	20 yd x 3
*Full subjective recovery	*Full subjective recovery		10 yd x 2
20 runs @ 490 yds	19 runs @ 460 yds	19 runs @ 440 yds	17 runs @ 420 yds