



**Department of Orthopaedic Surgery
Sports Medicine and Shoulder Service**

Anterior Cruciate Ligament Reconstruction Rehab Protocol

Physician Referral for Physical Therapy	
Patient Name:	Date:
Referring DX: ACLR (BTB HS QT)	
Recommended Frequency: 1 – 3 visits/ wk	
Total Duration: 4-12 months	

These guidelines, treatments, and milestones have been established to assist in guiding rehabilitation based on the most current available evidence. They are not intended to be substitute for sound clinical judgement with consideration of the individual contextual features of the patient and the demands of various functions/sports.

Pre-operative goals: Full knee extension range of motion (ROM), absent or minimal joint swelling, no knee extension lag with straight leg raise (SLR), educate the patient on what to expect following surgery, and protect the joint.

Timeline	Milestones	Treatment Recommendations
<u>Week 1</u> (Day 0-7)	<ul style="list-style-type: none"> • AROM/PROM = 0-90° <ul style="list-style-type: none"> ○ Recommend not emphasizing hyperextension equal to contralateral side, as patient should achieve this over time ○ (hyperextension from Day 0—for quad autografts) • Active quadriceps contraction with superior patellar glide 	<ul style="list-style-type: none"> • Wall slides • Patellar mobilization • Gait training • Stationary bike for ROM <u>Home Program</u> • Self applied ROM • Self patellar mobilizations • Quad sets • Long arc quads (90-30° flexion)

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		<ul style="list-style-type: none"> • SLR [may use electrical stimulation to assist with quad activation]³³
Week 2 (Day 7-14)	<ul style="list-style-type: none"> • Flexion >110° • Gait without crutches • Use of bike without difficulty • Walking with full extension • Reciprocal stair climbing (with hand rail use) • Maintain knee extension of 0° • Double limb sit to stand from 17" seat 	<ul style="list-style-type: none"> • Step ups in pain free ROM • Scar mobilizations when skin is healed • Wall squats/sits • Prone hangs or bag hangs for full extension ROM (if not already achieved) • Patellar mobilizations in flexion (if flexion ROM limited)
Weeks 3-5 (Day 14-35)	<ul style="list-style-type: none"> • Flexion to within 10° of contralateral • Reciprocal stair climbing (without hand rail use) • Quad strength 4+/5 or greater (test @ 45° flexion) • Maintain knee extension of 0° • Within one SD of 5x Sit to Stand test norm for age group⁷ 	<ul style="list-style-type: none"> • Patellar &/or Tibiofemoral mobilizations (as appropriate) • Progress bike and stair master duration to 10-minute minimum • Begin balance and proprioception
Weeks 6-8 (Day 35-56)	<ul style="list-style-type: none"> • Normalized gait pattern • Full ROM compared to contralateral • No greater than 1+ effusion using the Stroke test³⁵ • 5x Sit to stand: normal values for age group⁷ • ≤ 2 errors on SL squat^{3,15} 	<ul style="list-style-type: none"> • Progressive resistive exercises • Begin running progression on treadmill (progression based on the Soreness Rules)¹⁰
Weeks 9-12 (Day 56-84)	<ul style="list-style-type: none"> • Hop tests >85% • Maintain ROM • Trace to Zero effusion grade using the stroke test • ≤ 1 errors on SL squat (week 10)^{3,15} • Zero errors on SL squat (week 12)^{3,15} 	<ul style="list-style-type: none"> • Sport specific exercises • Agility activities • Functional testing • Closed chain core strengthening • Running progression
Weeks 13- Return to Sport	<ul style="list-style-type: none"> • All hop tests symmetry >90%¹¹ • Modified Star Excursion Balance Test symmetry ≤ 4cm¹⁴ • Acute to chronic workload ratio < 1.5^{13,16,17} 	<ul style="list-style-type: none"> • Sport specific exercises • Agility activities • Functional testing • Closed chain core strengthening • Running progression**
Follow up functional testing	<ul style="list-style-type: none"> • 4, 5, 6, and 12-month post-op testing • Progression towards power activities as needed 	<ul style="list-style-type: none"> • Maintain gains in strength • Hop tests (90-100% of contralateral)

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| | | <ul style="list-style-type: none">• Maintain ROM |
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Precautions/Additional information

Graft protection:

- **Brace:** Brace use and graft type are at the discretion of the surgeon
- Stress to ACL with passive ROM 0-120° is minimal. Most strain occurs in last 30° of NWB extension^{2,5,9,15}.

Adjunct treatments:

- NMES may be instrumental in improving muscular performance for those not responding to traditional strengthening³³.
- If concomitant injury present at the same time, that injury dictates rehab progression:
 - meniscal injury with repair:
 - Full PROM is allowed. Ambulate WBAT with brace locked at 0° until week 5
 - No loaded knee flexion beyond 45° until week 5, none beyond 90° until week 8
 - No forced knee hyperextension if anterior horn repair /No forced knee flexion if posterior horn repair
 - Avoid OKC exercise from 0-30° and CKC exercise from 90-120° if patient shows signs/symptoms of patellofemoral irritation^{4,5}
 - chondral damage: restrict WB for 3-4 weeks to avoid stressing the healing cartilage. Beware that prolonged weight bearing restriction may result in difficulty recovering ROM and quad activation²⁰.
 - partial meniscectomy: no modification of guideline (symptom management)¹².
 - MCL: If surgical repair, avoid directly stressing the MCL, and consider sagittal plane limitations if needed^{24,31}.
 - PCL: follow PCL guidelines

Treatment Progression/Success:

- Factors that can impact rehabilitation success include the following: psychosocial issues, motivation, swelling, quad activation failure, acute reconstruction²¹, involvement of other structures²².
- Success measured by: 1. Less than mild effusion, 2. >90% hamstring and 3. quad strength, 4. Absence of giving way episodes, 5. Participation in 1-2 seasons of sports at previous activity level, 6. Patient reported outcomes²⁰.
- Patient Reported Outcome Measure: Consider using SANE score, as it correlates well with Cincinnati Knee Rating System²⁹.
- Consider using Stoke Test Grading for Effusion to determine whether to progress³⁵. Use this tool to assist with grading activity. *I.e. - increased effusion by 2 grades would lead to a decrease in activity until the effusion decreases to the previous level.*
- Weight bearing exercises alone are not enough for optimal outcomes. Graded increases in load, appropriate to the phase of healing, should be considered. ³³

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- For additional questions, comments, or concerns regarding the implementation of these physical therapy guidelines, please contact Chris Sebelki, PT, DPT, PhD, OCS, Director of the SLU – SSM Health Physical Therapy Residency (314) 977-8724 OR chris.sebelki@health.slu.edu

Please respond to our anonymous survey regarding these guidelines to assist in improving patient care and advocacy.



https://slu.az1.qualtrics.com/jfe/form/SV_bpX7Z9AaVTzGblj

Appendices of referenced assessments

Soreness Rules <small>Adapted from Fees et al. 1998¹⁰</small>	
Criterion	Action
1. Soreness during warm-up that continues	2 days off, drop down 1 step
2. Soreness during warm-up that goes away	Stay at step that led to soreness
3. Soreness during warm-up that goes away from redevelops during session	2 days off, drop down 1 step
4. Soreness the day after lifting (not muscle soreness)	1 day off, do not advance program to the next step
5. No soreness	Advance 1 step per week or as instructed by healthcare professional

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- 5xSTS Normative Values⁷

Age (n)	Mean ± SD (95%CI)	Min-Max
14–19 (25)	6.5 ± 1.2 (6.0–7.0)	4.7–9.7
20–29 (36)	6.0 ± 1.4 (5.6–6.5)	3.9–11.2
30–39 (22)	6.1 ± 1.4 (5.5–6.8)	4.1–10.4
40–49 (15)	7.6 ± 1.8 (6.6–8.6)	5.6–13.2
50–59 (20)	7.7 ± 2.6 (6.5–8.9)	4.2–12.1
60–69 (25)	7.8 ± 2.4 (6.8–8.7)	4.7–15.1
70–79 (24)	9.3 ± 2.1 (8.4–10.1)	5.5–13.3
80–85 (14)	10.8 ± 2.6 (9.3–12.3)	5.8–17.6

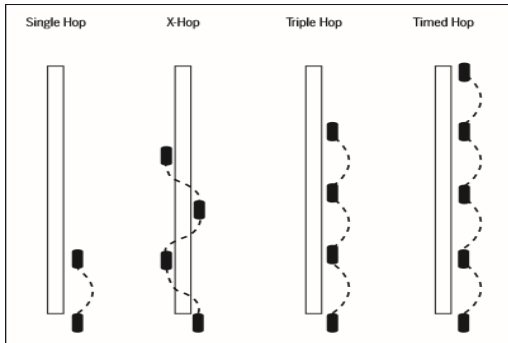
Errors (Impairments) seen in Single Leg Squat Movement Adapted from (Liebenson 2002) ¹⁸ in (Bailey et al 2010) ³		
Midfoot collapse	Early heel rise	Poor control of knee with ascent
Femoral adduction, IR	Pelvic drop	Excessive trunk flexion or knee extension on ascent

Running Program¹:

Level	Treadmill	Track
1	0.1-mile walk/0.1-mile jog, repeat 10 times	Jog straights/walk curves (2 miles)
2	Alternate 0.1-mile walk/0.2-mile jog (2 miles)	Jog straights/jog 1 curve every other lap (2 miles)
3	Alternate 0.1-mi walk/0.3-mi jog (2 miles)	Jog straights/jog 1 curve every lap (2 miles)
4	Alternate 0.1-mi walk/0.4-mi jog (2 miles)	Jog 1.75 laps/walk curve (2 miles)
5	Jog full 2 miles	Jog all laps (2 miles)
6	Increase workout to 2.5 miles	Increase workout to 2.5 miles
7	Increase workout to 3 miles	Increase workout to 3 miles
8	Alternate between running/jogging every 0.25 miles	Increase speed on straights/jog curves

- Hop tests¹: Return to sport dosing should consider Acute-to-chronic workload^{13, 16-17}

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Each session calculated by multiplying RPE (0-10) by duration (minutes) to obtain workload (augmented units). For example, RPE of 6 x 60 minutes = workload of 360 AUs.

Acute workload = average workload over the course of 1 week

Chronic workload = average workload over course of 4 weeks

** Progression to Running Criteria:

Isometric extensor limb symmetry index (LSI) > 70% plus extensor and flexor LSI > 70%

Active ROM 0 to > 125 degrees

Functional hop test > 70% contralateral side

Swelling < 1cm at joint line

No pain

Demonstrates good control on step down

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