Delaware Physical Therapy Clinic
540 S. College Ave
Suite 160
Newark, DE 19713
302-831-8893
www.udptclinic.com

Rehab Practice Guidelines for*: ACL Reconstruction*

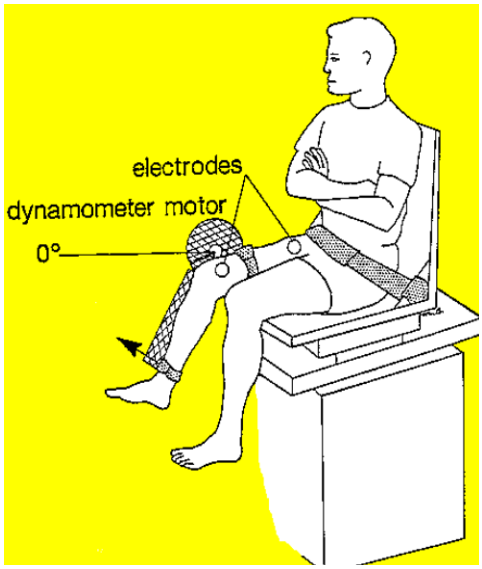
Assumptions: 1. Isolated ACL injury
2. Autograft (See specific graft types for precautions)

Primary surgery: ACL reconstruction
Secondary surgery (possible): See precautions section for modifications related to
Expected # of visits: 16-38
NMES Guideline:

1. Electrodes placed over proximal lateral quadriceps and distal medial quadriceps. (Modify distal electrode placement by not covering superior medial (VMO) arthroscopy portal until stitches removed and skin is healed)

2. Stimulation parameters: 2500Hz, 75 bursts, 2 sec. ramp, 12 sec. on, 50 sec. rest, intensity to max tolerable [at least 50% MVIC(see note at end)], 10 contractions per session. 3 sessions per week until quadriceps strength MVIC is 80% of uninvolved.

3. Stimulation performed **isometrically** at **60**° (dependent on graft site)



Pre-operative Goals: Full knee extension range of motion (ROM), absent or minimal effusion, and no knee extension lag with straight leg raise (SLR)

Immediate Post-operative (Week 1) **TOTAL VISITS** 1-3	**Treatment** Wall slides, patellar mobilization, gait training[1], NMES[2,3] (see guidelines) Bike for ROM Tx/HEP: supine wall slides, self patellar mobs 30- 50X per day, QS, LAQ (90-45°), and SLR 3x10 (3X per day)	**Milestones** AROM/PROM = 0-90° [4,5] Active quadriceps contraction with superior patellar glide

Early Post-operative (Week 2) **TOTAL VISITS** 4-6	Step ups in pain free range Portal/incision mobilization as needed (if skin is healed) Stairmaster, Wall squats/sits[6] Progress to functional brace as swelling permits Prone hangs if lacking full extension[7] PF mobilization in flexion(if flexion limited)	Flexion >110° Walking without crutches Use of cycle/stair climber without difficulty Walking with full extension Reciprocal stair climbing KOS ADL > 65%

Intermediate Post-operative (Weeks 3-5) **TOTAL VISITS** 7-15	Tibiofemoral mobilization with rotation if limited Progress bike and Stair master duration (10 minute minimum) Begin Balance and proprioceptive activities	Flexion to within 10° of uninvolved side Quad strength > 60% uninvolved

Late Post-operative (Weeks 6-8) **TOTAL VISITS** 16-25	Progress exercises in intensity and duration Begin running progression**: on treadmill with functional brace (may vary with MD)* Transfer to fitness facility*[8] * (If all milestones are met) ****(see running progression below)**	Quad strength >80% Normal gait pattern Full ROM (compared to uninvolved) Effusion < or = trace

Transitional (Weeks 9-12) **TOTAL VISITS** 25-38	Sports specific activities Agility exercises Functional testing (see description below) **Follow up Functional Testing:** 4 month, 5 month, 6 month, 1 year post-op. Recommending changes in rehab PRN. Progression may include one-legged emphasis in gym, explosive types of activities (cutting, jumping, plyometrics)	Maintaining or gaining quadriceps strength (>80%) Hop tests >85% (see attached) KOS Sports questionnaire >70% Maintaining gains in strength (> or = 90% to 100%) Hop Test (> or = 90% to 100%) KOS Sports (> or = 80% to 100%)

MVIC: Maximum Volitional Isometric Contraction

Patient is asked to volitionally extend the involved leg as hard as possible while knee is maintained isometrically at 60° knee flexion. Side to side comparison: (involved/uninvolved X 100 = % MVC)

Precautions:

Patellar tendon graft technique

Be aware of patellofemoral forces and possible irritation during PRE**'**s.
Treat patellofemoral pain if it arises with modalities, possible patellar taping**.**
Consider alteration of knee flexion angle to most comfortable between 45°-60° for MVIC and NMES treatments.

Hamstring tendon graft technique

No resisted hamstring strengthening until week 12.

Partial meniscectomy

No modifications required; progress per patient tolerance and protocol.

Meniscal repair

No weight-bearing flexion beyond 45° for 4 weeks.
Weight bearing in full extension OK.[9]
Seated Kinetron and multi angle quadriceps isometric can substitute for weight-bearing exercises.

Concomitant Abrasion Chondroplasty

WBAT with Axillary crutches 3-5 days
No modifications required, progress per patient tolerance and protocol

Concomitant Microfracture

NWB-ing 2-4 weeks with Axillary crutches
No weightbearing activities in treatment for 4 weeks
Consider location and size of lesion for exercise specific alterations

Chondral Repair (OATS, ACI, MACI)[10]

Follow procedure specific protocol if done concomitantly

Meniscal Transplantation

Follow procedure specific protocol if done concomitantly

MCL injury

Restrict motion to sagittal plane until week 4-6 to allow healing of MCL.
Perform PRE's with tibia in internal rotation during early post-op period to decrease MCL stress.
Consider brace for exercise and periods of activity if severe sprain and/or patient has pain.[11,12]
Non Repaired ROM restrictions: Gr 1 no ROM restrictions; Gr 2 0-90^{0} week 1, 0-110^{o} week 2; Gr 3: 0-30^{o} week1, 0-90^{o} week 2, 0-110^{o} week 3

PCL injury[13]

Follow PCL rehabilitation guidelines. (Not ACL protocol)

Posterolateral corner Repair[14]

Minimize external rotation torques and varus stress 6-8 weeks
Avoid hyper-extension
No resisted Knee flexion 12 weeks

ACL Revision[15]

Delay progression of running, hop testing, agility drills, and return to sport by 4 weeks. Crutches and immobilizer will be used 2 weeks following surgery. Otherwise follow same milestones

Running Progression: (requires: trace or less effusion, 80% or > strength, understand soreness rules)

	Running Progression	
	Treadmill	**Track**
Level 1	0.1 mile walk/0.1 mile Jog repeat 10 times	Jog straights/Walk Curves (2 miles)
Level 2	Alternate 0.1 mile walk/0.2mile jog (2 miles)	Jog straights/Jog 1 curve every other lap (2 miles)
Level 3	Alternate 0.1 mile walk/0.3 mile jog (2 miles)	Jog straights/Jog 1 curve every lap (2 miles)
Level 4	Alternate 0.1 mile walk/0.4 mile jog (2 miles)	Jog 1¾ lap/Walk curve (2 miles)
Level 5	Jog full 2 miles	Jog all laps (2 miles)
Level 6	Increase workout to 2 ½ miles	Increase workout to 2½ miles
Level 7	Increase workout to 3 miles	Increase workout to 3 miles
Level 8	Alternate between running/jogging every 0.25 miles	Increase speed on straights/jog curves

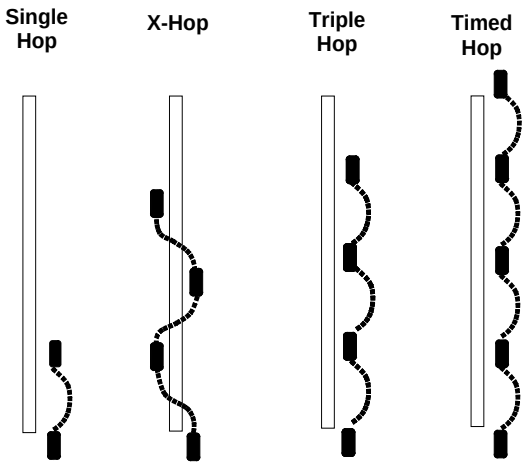
Progress to next level when patient is able to perform activity for 2 miles without increased effusion or pain. Perform no more than 4 times in one week and no more frequently than every other day. Do not progress more than 2 levels in a 7 day period.

Functional Testing (Week12)

Testing: Patient performs one practice on each leg for each hop sequence. Patient performs 2 timed or measured trials on each leg for each hop sequence. Measured trials are averaged and compared involved to uninvolved for single, triple, crossover hop. Compare uninvolved to involved for timed hop.

Passing Criteria for Return to Sport: Greater than or equal to 90% on: quadriceps MVIC, hop testing, KOS-ADLS score, and Global Rating of knee function score.

Reprinted by Permission from Tara Manal, University of Delaware Physical Therapy Clinic.



References

[1] Rudolph KS, Eastlack ME, Axe MJ, Snyder-Mackler L. 1998 Basmajian Student Award Paper. Movement patterns after anterior cruciate ligament injury: a comparison of patients who compensate well for the injury and those who require operative stabilization. *J Electromyogr Kinesiol.* 1998; 8:349-362.
[2] Snyder-Mackler L, Delitto A, Bailey SL, Stralka SW. Strength of the quadriceps femoris muscle and functional recovery after reconstruction of the anterior cruciate ligament. A prospective, randomized clinical trial of electrical stimulation. *J Bone Joint Surg AM.* 1995; 77:1166-1173.
[3] Snyder-Mackler L, Delitto A, Stralka SW, Bailey SL. Use of electrical stimulation to enhance recovery of quadriceps femoris muscle force production in patients following anterior cruciate ligament reconstruction. *Phys Ther*. 1994; 74: 901-907.
[4] Graf BK, Ott JW, Lange RH, Keene JS. Risk Factors for restricted motion after anterior cruciate Reconstruction. *Orthopedics*. 1994; 17:909-912.
[5] Irrgang J, Harner C, Fu F, et al. Loss of motion following ACL reconstruction: a second look. *J Sports Rehabil.* 1997; 358:188-193.
[6] Palmitier RA, An KN, Scott SG, Chao EY. Kinetic chain exercise in knee rehabilitation. *Sports Med.* 1991; 11:402-413.
[7] Rubinstein RA Jr, Shelbourne KD, VanMeter CD, McCarroll JR, Rettig AC, Gloyeske RL. Effect on knee stability if full hyperextension is restored immediately after autogenous bone-patellar tendon-bone anterior cruciate ligament reconstruction. *Am J Sports Med.* 1995;23:365-368
[8] Sailors ME, Keskula DR, Perrin DH. Effect of running on anterior knee laxity in collegiate-level female athletes after anterior cruciate ligament reconstruction. *J Orthop Sports Phys Ther.* 1995; 21 233-239.
[9] Barber FA, Click SD. Meniscus repair rehabilitation with concurrent anterior cruciate reconstruction. *Arthroscopy*. 1997;13:433-437.
[10] Reinold MM, Wilk KE, Macrina LC, Dugas JR, Cain EL. Current concepts in the rehabilitation following articular cartilage repair procedures in the knee. *J Orthp Sports Phys Ther*. 2006; 36:774-794.
[11] Manal TJ, Snyder-Mackler L. Practice guidelines for anterior cruciate ligament rehabilitation: a criterion based rehabilitation progression. *Oper Tech Orthop.* 1996;6:190-196.
[12] Millett PJ, Pennock AT, Sterett WI, Steadman JR. Early ACL reconstruction in combined ACL-MCL injuries. *J Knee Surg.* 2004; 17:94-98.
[13] Wilk KE. Rehabilitation of isolated and combined posterior cruciate ligament injuries. *Clin Sports Med.* 1994; 13:649-677.
[14] Chen FS, Rokito AS, Pitman MI. Acute and chronic posteroloateral rotatory instability of the knee. *J Am Acad Orthop Surg.* 2000;8:97-110.
[15] Meszler D, Manal TJ, Snyder-Mackler L. Rehabilitation after revision anterior cruciate ligament reconstruction:practice guidelines and procedure modified criterion-based progression. *Oper Tech Sports Med.* 1998;7:111-116.

This Clinical Guideline may need to be modified to meet the needs of a specific patient. The model should not replace clinical judgment.