

ACL RECONSTRUCTION PROTOCOL

*The rehabilitation for hamstring tendon graft and patellar tendon graft or quad tendon is differentiated within the protocol. We are less aggressive initially with hamstring tendon grafts because soft tissue to bone healing takes longer (approx 12 weeks) in comparison to bone to bone (approx 8 weeks). There is no early aggressive hamstring resistive exercise because this can irritate the hamstrings. Avoid hamstring resistive work for 1st 6 weeks. The hamstring graft may be approximately 4 weeks later in starting the running and plyometric program.

Ice:

- Swelling and bruising after surgical procedure is normal and should be expected, ice can help reduce swelling and bruising
- Do not place ice directly on the skin
 - Ensure a barrier is in place with the use of a pillowcase/towel to protect against damage
- When using ice pack, ice affected area for 10-15 minutes at a time, 4-5x/day
 - When appropriate, elevate the involved body part above the level of the heart

In the unlikely event of medical complications or need for further medical intervention (i.e. hospitalization), concerns regarding patient progress or compliance, please inform MD staff

Phase I (Week 1-4) – Immediate Post-Operative Phase

Week 1 (1-7 Days)

Education

- Gait – brace locked in full extension with 2 crutches
- Ice – if PRP used check with MD on post-operative restrictions regarding ice
- Patellar mobilizations – teach patient/caregiver gentle mobilizations for home

Exercises

- Ankle pumps
- Long sitting gastroc stretch with strap – progress to standing gastroc stretch as tolerated
- Edge of table hamstring stretch – can place towel roll under knee for hamstring graft and reduce as tolerated
- Heel slides/edge of table knee flexion stretch – progress to prone quad stretch as tolerated
- Quad sets – utilize e-stim as needed to provoke contraction
 - Can place towel roll under ankle to promote full extension
- Hamstring sets – for patellar tendon graft only
- Straight leg raises (flexion/extension/abduction/adduction)
 - Ensure no quad lag with flexion straight leg raise to protect graft
 - If medial meniscus/MCL repair do not perform adduction
 - If lateral meniscus/LCL repair do not perform abduction
 - If posterior meniscus/unstable meniscus repair do not perform extension

Week 1 (4-7 Days)

Exercises

- Bike – begin with rocking and progress to full revolutions as ROM allows
- Multi-angle quad isometrics – 60° and 90°
- Standing weight shifts
- Mini squats
- LAQ – begin full range with no weight and progress resistance as tolerated as long as no pain/compensation
 - Only perform with quad tendon and patellar tendon grafts
 - Do not perform with hamstring graft as hamstring is initially unable to reduce anterior tibial translation to protect graft
- Standing terminal knee extension – place band above knee to avoid anterior tibial translation
- Standing hamstring curls – only for quad tendon and patellar tendon grafts
 - No hamstring strengthening for at least 6 weeks for hamstring graft
- Heel prop/prone hang as necessary to increase extension

Week 2 (8-14 Days)

Education

- **MD will unlock brace as ROM allows at suture removal visit – as patients ROM progresses brace will be further unlocked by PT to accommodate new ROM**
 - **Do NOT unlock brace until MD does so at follow up visit**
- Gait – brace unlocked to ROM tolerance, with two crutches
 - **At 2 full weeks may begin to discharge crutches with brace opened to ROM tolerance**
 - **Ensure appropriate gait pattern and quad control prior to discharge**
 - **Discharge one crutch at a time**

Exercises

- Gait training – ensure correct form: knee flexion in swing, terminal knee extension, and weight shift in stance
- Add weight to SLR's as tolerated – ensure no quad lag with flexion SLR
- Heel raises
- Clamshells – add resistance as tolerated
- Swiss ball bridges with knees extended – do not perform with hamstring graft
- Progress weight shifts to single leg balance – ensure good quad control
 - When able to perform single leg stance with good control progress balance exercises as tolerated
- Continue low load long duration stretching for 5-6 minutes to promote extension

Week 3 (15-21 Days)

Education

- Gait
- Scar massage – instruct in gentle massage around incisions once incisions are closed

Exercises

- Gait training – focus on correct form without brace in therapy
- Initiate blood flow restriction training (BFR) once incisions are closed
 - May use BFR with NMES to facilitate better quad contraction
- Continue to progress balance exercises with static and dynamic surfaces and perturbation training
- Step down exercises – focus on eccentric quad control – begin with 2” step and progress height as able
- Mini squat with 2-3 second hold at 30° flexion – progress hold as tolerated
- Side step with theraband at knees
- Forward/lateral step up – begin with 2” step and progress height as tolerated
- Weight shift into mini lunge – forward and lateral
- Bilateral leg press – 90°-20° at 40% body weight
- Cone walking – forward, lateral, backwards
- Progress low load long duration stretching for up to 60 minutes per day if lacking extension
- Bridges – start bilateral and progress to unilateral as appropriate, do not perform with hamstring graft

Week 4 (22-28 Days)

Education

- **Gait – MD may DC brace at 4 full weeks if good quad control during ambulation**
- Scar massage – instruct in massage to incisions as long as incisions are closed

Exercises

- Continue BFR and NMES as necessary
- Wall sits – progress holds/resistance as tolerated
- Progress weight as tolerated on bilateral leg press 90°-20°
- Initiate limited range LAQ (90°-45°) for hamstring graft – increased resistance as tolerated
- Mini squats on BOSU – add holds as tolerated
- Continue to progress single leg balance exercises
 - Static/dynamic surfaces, eyes open/eyes closed varying degrees of knee flexion to 30°
 - Initiate Perturbations
- Progress cone walking – add sport cord to increase resistance/increase cone height, retro treadmill walking
- Bilateral squat to 90° - vary narrow/wide base of support
 - Can perform on static and dynamic surfaces (Airex, wobble board)
- Dowel Rod hip hinges and RDLs

Goals to Progress to Intermediate Phase

- ROM 0-120 degrees
 - If patient has natural hyperextension of contralateral knee achieve within 3-5 degrees of their normal hyperextension
- Gait in PT with full extension in stance and correct flexion during swing without crutches/brace
 - Continue to ambulate with brace outside of PT until discharged by MD
- Good quad control with single leg stance in varying angles of knee flexion
- Discharge brace – **ONLY if approved by MD**

Phase II (Weeks 5-9) – Intermediate Phase

Week 5-6 (29-42 Days)

Education

- Initiate cross friction massage to scar as needed

Exercises

- Progress stretches as needed – standing quadriceps, IT band, hip flexors, adductors
- Continue BFR as necessary
- May begin elliptical as tolerated
- Increase resistance on bike to improve cardiovascular endurance
- Hamstring strengthening
 - Progress load with isotonic and RDLs for patellar and quad tendon grafts
 - Add open chain strengthening for hamstring graft
- TRX assisted squats and lunges
- Increase load with bilateral squats – continue to vary wide and narrow base of support
- Bilateral leg press 0°-90° - progress to eccentric leg press (push with both LEs, lower back with 1 LE)
 - Progress resistance as appropriate with bilateral and eccentric leg press
- Initiate unilateral leg press – begin with low resistance and progress as able, ensure correct form
- Progress unilateral LE stance activities
- Mini lunges – can progress to multi-directional as able
- Side plank clam shells, side plank hip abduction

Week 7-9 (43-63 Days)

- Full ROM
- Incorporate dynamic warm up/stretching
- Continue BFR as necessary
- Progress unilateral stance functional drills
- Progress to full lunges
 - As able can progress to split squat position, walking lunges, multi-directional lunges
 - Can progress resistance as tolerated
 - Week 9 – progress lunges to dynamic surface (airex, BOSU)
- Continue to increase load/resistance with closed chain strengthening as appropriate
- Progress core work

Week 10-16 (64-112 Days)

Exercises

- Continue closed chain and open chain strengthening progressions
- Squats, deadlifts, leg press, knee extensions, sled, single leg sit to stand, single leg squats, bulgarian split squats, lunge variations
- Progress hamstring strengthening – Cybex, unilateral RDL's, glute bridge eccentric sliders, Nordics
- Incorporate core strengthening exercises
- Med-ball slam variations
- Single leg stability work with perturbations

Weeks 16+

Education

- Sometime after 12 weeks patient will be fit for functional brace – per MD order

Exercises

- **Plyometric activity may only begin once the patient passes return to plyo activity listed below**
- Functional retraining/work conditioning/simulation
- Plyos:
 - Pogos, band assisted ankle jumps, drop squats, line jumps, mini squats jumps, reformer jumps, jump rope

- Mini bounds – forward and lateral, skater jumps
- Box jumps/lands, work on landing form – start bilateral on 8in box, 2>2, 2>1, 1>1
- Agility ladder
- Begin running **with MD approval** as long as criteria below is met
 - Utilize alter-g treadmill if available

Criteria to Start Plyometric/Running Program

- **Clearance from MD**
- Land with good control/correct form with jumps
- MMT at least 5/5, ROM equal to uninjured side
- 1 RM Leg press test within 75-80% contralateral LE
- 1 min single leg sit to stand test within 75-80% contralateral LE
- Reach test/Y-balance test within 75-80% contralateral LE
- Hamstring strength at least 70% on involved LE isokinetically/isometrically
- Quadriceps strength at least 70-75% on involved LE isokinetically/isometrically
- Lateral step test within 75-80% contralateral LE
- No pain, crepitus, edema, giving way, normal gait

Criteria to Return to Sports

- **Clearance from MD**
- Completion of running and agility/plyometric program without symptoms/with good form
- Limb symmetry >90% for selected functional and strength tests:
- 1 minute timed SL sit to stand > 90%
- Ant reach within 4 cm
- Sidelying hip abduction strength > 33% of bodyweight with MicroFet.
- 1 RM Leg press > 90%
- Quadriceps strength >90 % measured with handheld dynamometer or knee extension machine
- Functional tests (single leg hop for distance, single-leg triple crossover hop, 6 meter timed hop) is >90% compared to opposite LE
- Quad torque to body weight ratio:
Males: @180°/sec 65-75%, Females 50-60%; @ 300°/sec males 45-55, females 35-45
- Hip abduction to body weight ratio > 35%
- Hamstring strength 100% for patellar tendon graft, at least 85% for hamstring graft
- Hamstring to quadriceps ratio is 65%
- KT test ≤ 3mm laxity compared to non-involved side
- Vertical Jump >90%
- Leg Press >90%
- Reach tests >90%
- KOS-Sports Subscale >90%
- Lateral shuttle – between 3 meter line, timed for 10 reps (5 in each direction). Look for knee control, knee position and or compensation
- LEFT test norms:

Males	females < 25 yrs/age	females > 25 yrs/age
90 sec – good	100 sec – good	120 sec – good
100 sec – avg	120 sec – avg	150 sec – avg
125 c – below avg	140 sec – below avg	180 sec – below avg
- Quad torque to body weight ratio: Males: @180°/sec 65-75%, Females 50-60%; @ 300°/sec males 45-55, females 35-45