ACL Reconstruction Rehabilitation Program

The Gundersen Health System Sports Medicine ACL Reconstruction Rehabilitation Program is an evidence-based and soft tissue healing dependent program allowing patients to progress to vocational and sports-related activities as quickly and safely as possible. Individual variations will occur depending on surgical technique and the patient's response to treatment.

Early utilization of NMES highly recommended and encouraged with 2x4", ideally 3x5" stim pads.
Early isolated OKC resisted knee extension should be implemented depending on patient tolerance- ie no increase in PF pain/joint effusion.

If a **meniscus repair is performed in conjunction with the ACL reconstruction**, follow meniscus repair WB restrictions (stable or unstable), ROM 0-90 for 2 wk, no squatting >90 for 4 months, as can be seen in meniscus repair protocol.
If a **hamstring/gracilis autograft** is utilized, avoid isolated hamstring strengthening for 6 weeks.
If a **patellar tendon graft** is utilized, work on patella mobilizations to prevent excessive scaring.
If an **allograft** is utilized, patients may need to be cautioned not to advance too quickly as post-operative pain may be less.
Please contact us at 1-800-362-9567 ext. 58600 if you have questions or concerns.

Phase I: 0-6 weeks	**Immediate post op maximum protection phase**
Goals	• Protect surgical graft • Minimize knee joint effusion • Restore full motion ASAP, emphasizing extension • Encourage quadriceps function • Prevent negative effects of immobilization • Normalization of walking with good heel-toe pattern
Brace	• Not all patients will utilize a post-operative brace. • wks 0-1: 0-90 deg, locked for ambulation and sleeping • wks 1+: 0-120 deg, unlocked for ambulation when good quadriceps control and ext ROM full • wk 4: D/C brace
ROM	• wks 0-2: 0-90 degrees, emphasis on extension initially with gradual progression of flexion • wks 2-3: 0-110 degrees • wks 3-4: 0-120 degrees • wks 6+: Full ROM
WB	• wk 0-1: WBAT with brace locked into extension • wk 1-4: WBAT with brace unlocked if good quadriceps control and knee extension ROM. Discontinue crutches when can ambulate with normal heel-to-toe pattern.
Precautions	• If hamstring/gracilis autograft, no isolated resistance to knee flexion initially. Start graded isometrics at wk 4 within tolerance. Progress to isotonics at wk 6. Also apply ice to posterior knee to minimize muscle spasm. • Encourage AROM and WB to promote healing, prevent atrophy of soft tissue and bone, prevent a decrease in collagen content, and to align fibroblast and collagen fibrils. • Emphasis on regaining extension ROM ASAP to prevent arthrofibrosis and decrease stress to the PF joint during ambulation. • Avoid descending stair reciprocally until adequate quadriceps control and lower extremity alignment

	• Avoid twisting and pivoting motions for 6-8 weeks to minimize shear forces to the healing graft.
Modalities	• Cryotherapy 15 minutes in duration 3x/day • IFC for pain/effusion if needed • **NMES quadriceps ASAP in varying positions using 2x4" but ideally 3x5" pads** ○ **Long sitting QS/SLR/SAQ** ○ **Short sitting LAQ isometrics into strap vs isotonics with resistance** ○ **Standing TKE with TB or CC resistance** Updated 11/2023
Treatment Recommendations Guidelines for progression based on tolerance	• Active warm-up (Bike AAROM progress to Bike with resistance, Nu Step) • Stretching to attain full extension with gradual progression of flexion. Goal of full ROM **BEFORE** wk 6. Emphasis on full return of knee extension **ASAP**. Low-load long duration stretching for extension with heat if needed (1st TERT= Total End Range Time) Manual stretching for extension with overpressure / recurvatum Patellar mobilizations PROM / AAROM / AROM Manual stretching into flexion (initially limited by knee joint effusion) wk 4: WB stretch on leg press for knee flexion ROM • Flexibility exercises for hamstring, gastoc-soleus • Scar tissue massage • Consider personalized blood flow restriction therapy if available. • Therapeutic exercises. Gentle strengthening protecting the surgical graft. Encourage quadriceps activation and strength. **Early isolated OKC <u>resisted</u> knee extension can be implemented depending on patient tolerance- ie no increase in PF pain/joint effusion.** Exercise in a pain-free manner. Avoid dynamic valgus during strengthening and functional activities (focus on hip abductor and external rotator strengthening). Incorporate total leg strengthening and balance / proprioception exercises. Work on gait drills (step-overs, march walk). . Biofeedback QS, SLR (if no lag), CKC knee extension Hip 4 way SLR, sidelying hip ER Gastroc soleus strengthening Hamstring OKC isotonics 0-90 deg in seated position **Quadriceps OKC knee extension per patient tolerance** CKC exercises: Heel raises, weight shifts, leg press and wall squats (0-60 deg) wk 2: Leg press, wall squats (0-90 deg), lateral step-overs step-ups, BW squats, retro TM walking for knee extension forward TM walking for gait training wk 3: Partial lunges front and lateral, leg press 2:1, loaded squats as tolerated wk 4: Elliptical Runner, leg press 2:1 and 1:1, deadlifts wk 5: Resisted sidestep with T-band, Bosu partial squats 0-60 deg Total leg strengthening Balance / Proprioception training: Double leg progress to single leg, static progressing to dynamic activities. Perturbation exercises CV conditioning / Core Stability

	• IFC for pain/effusion, NMES for quadriceps activation and control as needed • Ice (in stretch for extension if needed) 2nd TERT • HEP for 3rd TERT
Phase II: 6-12 weeks	**Moderate protective phase**
Goals	• Minimize knee joint effusion • Full ROM by 6-8 weeks • Gradual progression of exercises for strengthening, stretching, and balance • Implement low level foot placement drills working on control • Ability to squat with symmetry to 90 degrees and single leg squat with good knee flexion, control of any dynamic valgus, and without pelvic drop
ROM / Brace	• Progress to full ROM by 6-8 weeks. • Knee sleeve may be utilized depending on patient activities
Modalities	• Cryotherapy 15 minutes in duration 1-2x/day • IFC for pain/effusion if needed. NMES quadriceps if needed
Precautions	• Avoid overloading the fixation site by utilizing low amplitude low velocity movements. • Avoid quick twisting and pivoting motions for 10-12 wks to minimize shear forces. • Implement low level foot placement focus on control at week 9.
Treatment Recommendations Guidelines for progression based on tolerance	• Active warm-up: Bike with resistance, Nu Step, Treadmill walking • Stretching for full extension and flexion as needed. Low-load long duration stretching with heat if needed (1st TERT= Total End Range Time) Manual stretching for extension and/or flexion Leg press stretch for flexion • Flexibility exercises as needed • Therapeutic exercises: **Focus on N-M control and strengthening exercises**. Avoid dynamic valgus during strengthening and functional activities. Incorporate total leg strengthening, focus on hip/glutes, quadriceps, and hamstring. Progress with balance / proprioception exercises. Correct asymmetrical loading patterns Total leg strengthening and CV conditioning Hip and core strengthening to prevent knee valgus Hamstrings isotonics prone 0-90 deg. Quadriceps isotonics OCK knee extension Balance / Proprioception training: Single leg stance activities static progressing to dynamic activities. Perturbation exercises CKC exercises: Leg press 1:1, step-ups/step downs, squats progression double to single leg, split squats lunge progression, deadlifts, sidestep/sideshuffle with SPRI wk 8: Hamstring curls with physio ball Balance exercises: add in external focus of attention (ball catch, plyo back throws) Isokinetic quadriceps/hamstrings VSRP 180-300 deg/sec sub-max to max Wk 10: Isokinetic quadriceps/hamstring

	VSRP 60-300 deg/sec sub-max to max • Low level foot placement drills starting at wk 9 • IFC for pain/effusion / NMES for quadriceps activation and control as needed • Ice (in stretch if needed) 2nd TERT • HEP for 3rd TERT if needed
Independent strengthening	• wk 12: Can progress to independent strengthening program with monthly or bi-monthly visits if good ROM, minimal effusion, full MMT, able to SL squat, pass y-balance.
Phase III: 12-24 wks (3-6 months)	**Advanced Strengthening and Functional Activities**
Goals Make sure patient is enrolled in MyCare for IKDC survey (6M, 9M, 1Y, 2 Y, 5Y)	• Progress muscle strength, endurance, and balance activities. Ideally 3x/week of exercises at a fitness center, step-down, or home program. Progress to higher level activities depending on functional demands and MD approval • Address fear avoidance beliefs by graded exercise progression, cuing, positive reinforcement, referral if necessary. • Initiate a return to running program at 3-4 months if passes criteria and has no compensations with running pattern. • Initiate working on landing mechanics and control at 4-5 months if passes criteria on the following page • Progress agility drills at 4-5 months
Brace	• Your MD may recommend a knee sleeve or functional brace to be used until 12 months from your surgery for higher level activities
Modalities	• Cryotherapy 15 minutes 1x/day or after strenuous activity
Treatment Recommendations **<u>Return to Running Benchmarks</u>:** 4 months Passes testing criteria - See next page **<u>Return to Landing Drills Benchmarks:</u>** 4 months Passes testing criteria - See next page **<u>During Landing drills</u>:**	• Active warm-up: • Continue with stretching and flexibility exercises as needed • Strengthening and endurance exercises**: Focus on strengthening and N-M control activitie**s. Advance as tolerated with emphasis on functional strengthening. Focus on soft landing with knee flexion, no medial collapse/knee valgus, and postural control. Progress with balance / proprioception exercises. Progress to working on landing mechanics and some agility drills as appropriate. Correct assymetrical loading patterns Total leg strengthening: hip/quadriceps/hamstring Hip strengthening – neuromuscular control to prevent knee valgus Core strengthening – prevent frontal plane trunk lean during landing/SLS Hamstring full ROM isotonics Quadriceps OKC knee extension. CKC exercises: lunge progression, squat progression, step-up/downs progress with double leg / off-set foot position / single leg progress single direction to multiple directions. Balance exercises: Single leg, progress to dynamic and reactive **Return to running program** if passes benchmarks- see next page • 4 months-5 months: continue with strengthening and dynamic balance

Focus on: 1.Soft landing with knee flexion > 30 deg 2. no medial collapse/knee valgus 3. no hip IR/ pelvic drop 4. Dynamic postural control	progress to the following exercises if clinical appropriate (see side bar) ○ Landing drills: Low amplitude sub-max drills Shallow jump landings, double to single line jumps, squat jumps progress to higher level if meets criteria (see sidebar) ○ Agility drills: Low amplitude low velocity drills: skipping F/B, jogging F/B, skaters, carioca progress to higher level with speed and complexity (when appropriate) agility ladder drills, cutting/pivoting (changing directions), changing speeds, anticipated to un-anticipated
Phase IV: 6-9 months	**Return to Higher Level Activities and Sport Phase**
Goals	• Continue to progress with strengthening, landing and agility drills to pass return to sports criteria – see testing algorithm • Progress to sport specific drills • Address fear avoidance beliefs by graded exercise progression, cuing, positive reinforcement, referral if necessary. • **Return to sports at 9-12 months if passes criteria – see testing algorithm.** Sports progression may take 2-4 weeks for full clearance back to full competition
Brace	Your MD may recommend a knee sleeve or functional brace to be used until 12 months from your surgery for higher level activities
Treatment recommendations	Specific interventions and treatments will depend on the testing results. Address areas of deficits and sport specific demands. • Strengthening exercises (if strength scores <90%) • Dynamic balance exercises if indicated (Y balance <4cm, poor control) • Landing/jumping/hopping drills if limb symmetry <90% on hop test and/or faulty movement patterns (stiff knee landing, assymetrical loading, knee valgus, poor postural control. • Progress agility drills • Progress to sport specific exercises and drills 9 months+: possible clearance for return to sport, depending on testing -see next pages for testing algorithm

Return-to-Sports Progression: (2-4 weeks, depending on tolerance)	Step 1: 1 on 1 drills (non-contact) sport specific activities Step 2: 1 on 1 drills (contact) full speed sport specific activities Step 3: Team scrimmage (non-contact) Step 4: Team scrimmage no restrictions Step 5: Game activities with restricted playing time Step 6: Game activities with no restrictions

ACL Return-to-Running and Return-to-Sport Testing Algorithm: Determined by:
Time out from surgery, Testing performance, PT/MD approval

6 weeks

1.Knee ROM
2.Hip strength:
    Abduction MMT
3.SL 30 deg Stork test
4.FOTO

8 weeks:

1.Knee ROM
2.Hip strength:
    Abduction MMT/dynamometry
    Hip Abduction Side plank test
3.SL 30 Stork test
4.Y balance
5. Squat WB symmetry: Force plate

12 weeks (3 months)

1. Knee ROM
2.SL 60 deg Stork test
3.Hip strength:
    Abduction MMT/ dynamometry /
    Hip Abduction Side plank test
4.Biodex test :
    20 deg extension block
    2 speeds: 180 deg/sec (5 reps) 300 deg/sec (30 reps)
5.Y balance test
6.Squat WB symmetry: Force plate
7.FOTO

Return to Running Benchmarks:

1.Time: at least 4 months post-op:
2. MD / PT clearance
3. No knee joint effusion
4. ROM: limb symmetry:
    extension within 5 deg
    flexion within 10 deg
5.Biodex: Limb symmetry of PT:
    Quad: 75%
    Hams: 75%
6. Anterior lateral hop to stabilization drill completed with no apprehension and good movement control
7. Assess running form: Treadmill running (sub-max at self selected speed)

Recommendations:

1.Biodex:
  Quad PT/BW: +/- 5%
    Males: 95%,75%, 50% at 60,180,300deg/sec
    Females: 85%, 65%, 35% at 60,180,300deg/sec
  H/Q ratio: +/- 5%: 65%, 75%, 90% at 60,180,300deg/sec
  Total work at 300 deg/sec:
    Quad: limb symmetry 75%
    Hams: limb symmetry:75%
2. SL 60 deg stork test:
    Limb symmetry: 90%
3. Hip Abductor strength: MMT 5/5 or dynamometry 90%
4. Squat WB symmetry with near equal WB
5. Y balance: Limb symmetry: < 4cm

16 weeks (4 months) – RETURN to RUNNING

Repeat previous tests not passed
For Biodex test:
20 deg extension block
3 speeds: 60 d/sec (5 reps)
180 d/sec (5 reps) 300 d/sec (30 reps)
***if adequate strength scores for return to running**
(quads at least 75%, hamstrings: at least 75%)
1.Anterior lateral hop to stabilization
2.Sub-Max Jump test: no arm swing
3.Sub-Max Single Hop Assessment: no arm swing
For apprehension and control
4.Trial of running
5. Screen for fear avoidance/kinesiophobia
(ACL-RSI survey)

Return to Jumping/Landing Drills Benchmarks:

1.Time: at least 4-6 months
2.MD/ PT clearance
3.No knee joint effusion
4.Biodex: Limb symmetry of PT:
Quadriceps and hamstrings: 75-85% = sub-max landing drills
Quadriceps and hamstrings: 85-90% = max landing drills

Minimize the following 4 variables with landing drills:
1. Stiff landing (< 30 deg knee flexion)
2. Knee valgus
3. Hip IR / pelvic drop
4. Loss of Dynamic balance

ACL Return-to-Running and Return-to-Sport Testing Algorithm

Return to sport depends on:
Timeframe from surgery
Test performance
MD and PT approval

24 weeks (6 months)

Repeat previous tests not passed
1. Biodex test: Full ROM with no ext block
3 speed test: 60 deg/sec (5 reps),
180 deg/sec (5 reps),
300deg/sec (30 reps
2. Squat WB symmetry: force plate
3. Landing Assessment: qualitative*
a. Broad jump - 2D – no arm swing
a. Land Vertical Jump – 2D (front and side)
b. Sub-max Single leg Hop –2D (front and side) – no arm swing
progress to max if:
strength 90%
limited landing mechanic variable
4.FOTO and IKDC (Mycare)
5. Screen for fear avoidance/kinesiophobia
(ACL-RSI survey)

*Landing mechanic variables at impact for potential injury risk:
1. Stiff landing (< 30 deg knee flexion)
2. Knee valgus
3. Hip IR / pelvic drop
4. Decreased dynamic balance
(poor trunk control, increased # reps to complete)

9 months- Possible return to sport

Repeat previous tests not passed

1.Biodex test: Full ROM with no ext block
3 speed test: 60 deg/sec (5 reps),
180 deg/sec (5 reps),
300deg/sec (30 reps)

2. Landing Assessment: quantitative for limb symmetry
qualitative for landing mechanics variables
a. Single leg hop (no arm swing) – 2D (front and side)
b. Triple hop (arm swing) – 2D (front)
c. Cross-over hop (arm swing) – 2D (front)

3. Agility test: LEFT test components or time

4. FOTO and IKDC (Mycare)

5. screen for fear avoidance/kinesiophobia
(ACL-RSI survey)

2 year/ 5 year

IKDC (mycare)

Return to Sport Benchmarks:

1.Time: at least 9-12 months
2.MD/ PT clearance
3.No knee joint effusion
4.ROM: limb symmetry:
extension within 5 deg
flexion within 10 deg
5.Biodex: Limb symmetry of PT:
Quad: 90%
Hams: 90%
6.Landing Assessment:
(Single Hop/ Triple Hop/ Cross-over Hop)
Quantitative: Limb symmetry: 90%
Qualitative variables - no faulty landing mechanics – see previous column*
7.Agility components with no compensation
8. No evidence of fear avoidance

Recommendations:

1.Biodex:
*Quad PT/BW: (+/-5%)
Males: 95%, 75%, 50% at 60, 180, 300 deg/sec
Females: 85%, 65%, 35% at 60,180,300 deg/sec
H/Q ratio: (+/- 5%)
65%, 75%, 90% at 60, 180, 300 deg/sec
Hams PT/BW: (+/- 5%)
Males: 60%, 35%, 25% at 60, 180, 300 deg/sec
Females: 60%, 35%, 25% at 60, 180, 300 deg/sec

Total work: 300 deg/sec
Quads: Limb symmetry:90%
Hams: Limb symmetry: 90%

2. Hip Abductor strength: MMT 5/5 or dynamometry 90%
3.Y balance: Limb symmetry: < 4cm
4. Jump test:
Males: 90%-100% height
Females: 80%-90% height
5. Single hop test:
Males: 80-90% height
Females: 70-80% height

ACL Reconstruction Program References

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