

KNEE ANTERIOR CRUCIATE LIGAMENT (ACL) SPRAIN NON-OPERATIVE GUIDELINE

The following Anterior Cruciate Ligament (ACL) Non-operative Guideline was developed by HSS Rehabilitation and is divided into four phases dependent on patient presentation and level of irritability. The guideline focuses on partial and complete ligament ruptures. Note that some physicians may choose to progress partial ACL tears more slowly to allow more time for healing. Brace usage is dependent on physician recommendation. Progression is both criteria-based and patient specific. Phases are designed to give a clinician a general sense of progression. This rehabilitation program emphasizes reduction of pain and edema in the acute phase while not overstressing any involved tissues. Advancement through the phases may vary in individuals with concomitant injuries such as other ligamentous involvement and meniscal tears. In addition, progression through the phases should be in alignment with patient goals.

**FOLLOW REFERRING PHYSICIAN MODIFICATIONS AND BRACE GUIDELINES AS
PRESCRIBED**

KNEE ACL SPRAIN NON-OPERATIVE GUIDELINE

Phase 1: Acute/High Irritability

PRECAUTIONS

- Screen for fractures with Ottawa Knee Rules
- Modify irritable activities and exercises
- Use appropriate assistive device (AD)/brace as needed
- Minimize joint effusion and edema
- Monitor episodes of knee buckling/instability
- Monitor end-feel extension limitations to rule out other pathologies

CONSIDERATIONS

- Know the level/grade of tear and other tissues involved

ASSESSMENT

- Lower Extremity Functional Scale (LEFS)
- Pediatric International Knee Documentation Committee Subjective Knee Evaluation Form (Pedi-IKDC), as applicable
- Fear Avoidance Beliefs Questionnaire (FABQ)
- Numeric Pain Rating Scale (NPRS)
- Neurovascular Assessment
- Edema and girth (thigh) measurements
- Palpation
- LE active range of motion (AROM) and passive range of motion (PROM)
- Patellar mobility
- LE flexibility
- Quality of quadriceps contraction
- LE strength
 - Manual muscle test (MMT) and/or hand held dynamometer (HHD)
- Gait
- Special tests
 - Lachman, pivot shift, anterior drawer, posterior drawer, Lever Sign, valgus/varus testing, meniscal tests (where appropriate), patella apprehension

TREATMENT RECOMMENDATIONS

- Patient education
 - Activity modification to reduce/eliminate pain and edema
 - Understanding the importance of compliance with the home exercise program (HEP)
- Edema management
 - Protection, rest, ice, compression, elevation (PRICE)
 - Modalities
- Manual therapy
 - Joint mobilizations as needed
 - Soft tissue massage (STM)
 - Myofascial release
 - Taping as needed
- ROM/Flexibility
 - PROM: Low load long duration stretching for knee extension
 - Active assisted range of motion (AAROM)
 - Stretching
 - Aquatic therapy if available
 - Stationary bicycle
- Neuromuscular re-education
 - Neuromuscular electric stimulation (NMES) quadriceps
 - Biofeedback
- Strengthening
 - Progressive resistance exercises (PRE)
 - Consider Blood Flow Restriction (BFR) to low demand exercises with FDA approved device and qualified therapist with physician clearance
 - Quadriceps sets, straight leg raise (SLR)
 - Hamstrings: prone curls, hamstrings isometrics
 - Leg press bilaterally
 - LE stabilizers proximal/distal to the knee
 - Upper extremity (UE) and core strengthening
 - No limits on UE or core workouts that do not affect the injured knee
- Functional training
 - Gait: follow physician's prescribed weight bearing restrictions and brace guidelines
 - Progressively wean off AD as tolerated or based on physician recommendation
 - Retrograde treadmill
 - Aquatic therapy if available
 - Stairs: Non-reciprocal pattern
 - Squats bilaterally: partial ROM (0°-45° in pain-free arc)
- Balance/Proprioception
 - Weight shifting: various surfaces
- Cardiovascular Training

CRITERIA FOR ADVANCEMENT

- Minimal to no edema present
- Restoration of knee ROM
 - Knee extension 0° and knee flexion $\geq 120^\circ$
- Normalize gait pattern without AD
- SLR without quadriceps lag

EMPHASIZE

- Pain-free basic exercises
- Edema management
- Importance of hamstring as dynamic stabilizer
- Limit motions, activities and exercises which stress healing tissues
 - Avoid anterior tibial translation, pivoting and activities that cause instability

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Phase 2: Sub-acute/Moderate Irritability

PRECAUTIONS

- Avoid premature return to activity
- Monitor response to loaded activities and ADLs
- Avoid stretching/stressing injured ligaments
- Avoid patellofemoral joint stress
- Minimize joint effusion and edema
- Monitor episodes of knee buckling/instability
- Monitor end-feel extension limitations to rule out other pathologies

ASSESSMENT

- LEFS
- IKDC (if applicable)
- NPRS
- Edema measurements
- Patellar mobility
- LE AROM and PROM
- LE flexibility
- Quality of quadriceps contraction
- LE strength: MMT and/or HHD
- SLR in supine
- Gait
- Functional assessment
 - Squat: double leg (DL): strategy, alignment, depth, symmetry
 - Single leg balance: alignment and control
 - Step up

TREATMENT RECOMMENDATIONS

- Patient education
 - Progressive activity modification (0/10 NPRS with all ADL's)
 - Reinforced compliance with HEP
 - Movement strategies (importance of hip strategy versus knee strategy)
- Edema management:
 - Protection, Elevation, avoid NSAIDs (physician directed), compression, education (PEACE)
 - Load, optimism, vascularization, exercise (LOVE)
 - Modalities
- Manual therapy
 - Joint mobility as needed
 - STM as needed
- ROM/flexibility
 - Achieve full and pain-free knee AROM
 - Stretching and foam rolling as needed
- Neuromuscular re-education
 - NMES quadriceps as needed
- Strengthening
 - Quadriceps PREs
 - Open kinetic chain (OKC) knee extension
 - Partial tears: limited ROM of 90°-45° knee flexion
 - Complete tears: pain-free and crepitus-free ROM
 - Closed kinetic chain (CKC) knee extension
 - Hamstrings
 - standing curls, heel raise bridge, Romanian Deadlift (RDL)
 - LE stabilizers proximal and distal to the knee
 - Emphasize CKC exercises 0°-90° flexion
 - Leg press: double leg → eccentric → single leg progression
 - Avoid knee hyperextension
 - UE and core strengthening
 - No limits on UE or core workouts that do not affect the injured knee
- Functional training
 - Squat progression
 - Step progression
 - Forward, lateral, down
 - Progress step height
- Balance/Proprioception
 - Single leg (SL) balance: various surfaces, eyes open/closed
 - Balance training devices
 - Perturbation training

- Cardiovascular Training
 - Stationary bicycle, elliptical – progressively increase resistance
- Aquatic Therapy: if available for flexibility, ROM, proprioception, gait, functional training

CRITERIA FOR ADVANCEMENT

- Full knee ROM
- Pain and edema managed as activity increases
- Strength testing: Limb Symmetry Index (LSI) equal or above 70% (>1.7 NM/kg BW)
- Able to perform symmetrical squat with proper alignment and control
- Able to perform pain-free FSU 8"
- Able to perform pain-free FSD 8"
- Able to perform single leg balance without compensation
- Demonstrates frontal plane knee stability during functional tasks

EMPHASIZE

- Importance of adherence to HEP and activity modification
- Pain-free exercise
- Edema management

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Phase 3: Chronic/Low Irritability

PRECAUTIONS

- Avoid premature return to activity
- Monitor response to load: exercise, ADLs
- Avoid compensatory movement strategies
- Avoid inadequate rest and recovery to prevent fatigue-related injury
- Avoid patellofemoral pain
- Minimize joint effusion and edema with plyometrics
- Monitor episodes of knee buckling/instability

ASSESSMENT

- LEFS
- IKDC (if applicable)
- NPRS
- Irritability monitoring
- Patellar mobility
- LE flexibility
- Strength test: consider testing procedure before progressing to plyometrics
 - Hand held / pulley dynamometer LSI and/or isokinetic dynamometer if available
- Functional assessment

TREATMENT RECOMMENDATIONS

- Patient education
 - Importance of adequate rest and recovery
 - Determine activities that may cause irritability, pain and edema
- Manual therapy as needed
- Flexibility as needed
- Strengthening
 - Double leg → single leg exercise progressions
 - squat
 - leg press
 - bridge
 - Body weight → external resistance exercise progressions
 - Isokinetic exercises if available (high → moderate → slow velocities)
 - Full kinetic chain exercises

- Aquatic (sports specific, higher level resistance)
- Balance/proprioception
 - Dynamic proprioceptive exercises and perturbation training
 - Proprioceptive Neuromuscular Facilitation (PNF) exercises
 - Slow speed, low force, controlled movements
- Functional training: advance step progressions
- Initiate plyometric program progressing from DL to SL and from vertical to horizontal
 - Progress 1 exercise per week
 - Vertical jumping progression
 - DL box jump → jump in place → drop jump
 - SL box jump → jump in place → drop jump
 - Horizontal jumping progression (DL to SL)
 - Forward hops
 - Side to side hops
 - Broad jump
 - Side to side jumps
- Initiate running program on non-consecutive days with interval training
 - Utilize antigravity treadmill if available
- Cardiovascular Training: progressively increase resistance

CRITERIA FOR DISCHARGE OR ADVANCEMENT TO PHASE 4 (IF RETURNING TO SPORT)

- Demonstrate SL squat with proper alignment and control
- Proper utilization of full kinetic chain during exercise
- Strength testing LSI equal or above 80%, (2.0 NM/kg BW)
- Lack of pain and apprehension with running and plyometric activities

EMPHASIZE

- Importance of adherence to HEP
- Pain-free exercise
- Proper knee alignment and strategy with functional strengthening
- Avoid activities that cause instability
- Landing with good eccentric control in frontal/sagittal planes

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Phase 4: Return to Sport

PRECAUTIONS

- Avoid premature return to play
- Avoid instability during sport specific training
- Avoid patellofemoral pain with plyometrics and sports specific training
- Minimize joint effusion and edema with plyometrics and sport specific training
- Monitor episodes of knee buckling/instability

CONSIDERATIONS

- Sport and position
- Need for functional athletic brace
- Physician clearance for return to sport

ASSESSMENT

- LEFS
- IKDC (if applicable)
- NPRS
- LE flexibility
- LE strength
- Functional movement screen
 - Quality of movement: DL and SL squats, jumping
 - strategy, alignment, symmetry, control, pain
- Physical performance tests
 - Star excursion test
 - SL deceleration ability
 - SL power assessment
 - Hop tests:
 - Vertical jump
 - Single hop for distance
 - Crossover hop
 - Triple hop for distance
 - 6-meter timed hop

TREATMENT RECOMMENDATIONS

- Strength progression/maintenance program
- Running
 - Progress to shuttle runs, sprinting
 - Progress to distances required by sport
- Balance and proprioception
 - Dynamic proprioceptive exercises and perturbation training
 - PNF exercises
 - High speed, high force, uncontrolled movements
- Plyometric progressions
- Agility
 - Ladder, hurdles, cutting drills
- Sport specific training
- Utilization of functional brace for sports participation per physician's recommendation
- Consider collaboration with ATC, performance coach/strength and conditioning coach, skills coach and/or personal trainer to monitor load and volume with return to sport participation

CRITERIA FOR DISCHARGE

- Isokinetic testing (quadriceps, hamstrings) if available: $\geq 90\%$ limb symmetry peak torque (torque/BW ratio > 2.5 - 3.0 Nm/kg)
- $\geq 90\%$ limb symmetry of contralateral limb on hop tests
- $\geq 90\%$ of contralateral limb on star excursion test
- No symptoms with sprinting, sport-specific multidirectional movements, and plyometrics
- Movement patterns, functional strength, flexibility, motion, endurance, power, deceleration and accuracy to meet the demands of the individual sport and position

EMPHASIZE

- Importance of recognizing fatigue
- Sports specific drills with eccentric control, avoiding increased trunk flexion, dynamic genu valgum and femoral internal rotation
- Collaboration with Sports Performance experts

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References

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