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

The following anterior cruciate ligament (ACL) non-operative guidelines were developed by HSS Rehabilitation and are divided into four phases dependent on patient presentation and level of irritability. These guidelines focus 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’s 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 swelling 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 physician modifications and brace guidelines as prescribed.
KNEE ACL SPRAIN NON-OPERATIVE GUIDELINES
Phase 1: Acute/High Irritability

PRECAUTIONS
- Screen for fractures with Ottawa Knee Rules
- Modify activities and exercises that increase pain
- Use appropriate assistive device (AD)/brace as needed
- Minimize joint effusion and edema
- Monitor episodes of knee buckling/instability

CONSIDERATIONS
- Know the level of tear and other tissues involved

ASSESSMENT
- Lower Extremity Functional Scale (LEFS)
- International Knee Documentation Committee (IKDC)
- Knee Injury and Osteoarthritis Outcome Score Junior (KOOS Jr)
- Numeric Pain Rating Scale (NPRS)
- Neurovascular Assessment
- Lower extremity (LE) active range of motion (AROM) and passive range of motion (PROM)
- LE flexibility, where appropriate
- LE strength, where appropriate
- Edema and girth (thigh) measurements
- Palpation of pain generators
- Special tests
  - Lachman, pivot shift, anterior drawer, posterior drawer, valgus/varus testing, meniscal tests (where appropriate), patella apprehension
- Patellar mobility
- Quality of quadriceps contraction: good, fair, poor
- Straight leg raise (SLR) in supine: with or without lag
- Gait: with/without AD
- Prior/current level of function
TREATMENT RECOMMENDATIONS

- Patient education
  - Activity modifications to decrease or eliminate pain and swelling
  - Understanding the importance of compliance with the home exercise program (HEP)
  - Management of pain and effusion

- Edema management
  - Protection, rest, ice, compression, elevation (PRICE)
  - Modalities

- Manual therapy
  - Joint mobilizations
    - Patella mobilizations in all planes
  - Soft tissue massage (STM)
    - Myofascial release
    - Edema control
  - Taping as needed

- ROM/Flexibility
  - AROM, AAROM (active assisted range of motion)
  - Stretching
    - Low load prolonged stretching for knee extension
    - LE musculature
  - Foam rolling
  - Aquatic therapy if available
  - Stationary bicycle

- Neuromuscular re-education
  - Neuromuscular electric stimulation (NMES) quadriceps
  - Biofeedback

- Strengthening
  - Progressive resistance exercises (PRE)
    - Consider blood flow restriction to low demand exercises with FDA approved device and qualified therapist if patient cleared by MD
    - Quadriceps
      - Quadriceps sets, SLR
    - Hamstrings
      - Standing curls
    - Leg press bilaterally
  - LE stabilizers proximal/distal to the knee
    - Hip abductors, adductors, extensors, and calves
    - Advance weight bearing exercise as tolerated
  - Upper extremity (UE) and core strengthening
    - No limits on UE or core workouts that do not affect the injured knee
• Functional training
  o Gait
  o Follow physician’s prescribed weight bearing restrictions and brace guidelines
    ▪ Progressively wean off AD as tolerated and based on physician recommendation
    ▪ Retrograde treadmill
    ▪ Aquatic therapy if available
  o Stairs
    ▪ Non-reciprocal pattern

• Squats bilaterally
  o Body weight
    ▪ Partial ROM (0°-45° in pain-free arc)

• Proprioception
  o Weight shifting
    ▪ Flat stable surface
    ▪ Soft surface
    ▪ Balance training devices

• Cardiovascular training
  o Stationary bicycle

CRITERIA FOR ADVANCEMENT
• Minimal to no swelling present
• Restoration of knee ROM
  o Knee extension 0° and knee flexion ≥ 120°
• Normalize gait pattern without AD
  o Restoration of full weight bearing status
• SLR without lag

EMPHASIZE
• Pain-free basic exercises
• Edema management
• Importance of hamstring as dynamic stabilizer
• Limit motions, activities and exercises which stress healing tissues
  o Avoid tibial anterior translation, pivoting and activities that cause instability
KNEE ACL SPRAIN NON-OPERATIVE GUIDELINES
Phase 2: Sub-acute/Moderate Irritability

PRECAUTIONS
• Avoid premature return to activity
• Avoid stretching injured ligaments
• Avoid patellofemoral joint stress
• Minimize joint effusion and edema
• Monitor episodes of knee buckling/instability

ASSESSMENT
• LEFS
• IKDC
• KOOS Jr.
• NPRS
• Edema measurements
• Patellar mobility
• Quality of quadriceps contraction: good, fair, poor
• LE AROM and PROM
• LE flexibility, where appropriate
• LE strength, where appropriate
• SLR in supine
• Gait without AD
• Squat: bilateral
• Single leg balance
• Step up

TREATMENT RECOMMENDATIONS
• Patient education
  o Progressive activity modification (0/10 with all ADL’s)
  o Reinforced compliance with HEP
  o Movement strategies (importance of hip strategy versus knee strategy)
  o Edema management: PRICE, modalities
• Manual therapy
  o Joint mobility
    ▪ Patella all planes
  o STM as needed
• Neuromuscular re-education
  o NMES quadriceps as needed

• ROM/flexibility
  o Achieve full and pain-free AROM
  o Stretching
  o Foam rolling
  o Aquatic therapy if available

• Strengthening
  o Quadriceps progressive resistive exercise (PRE)
    ▪ Open kinematic chain (OKC) knee extension
      • Partial tears: limited ROM of 90°-45° knee flexion
      • Complete tears: pain-free and crepitus-free ROM
  o Closed kinematic chain (CKC) knee extension
    ▪ Standing TKE

• Hamstrings
  o Romanian Deadlift

• Strengthening (continued)
  o LE stabilizers proximal and distal to the knee
    ▪ Hip abductors, adductors, extensors, and calves
  o Emphasize CKC exercises 0°-90° flexion
    ▪ Leg press: double leg → eccentric → single leg
      • Avoid hyperextension
    ▪ Monster walks
  o UE and core strengthening
    ▪ No limits on UE or core workouts that do not affect the injured knee
    o Aquatic therapy if available

• Balance and proprioception
  o Single leg balance
    ▪ Progress to unstable surfaces → eyes closed
  o Balance training devices
  o Perturbation training

• Functional training
  o Gait
    ▪ Aquatic therapy if available
  o Squat
    ▪ Bilateral to chair, progress depth as tolerated to <90°
  o Forward step ups (FSU)
    ▪ Progress from 6-8”
  o Forward step downs (FSD)
    ▪ Progress from 4-6”
Lateral step up/down (watch volume)
  - Progress from 4-6"

Cardiovascular
  - Stationary bicycle – progressively increase resistance

CRITERIA FOR ADVANCEMENT
- Full knee ROM
- Pain and edema managed as activity increases
- 5/5 strength gross lower quarter
- Able to perform symmetrical squat with proper alignment and control
- Able to perform pain-free FSU 8"
- Able to perform pain-free FSD 6"
- 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
KNEE ACL SPRAIN NON-OPERATIVE GUIDELINES

Phase 3: Chronic/Low Irritability

PRECAUTIONS
- Avoid premature return to activity
- Avoid compensatory movement strategies
- Avoid inadequate rest and recovery to prevent fatigue-related injury
- Avoid patellofemoral joint stress
- Minimize joint effusion and edema with plyometrics
- Monitor episodes of knee buckling/instability

ASSESSMENT
- LEFS
- IKDC
- KOOS Jr.
- NPRS
- LE flexibility, where appropriate
- LE strength, where appropriate
- Squat: bilateral, unilateral
- Single leg balance
- Dynamic
- Effects of muscle fatigue on movement patterns, quality or pain
- Functional step up and step down

TREATMENT RECOMMENDATIONS
- Patient education
  - Functional progress
  - Importance of adequate rest and recovery
  - Determine activities that may cause irritability, pain and swelling
- Manual therapy
  - STM to musculature as needed
- Flexibility
  - Stretching as needed
  - Foam rolling as needed
• Strengthening
  - Progression of isotonic exercises
    - Double leg → single leg exercises, e.g., OKC double → single leg in pain-free arc
    - Body weight → external resistance
  - Isokinetic exercises if available (high → moderate velocities)
    - Full kinetic chain exercises
    - Aquatic (sports specific, higher level resistance)
• Balance and proprioception
  - Dynamic proprioceptive exercises and perturbation training
  - PNF exercises
    - Slow speed, low force, controlled movements
• Functional training
  - FSD 8”
  - Lateral step up/down 8” (watch volume)
  - Squat: single leg
• Plyometrics
  - Jumping
    - Bilateral vertical → forward → lateral
  - Hopping
    - Single alternating → single unilateral
    - Single vertical → forward → lateral
  - Running program
    - Progress distance and speed
• Cardiovascular
  - Elliptical
  - Swimming
  - Stationary bicycle – progressively increase resistance

CRITERIA FOR DISCHARGE OR ADVANCEMENT TO PHASE 4 (IF RETURNING TO SPORT)
• Demonstrate FSD 8” with proper form and control
• Demonstrate unilateral squat with proper alignment and control
• Proper utilization of full kinetic chain during exercise
• Lack of pain and apprehension with running and plyometric activities

EMPHASIZE
• Importance of adherence to HEP
• Pain-free exercise
• Proper knee alignment with functional strengthening
• Avoid activities that cause instability
• Landing with good eccentric control in frontal/sagittal planes
KNEE ACL SPRAIN NON-OPERATIVE GUIDELINES
Phase 4: Return to Play

PRECAUTIONS
- Avoid premature return to play
- Avoid instability during sport specific training
- Avoid patellofemoral joint stress 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, position
- Need for functional athletic brace
- Physician clearance for return to sport

ASSESSMENT
- LEFS
- NPRS
- Functional movement screen
  - Quality of movement, e.g., symmetry, pain
  - HSS QMA if available
- Special tests, e.g., Swain test, valgus laxity test
- Physical performance tests
  - Star excursion test
  - Hop tests, e.g.:
    - Single hop for distance
    - Crossover hop
    - Triple hop for distance
    - 6-meter timed hop
  - Isokinetic testing if available
TREATMENT RECOMMENDATIONS

- Running
  - Progress to shuttle runs, sprinting
  - Distances required by sport
- Balance and proprioception
  - Dynamic proprioceptive exercises and perturbation training
  - PNF exercises
  - High speed, high force, uncontrolled movements
- Plyometrics
  - Progress resistance and endurance
- Agility
  - Ladder, hurdles, cutting drills
- Sport specific training
- Utilization of functional brace for sports participation per physician’s recommendation

CRITERIA FOR DISCHARGE

- Isokinetic testing (quadriceps, hamstrings) if available: ≥ 90% limb symmetry (average peak torque, total work)
- ≥ 90% limb symmetry of contralateral limb on hop tests
- ≥ 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
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References


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