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ACL-MCL RECONSTRUCTION

Physical Therapy, Strength and Conditioning

PHASE I: MAXIMUM PROTECTION (WEEKS 0 TO 2)

Week 0-1

- Brace—six weeks
- Weight bear as tolerated with crutches with brace locked in extension 6 weeks. Wean from crutches as tolerated.

Goals
- Reduce inflammation
- Normalize patella mobility with manual mobilizations
- Full extension both passive and active
- No extension lag with straight leg raise
- 0-30° of knee flexion, progressing to full as tolerated

Exercise Progression
- Gait training
- Extension—heel props for full extension
- Flexion—off table or wall slides
- Quadriceps setting using NMES as needed
- Multi-plane straight leg raises
- Bilateral calf raises

Weeks 1 to 2

Goals
- Reduce inflammation
- Full knee extension/hyperextension
- Good quadriceps control with no extension lag
- 0-60° of knee flexion

Exercise Progression
- Continue with 0-1 week program
- Extension—continue with heel props or add prone hangs (as needed)
- Flexion—wall or heel slides
- Ball bridge and/or isometric hamstring activation
- Mini squats

Cardiovascular Exercise
- Stationary biking
- Short walks using both crutches

Phase I Clinical Pearls:

1. Control inflammation with frequent icing and elevation. It is important for the patient to avoid extensive periods with their leg in a dependent position, especially during the first week. Limit time at work and school during week 1.
2. Retrograde effleurage with leg elevation is beneficial for edema reduction and corresponding increases in ROM and quad control.
3. Obtaining full extension early is essential for a successful outcome. Use sound clinical judgment when determining how aggressive one needs to be. A female with hyper-laxity (10° hyperextension) can work at neutral for 1-2 weeks then gradually work toward full hyperextension, while a fairly tight 35 year old male may need to work hyper-extension with heel props beginning post-op day 1.
4. Patients may have difficulty generating an adequate VMO contraction secondary to both disuse atrophy and reflex inhibition related to swelling. Use NMES for neuromuscular re-education as needed but work aggressively for a controlled volitional contraction. Have the patient work to achieve a "heel up" position when quad setting. Placing a small 1" towel roll under the heel while executing a quad set will help the quadriceps contract at end range. Remove the towel after 10-15 reps with a 10 second contraction, the patient should then be able to demonstrate full or near full active extension. Encourage the patient to perform an additional 10-15 repetitions to reinforce this movement pattern.
5. Perform PROM exercises 3x/day to maximize ROM return. Instruct patient on the importance of restoring ROM before concentrating on strength.
6. Begin soft tissue mobilization to the hamstrings and gastrocnemius to reduce muscle tightness, myofascial restriction, and trigger points, which will subsequently improve knee extension. Integrate soft tissue mobilization and myofascial release of the quadriceps, IT band, and adductor groups as appropriate.
7. Restoring normal patellofemoral (PF) arthrokinematics is essential for restoration of normal PF tracking and a successful outcome. Manual mobilization of the patella with medial/lateral/superior/inferior glides, medial/lateral tilts. These mobilizations can be performed with the knee in full extension (loose-packed position for the patellofemoral joint) and slight knee flexion (approximately 30°).
8. Begin stationary bicycle after week 1 to increase knee flexion. Initially, patients may not be able to pedal through a full revolution, instruct the patient to perform partial forward and backward revolutions until there is adequate knee flexion to allow a full cycle. Note: Most patients are able to achieve a full cycle revolution backwards first, followed by forward.
9. Educate the patient on the importance of core control using level 1 core exercises. Reinforce that the patient is using and integrating "neutral spine" mechanics throughout the phase 1 program.

PHASE II: PROGRESSIVE STRETCHING AND EARLY STRENGTHENING (WEEKS 2 TO 6)

Weeks 2 to 4

Goals

- Progress off crutches
- Full knee extension/hyperextension
- Knee flexion to 90°, progress as tolerated
- Normalize gait mechanics
- Normalize patellofemoral joint and scar mobility

Exercise Progression
- Extension—continue with heel props and prone hangs as needed
- Flexion—continue with end range heel slides
- Bilateral squat progression—focus on proper alignment
- Multi-plane open and closed kinetic chain hip strengthening
- Step-up progression – focus on proper alignment
- Hamstring activation with bridge on floor, ball or box
- Progress to unilateral heel raise off the floor then off a step
- Proprioception drills

Cardiovascular Exercise
- Stationary biking
- Treadmill/outdoor walking with focus on proper gait mechanics

Weeks 4 to 6

Goals
- Reduce inflammation
- Full ROM
- Normal gait

Exercise Progression
- Controlled movement series—warm-up
- Leg press, hamstrings curls
- Single leg RDL's

Cardiovascular Exercise
- Increase intensity/duration
- Stationary biking
- Treadmill/outdoor walking with focus on proper gait mechanics
- Arc trainer or elliptical

Phase II Clinical Pearls:

1. Continue with soft tissue mobilization and myofascial release to the quadriceps, hamstrings, gastrocnemius, IT band, and adductors prior to beginning ROM.
2. Perform patellar mobilizations and soft tissue work to the anterior interval in 0 and 30° flexion prior to beginning therapeutic exercises. Patient may begin self-maintenance of soft tissue using a foam roller or massage stick.
3. Scar tissue mobilizations to reduce adhesions.
4. Continue to normalize gait mechanics and patellofemoral tracking. Stretching the quadriceps, hamstrings and calf between closed chain sets is an excellent way to free the PF joint to allow pain-free loading.
5. Develop strength and muscular endurance through low intensity cardiovascular exercise on the bike, elliptical, walking (outside or treadmill) or deep water pool program. Aim for 20-30 minutes, 5x/week.
6. Ongoing emphasis on core integration, neutral spine and good alignment with all phase 2 exercises. Use the base core program to normalize global compensatory patterns to prepare for more complex movement patterns and loading encountered during phase 3.
7. Walking briskly outside is preferable to treadmill due to different ground reaction forces with heel contact and push off. Use intermittent elevation to create more push off if using a treadmill.

8. Unilateral closed kinetic chain exercises are useful for encouraging co-contraction of muscles with reduced shear forces at the knee joint and should be progressed in a safe and logical manner. Instruct the patient to maintain good alignment of the knees relative to the hips and feet, avoiding valgus collapse. Exercises should start with partial progressing to full-range and concentric progressing to eccentric loading based on the patient's ability to control hip, knee and foot alignment.
9. As the patient begins a more strenuous strengthening program at the 4-6 week mark it is important to factor in additional recovery. 3x/week with closed chain work is appropriate with at least 24 hours rest between loading sessions. Varying exercises to provide differing loading patterns will continue to challenge the patient. Sample week:
    - *3x12-15 of each of the following exercises 3 x/week:*
    - *Leg press or squats (choose 1)*
    - *12" step-ups or unilateral leg press*
    - *Hamstring curl machine, glute-ham or RDL's*
    - *Calf raises bilateral off a step or on machine*

    Using this format allows you to select a bilateral and unilateral closed chain exercise as well as one exercise of the hamstrings and calf while avoiding too much volume in one exercise session.
10. Cardiovascular work should also alternate between hard and easy days (i.e. Monday—25 minute brisk walk, Tuesday—30 stationary bike with light resistance, Wednesday—24 minutes elliptical etc.)

PHASE III: ADVANCED STRENGTHENING AND ENDURANCE TRAINING (WEEKS 6 TO 12)

Weeks 6 to 12

Goals
- Control inflammation with increasing loads
- Full knee flexion and extension with terminal stretch
- Progressive strengthening
- Increase muscular endurance

Movement Prep
- Foam roller
- Controlled movement series

Exercise Progression
- Weighted squat progression
- Single leg squat/lunge progression (dips, retro, walk and split), focus on eccentric control and alignment.
- Monster walks

Core Program
- Front plank—full, may advance to alternating leg lift
- Bridge—marching or single leg
- Side plank—full
- Dead bug progression
- Quadruped alternating arm-leg

Cardiovascular Exercise
- Stationary biking
- Treadmill/outdoor walking with focus on proper gait mechanics
- Arc trainer or elliptical

Activity Progression
- Outdoor biking—week 8-10
- Shallow water pool running—week 8-10
- Swimming free style—week 8-10
- Higher intensity interval work with CV program—week 10-12

Phase III Clinical Pearls:

1. Manual work in this phase will begin to decline relative to treatment time spent performing therapeutic exercises for specific stretching, advanced strengthening, and higher-level functional task training. Keep in mind it is important to maintain proper PF tracking by using patella mobilization as needed.
2. Emphasize the importance of proper alignment with all bilateral and unilateral impact and non-impact closed chain loading. In the sagittal plane, the hip, knee and foot should maintain a straight alignment without the knee falling into a valgus position. With proper frontal plane alignment, the knees do not cross beyond the end of the toes, the hips drop posteriorly while the torso inclines forward, this allows the patient/athlete to maintain their center of gravity while dampening vertical load with take-off and landing.
3. Proper dynamic warm-up, muscle activation series and self-directed soft tissue mobilization using a foam roller are important preparatory exercises prior to weight room and cardiovascular activity. Patients commonly develop PF pain when they reduce their intrinsic hip stability and soft tissue mobility exercises in the later stages of their rehab program.
4. Educate patients on proper frequency and intensity for performance of their HEP; LE strengthening should be performed a maximum of 3x/week to allow for adequate muscle recovery between sessions. Higher intensity/interval cardiovascular days should be followed by lighter recovery work. Follow the LE workout design outlined in phase 2 with increasing resistance. Error on the side of caution when prescribing both load and recovery!
5. Building muscular endurance is critical during phase 3. Interval training offers a higher intensity non-impact loading that will build muscular strength, endurance and girth without overstressing articular cartilage and remodeling connective tissue.
6. Increase eccentric load with all closed chain work. Retrograde elevated treadmill walking at 10-12% elevation is an excellent way to add quality eccentric work. A typical program will consist of 4 sets, 20 minutes total; 3 minutes forward at 10-15% @ 3.0-4.0 MPH and 2 minutes backward 10-12% @ 2.8-3.5 MPH, 2x/week. Reverse sled pulls may be used as an alternate exercise selection.
7. Ideal take-off and landing mechanics include hip flexion, knee flexion and ankle dorsiflexion; teaching “foot flat” mechanics optimally transfers proper squatting alignment into ballistic impact activity offering the safest transition to impact loading.

PHASE II: ADVANCE STRENGTHENING AND RUNNING PROGRESSION (WEEKS 12 TO 24)

Goals
- Control inflammation with increasing loads
- Progressive strengthening
- Increase muscular strength, power and endurance

Movement Prep
- Foam roller
- Controlled movement series

Exercise Progression
- Increasing loads from phase III

Core Program
- Increasing loads from phase III

Non-impact Cardiovascular Exercise
- Stationary biking
- Arc trainer or elliptical
- Swimming

Running Progression
- Basic ladder series—12 weeks
- Skipping—12 weeks
- Walk/jog interval—12 weeks
- Linear acceleration/deceleration—16 weeks
- Sprinting—20 weeks
- Change of direction and lateral agility—20 weeks

Jumping Progression (*gradual progression)
- Low amplitude bilateral single response jumps—12-14 weeks
- Bilateral multiple response jumps—20 weeks
- Unilateral single response jumps—20 weeks

Sports Specific Activity Progression
- Interval golf program—20 weeks
- Non-contact and non-reactive field/court progression—20 weeks

Sports Test and Follow-up with Physician
- Follow-up examination with the physician
- Sports test for return to competition at 6 months

Phase IV Clinical Pearls

1. Ensure proper warm-up before performance of all plyometric and functional training. Continued soft tissue maintenance with foam roller and massage stick.
2. Skilled supervision by a coach, therapist or trainer is needed to evaluate the athlete during field/court progressions to ensure they are using proper acceleration, deceleration and cutting mechanics. Compensatory patterns can easily develop if left unaddressed leading to inefficiency and possible injury.
3. Proper recovery with ice, rest and pool work is essential to combat swelling with gradually increasing loads. Use sound clinical judgment by resting an athlete an additional 24 hours to allow full recovery from intense bouts when necessary.
4. Create variety in the weight room program design as outlined. In phase 4 cardiovascular and functional days should be more specific to the patient's sport. Remember, that each day can't be a high intensity day, otherwise a significant setback is inevitable. Heavy loading days should comprise 3 out of the 5-6 workouts in a given week. More load can be implemented when an athlete is able to break up the weight room and functional work in two separate times during the day. Many working adults don't have that luxury so it is important to structure a program that can be completed in about 90 minutes to ensure quality work.
5. Training at these higher levels calls attention to the importance of proper hydration and nutrition before, during and after the workout. Make sure the patient/athlete understands the importance of these two variables and their impact on the quality of exercise, the response to loading and the recovery afterward.