MPFL Reconstruction with Tibial Tubercle Osteotomy Physical Therapy Protocol

The following rehabilitation guidelines and protocol are developed for patients who have undergone MPFL (medial patellofemoral ligament) reconstruction WITH bone realignment procedure (tibial tubercle osteotomy) for patellar (kneecap) instability. This protocol is slower than a ligament only surgery, as we must respect the bone healing process. Exercises should be gradually progressed based upon protocol recommendations and criteria, physician discretion, and the patient's ability to perform the exercises correctly and without an increase in pain. This protocol has many notes relating to our philosophy and rationale behind the rehabilitation after your surgery, and we ask that you read them as you come across them as they may differ from your standard rehabilitation experience. There are some specific time points noted in this protocol for the initial stages largely due to the bone healing process, but as we move into the later stages of the protocol, progression should be largely based on achievement of milestones rather than the passage of time. Some patients recover more slowly than others, and that is fine provided steady forward progress is happening. This protocol is not designed to replace the judgment, communication, and experience of a skilled physical therapist. If at any point in the rehabilitation process there are concerns or questions that arise, please do not hesitate to contact us so that we can answer it to the best of our ability.

Key Considerations

Patient Education

It is important to take the time during initial evals, and then regularly throughout the course of rehabilitation, to discuss and review important considerations related to their injury. Remember that each patient will present with different post-surgical considerations, pain levels, goals, etc. Reviewing this information with the patient and what to expect throughout the rehabilitation is of paramount importance.

For the Physical Therapist

Arthrogenic Muscle Inhibition (AMI):

Arthrogenic muscle inhibition (AMI) is a common occurrence following knee surgery and limits the quadriceps ability to activate effectively. Clinicians can consider the use of neuromuscular electrical stimulation (NMES), cryotherapy, etc. to limit the effects of AMI and promote quadriceps activation.

Exercise Progressions/Loading:

All exercises should be performed with progression of loading variables as tolerated (increased repetitions, sets, weight, speed, etc.)

Maintenance of Strength in Uninvolved Limb

Start bilateral strength work (single leg exercises should be performed on the operative side AND uninjured side) by week 3-4 – it is critical to keep the uninvolved limb from becoming the involved limb

Movement Quality

It is important to evaluate the entire kinetic chain. The knee is controlled from above and below - poor hip/ankle mobility can create unnecessary stress on the reconstructed ligament, and poor hip adduction/IR strength or hyperpronation of the foot can result in lack of control of the knee.

Patellofemoral joint mechanics

Rehab of the extensor mechanism after patellar stabilization surgery requires understanding how anatomic variants (hip rotation, femoral version), poor lumbo-pelvic-hip control, and quadriceps control deficits can negatively affect the function of the patellofemoral joint. Specific care should be taken to avoid dynamic knee valgus and femoral internal rotation which can cause abnormal loads on the healing graft. Maintenance of neutral lower extremity alignment (anterior superior iliac spine over knee over 2nd toe) should be stressed throughout exercises and functional activities.

If at any time there are signs of infection (increased swelling, redness, drainage from the incisions, warmth, fever, chills or severe pain that is uncontrolled with the pain medication), or signs of DVT (calf swelling or tenderness, calf redness) please contact us at the office: 214-383-9356.

Milestones and Required Clinical Visits in MD's Office

- 2 weeks – Incision check
- 6 weeks – Motion check – new x-rays
- 12 weeks – Strength check – new x-rays
- 5-6 months – Performance check

Phase I: Max Protection Phase – First month after surgery	
Goals	- Gain control of pain and diminish joint swelling - Emphasis on regaining full passive extension as early as possible as well as gradual improvement of passive knee flexion - Increased quadriceps activation and reestablishing quad control - Protect ligament reconstruction and bone healing process from strain
Brace/crutches	**Week 0 – 2: Non weight-bearing** with two crutches at **all times**. **Week 2 – 4: Heel-touch weight bearing (10%)** with two crutches **Brace** is to be worn at all times except for showering/bathing, working with PT, or doing home exercises/stretches for the first 8 weeks. The brace is to be locked out in full extension during ambulation - Brace can be unlocked (range 0-90) when sitting or non-weightbearing starting after first visit with MD - Brace to be worn at night until released by MD
Suggested Exercises	**ROM** Week 0-2: No flexion past 90 Week 3-4: No flexion past 110 Patellar Mobilizations - Avoid lateral glides Extension ROM - Hamstring/gastroc stretching, etc. - Low load long duration knee stretching (heel prop) Flexion ROM - Heel/wall slides, etc. - Don't worry if flexion is tough to obtain in the earliest phase **Strength** Weeks 0-2: Calf pumps, quad sets, straight leg raise in brace, modalities Quadriceps strength/control - NMES • To be used with all quad exercises if quad is not effectively or efficiently firing • Utilize until able to perform 20 full range active terminal extensions - Short arc quad progression • Towel roll at heel → mid-gastroc → knee → decrease towel height to table - Floor-based core and glutes work - Ankle/calf work
Frequency & Duration	2x weekly formal PT, 2-3x daily home exercises/ROM work
Progression Criteria	Progress to phase 2 after 1 month postop

Phase II: Early Motion/Healing Phase

Goals	- Gain control of pain and diminish joint swelling - Restoration of patellar mobility (suprapatellar/infrapatellar fat pad) - Emphasis on regaining full passive extension as early as possible as well as gradual improvement of passive knee flexion - Increased quadriceps activation and reestablishing quad control - Protect ligament reconstruction and bone healing process from strain
Brace/crutches	**Week 4 – 6: May progress to weight bearing as** tolerated (add 25-50% per week) with brace locked at 0. **Week 6 – 8: Advance to normal gait pattern.** Crutches may be discontinued once sufficient quad control is demonstrated. **Brace** is to be worn at all times except for showering/bathing, working with PT, or doing home exercises/stretches for the first 8 weeks. The brace is to be locked out in full extension during ambulation until 20 *excellent* straight leg raises without any extension lag can be performed - Brace can be unlocked (range 0-90) when sitting or non-weightbearing, off at night
Suggested Exercises	**ROM** Patellar Mobilizations - Avoid lateral glides Extension ROM - Hamstring/gastroc stretching, etc. - Low load long duration stretching (heel prop/prone hang) • Patient should be doing extension stretching multiple times daily starting as early as day of surgery Flexion ROM - 0-110 limited until post-op week 6, then progress as tolerated with maintenance of full extension - Heel/wall slides, etc. - Don't worry if flexion is tough to obtain in the earliest phase
Suggested Exercises	**Strength** Quadriceps strength/control - NMES • To be used with all quad exercises if quad is not effectively or efficiently firing • Utilize until able to perform 20 full range active terminal extensions - Short arc quad progression • Towel roll at heel → mid-gastroc → knee → decrease towel height to table - Initiate weight shifting - Closed chain for quad exercises for first 8 weeks - Standing terminal knee extensions - Floor-based core and glutes work - Hamstring curls Ok to begin bicycle after 6 weeks once flexion is easy to 110 degrees, make sure seat is set to appropriate height to avoid unnecessarily deep knee flexion Note on blood flow restriction: BFR has excellent results in preventing atrophy and producing muscle hypertrophy, particularly in non weightbearing patients, but only once there is good voluntary contraction of the quads.

	Balance/proprioception: Weight shifts (body weight) sagittal/frontal planes - Progress to single leg balance, add visual restriction etc. Gait training drills - Retro walking, cone step overs, etc.
Frequency & Duration	2-3x weekly formal PT, 2-3x daily home exercises/ROM work
Progression Criteria	Must meet **ALL** criteria prior to progressing into phase 3: 1. Full knee active range of motion: > 0-120 with side to side knee extension difference ≤ 5° 2. Minimal complaints of pain and swelling in the surgical knee 3. Complete 20 repetitions of a straight leg raise with no extension lag 4. Perform single leg balance of the surgical limb on a solid surface for 1 minute (0-20 degrees of knee flexion allowed) 5. Adequate bone healing determined by MD on xrays

Phase III: Motion and Strengthening	
Goals	- Improve single limb strength (emphasis on eccentric strengthening and neuromuscular control). - Develop strength and stability in all planes of motion (sagittal, frontal, transverse planes) and under various proprioceptive conditions while focusing on achieving proper trunk, knee, and ankle alignment. - Increase external focus of control with feedback and instructions - Improve cardiovascular fitness and muscle endurance
Precautions	**Brace** will likely be discontinued at week 8 provided excellent quad control is present. Occasionally the brace is transitioned to a patellar stabilizing (tru-pull) style brace
Suggested Exercises	*Increase repetitions, weight, and visual manipulation of phase 2 exercises, plus:* **ROM** Continue to progress flexion with goal of symmetry to contralateral side **Strength** Squat movement pattern (keep flexion <90 degrees until week 10) - Lunge → lateral step down → single leg squat → resisted single leg squats - Use shuttle/leg press to help bridge gap between stages Hip hinge movement pattern - Double leg deadlift → single leg deadlift Bilateral lower extremity strength - Continue progression of all phase 1 exercises **Balance/proprioception** – neuromuscular training (see note)
Frequency & Duration	2-3x weekly formal PT, daily home exercises/stretching
Progression Criteria	Must meet **ALL** criteria prior to progressing into Phase 4: 1. Full knee active range of motion: no side to side active knee extension difference 2. Minimal complaints of pain and swelling in the surgical knee 3. Normalized gait 4. Single limb squat for 1 minute without resistance using Vail Sport Cord criteria (testing protocol online)

Neuromuscular Based Training

We believe that heavy emphasis on proprioceptive exercises to include perturbation and reactive training beginning around 2 months postoperatively creates positive outcomes in regard to restoring neuromuscular pathways in the body. It may sound trite, but we are not treating a knee, we are treating a person who has a knee injury. The knee is a complex joint of bone, cartilage, ligaments, etc, but the neuroreceptors within these structures and their connections to their controlling muscle, as well as the processing centers and programming for knee joint movement in the brain are underappreciated and often under-rehabbed.

Phase IV: Introduction to Landing/Impact, Return to Running	
Goals	- Increase the intensity of training - Improve the strength foundation - Incorporate functional balance activities utilizing muscle strength, proprioception, and UE manipulation - Start progression of running program
Suggested Exercises	*Increase repetitions, resistance, and speed of movement of earlier phases, plus:* **Landing Progression** Proper eccentric control must be taught before jumping/running can begin - 2-leg to 2-leg with hold → 2-leg to 1-leg with hold → 1-leg to 1-leg with hold - 2-leg to 2-leg repeated → 2-leg to 1-leg repeated → 1-leg to 1-leg repeated **Bodyweight Assisted Running** Alter-G and pool running can be a great adjunct in preparation to run, as it allows for introduction to impact without need for full resistance of gravity as the patient continues to become stronger. Patients will become more comfortable with running technique as well. **Reactive Exercises** Cognitive challenges applied during exercise/activity allow for attentional focus to be directed away from task at hand, similar to in sport. This is important for patients as they progress from a period of internal to external focus during activity. - Visual (stroboscopic glasses, etc.) - Cognitive (completing math problems, etc.) - Coordination (catching different colored items, touching different items, etc.) **Interval Running Program** Utilize a program focused on progression of running volume while utilizing walking rest - Find example program online at www.parkerorthopedics.com → Patient Resources → Rehab Protocols → Return to Running **Multi-planar Movements** Introduction of horizontal and transverse plane movements, starting with static and progressing to dynamic in preparation of jumping in other planes - Static (lateral lunges in place, etc.) - Dynamic (lateral lunges, curtsy lunges, single leg balance with rotation, etc.) - Jumping (2-leg → 1-leg lateral/rotational bounding → hopping, etc.)
Frequency & Duration	2x weekly formal PT with 4x weekly home exercises
Progression Criteria	Must meet **ALL** criteria prior to progressing into Phase 5: 1. Y-balance testing, single leg hop, single leg triple hop within 10% of uninjured leg 2. Display IKDC score of ≥ 60 3. Be able to perform 30 single leg calf jumps with minimal assistance for balance 4. Complete jump landing progression with good neuromuscular control

Return to Running

Our protocol for return to running is slow compared to the standard for our area as we believe that running prior to excellent strength and motor control can allow for maladaptive gait patterns and neuromuscular programming that can be very difficult to overcome once set in the brain. By pushing the return to full body weight running further back, we have found improved results with being able to run with a normal gait and no increase in anterior knee pain, which translates to a sense of enjoyment and success with running to the athlete, rather than apprehension or dread. This allows for more rapid progression of sport specific activities rather than languishing in the running phase for too long due to abnormal gait or increased knee pain.

Phase V: Return to Sport	
Goals	- Progress movements geared toward speed, power, and function based upon sport and position requirements. - Incorporate reactive functional balance activities that require athlete to react to changing environment of their particular sport. - Re-integrate into team activities
Suggested Exercises	*Increase repetitions, resistance, and speed of movement of earlier phases and in multi-planar movements as athlete now reacts to changing demands of the environment, plus:* **Cutting/Pivoting** Movements should be in a graded manner, starting with activities that have lower cognitive load at lower speeds and progressing to more anticipatory activities at higher speeds - Introductory (planned 30º cut, planned forward to backward running, etc.) - Intermediate (planned 45º cut, reactive forward to backward running, etc.) - Advanced (reactive 90º cut, mirror drills with partner, etc.) **Power/Rate of Force Development (RFD)** Important to focus on increasing speed of exercises at this stage, as athlete is normalizing overall strength but will likely be lacking proper RFD for sport activities **Bridge Program** Connect athlete with qualified sports performance personnel 2 to 3 days per week to work on speed, agility, and functional performance within their respective sport **Sprinting Progression** Utilize a program focused on progression of sprinting volume and intensity
Frequency & Duration	1-2x weekly formal PT, 2-4x weekly exercises with athletic trainer/coach/home
Progression Criteria	- Must see MD for full clearance to return to competitive sports. Return to sport testing including strength and motion analysis will be performed prior to this visit. Our primary goal of return to sport testing is to prevent reinjury to the surgical knee AND injury to the other knee. In young athletes, the risk of another injury to their knee on return to sport can be as high as 30-40%. However, that injury rate after they have been documented as PASSING all return to sport criteria is 5%. Half of all new or re-injuries occur within the first ~70 practices and games, because people just aren't ready.