



Main Line Health®

Orthopaedics & Spine

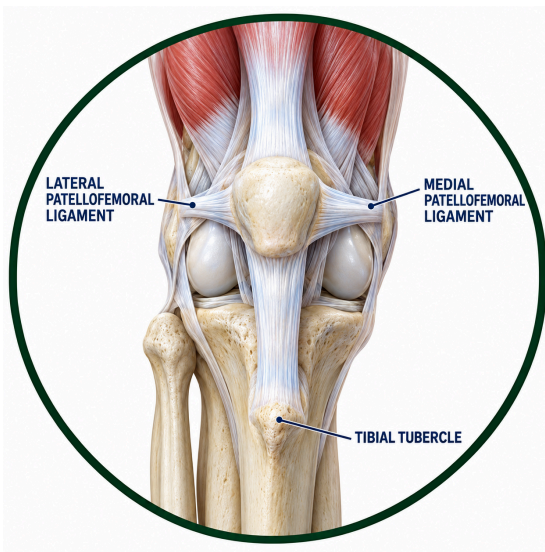
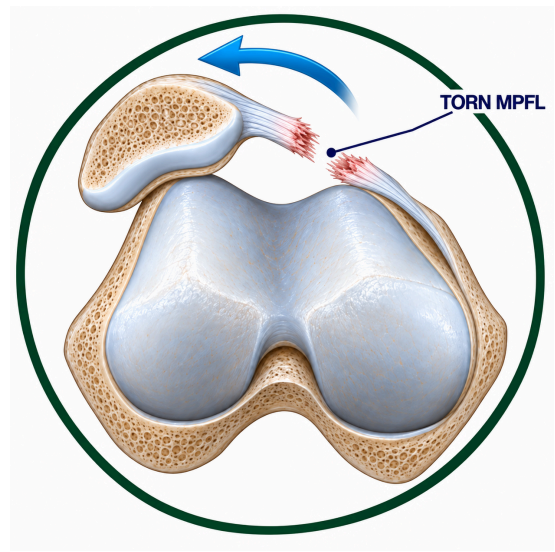
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PATELLAR STABILIZATION: MPFL RECONSTRUCTION +/- TIBIAL TUBERCLE OSTEOTOMY

Understanding the Injury

The patella (kneecap) glides in a groove at the end of the femur (thighbone) called the trochlea. The quadriceps muscles attach to the patella, which connects to the tibia (shinbone) through the patellar tendon, allowing the knee to straighten with power.

The medial patellofemoral ligament (MPFL) runs from the inner edge of the patella to the femur and is the main restraint that keeps the patella from sliding toward the outside of the knee. It is torn in nearly every patellar dislocation.



A dislocation most often occurs with a twisting or pivoting movement on a bent knee, or from a direct blow. The patella slides out of its groove toward the outside of the knee, followed by pain and swelling; many patellae relocate on their own when the knee is straightened. A partial slip that returns on its own is called a subluxation and often feels like the knee giving way.

After a first dislocation, many patients recover well with rehabilitation alone. Some patients, however, have a higher risk of recurrence because of a shallow trochlear groove (trochlear dysplasia), a high-riding patella (patella alta), or a tibial tubercle positioned too far to the outside. Repeated dislocations can damage the cartilage of the patella and femur.

Diagnosis of Patellar Instability

Diagnosis is made through your history and a physical examination of patellar tracking and stability. X-rays show the position and height of the patella and the shape of the trochlear groove. An MRI evaluates the MPFL, cartilage injury, and loose fragments, and can measure how far the tibial tubercle sits to the outside of the groove (the TT-TG distance). Dr. Fliegel will review all findings with you before recommending a treatment plan.

Do You Need Surgery?

Most first-time dislocations are treated without surgery, using a brace and a focused strengthening program for the quadriceps and hip muscles. Surgery is typically recommended for recurrent dislocations, for a first dislocation with a loose cartilage or bone fragment that needs to be repaired or removed, or when anatomic risk factors make another dislocation likely.

The goal of surgery is to restore stability so the patella tracks within its groove, protecting the cartilage and allowing a safe return to activity.

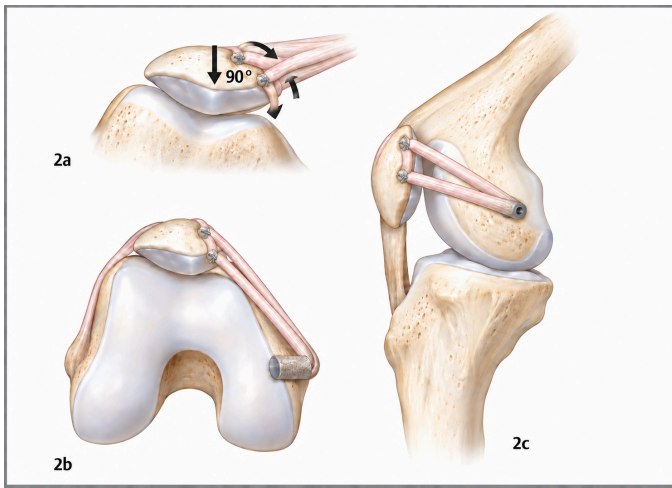
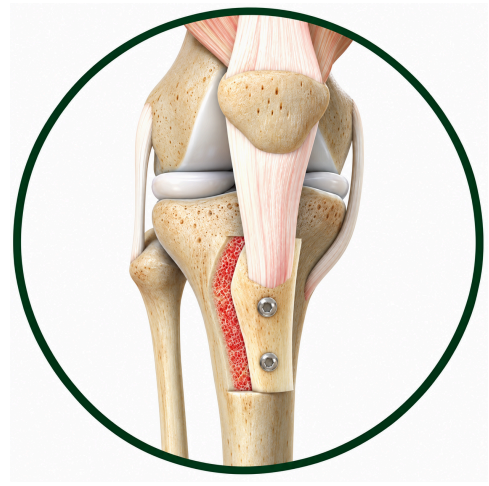
Patellar Stabilization Surgery

MPFL reconstruction replaces the torn ligament with a tendon graft, either from your own hamstring or a donor (allograft) tendon. Through small incisions, the graft is anchored to the inner edge of the patella and to the femur at the ligament's natural attachment point, restoring the restraint that keeps the patella in its groove. Arthroscopy is often performed at the same time to evaluate and treat any cartilage injury or loose fragments.

A tibial tubercle osteotomy (TTO) may be added when the tibial tubercle, where the patellar tendon attaches, sits too far to the outside or too high. Through an incision below the knee, the tubercle is cut, shifted — most often toward the inside and slightly forward — and secured with two screws. This realigns the pull of the quadriceps and can offload damaged cartilage. The screws may be removed later if they become bothersome once the bone has healed.

Dr. Fliegel will discuss which procedure, or combination of procedures, best suits your anatomy. Because a TTO involves a bone cut that must heal, recovery after TTO is more protected in the early weeks than after MPFL reconstruction alone.

Expected Outcomes and Surgical Risks



Most patients who undergo patellar stabilization have no further dislocations and return to their desired activities. Patients with pre-existing cartilage damage may continue to have some kneecap pain or grinding, although knee function usually improves.

Potential risks and complications include:

- Stiffness or loss of knee motion
- Persistent kneecap pain or grinding
- Recurrent instability or graft failure; rarely, patella fracture
- After TTO: delayed bone healing, painful screws, or, rarely, fracture of the tibia
- Wound infection, blood clot, or nerve injury (uncommon)

Return-to-activity timelines are guidelines – jogging typically begins around 3 to 4 months, with return to sport around 5 to 6 months after MPFL reconstruction and often 6 months or longer after TTO – with advancement determined by strength testing and clinical criteria, not calendar time alone.

PRE-OPERATIVE INSTRUCTIONS

Surgery Preparation Guide

Your preparation before surgery plays an important role in a smooth procedure and recovery. Please review the timeline below carefully.

Several Weeks Before Surgery

(As directed by Dr. Fliegel and the surgical team)

- Attend your pre-operative visit for a full history, physical examination, and surgical counseling.
- Work on full knee motion and quadriceps strength before surgery, as directed.
- Establish care with a physical therapist before surgery if possible.

Arrange your home: confirm your hinged knee brace, crutches, ice machine or ice packs, and a shower stool are in place before surgery.

Several Days Before Surgery

- Wash the knee and leg with Hibiclens (chlorhexidine) surgical soap twice daily for 3 days before surgery.
- Avoid cuts, scrapes, sunburn, or any skin irritation near the knee. Do not shave the surgical area.

The Day Before Surgery

- Confirm your hospital arrival time with our office.
- Arrange for a responsible adult to drive you home and stay with you for the first 24 hours.

The Day of Surgery

- Bring any MRI, CT, or X-ray studies performed outside our system.
- Bring your knee brace and crutches if previously provided.
- Bring insurance cards, photo identification, a list of your current medications, and loose-fitting shorts that will fit over a knee brace.

PATELLAR STABILIZATION REHABILITATION PROTOCOL

This protocol is a guideline for both patients and physical therapists. Progression from one phase to the next is determined by meeting criteria, not calendar time alone. Please provide your physical therapist with a copy of this protocol. Where the protocol differs after a tibial tubercle osteotomy (TTO), this is noted.

The primary goals are to:

Protect the reconstruction (and osteotomy, if performed) while it heals

Restore full knee extension and progressive flexion

Reduce swelling and restore quadriceps control

Rebuild strength, balance, and neuromuscular control

Safely return to work, recreational, and sport activity

PHASE I: MAXIMUM PROTECTION (0–2 Weeks)

Goals

- Protect the reconstruction — avoid falls and twisting
- Maintain full knee extension
- Begin gentle, controlled knee flexion, progressing toward 90° by 6 weeks
- Reduce swelling and pain; establish quadriceps activation

Brace and Weight Bearing

- MPFL reconstruction: weight bearing as tolerated with crutches, in a hinged brace locked in full extension for walking; the brace may be unlocked for sleeping, exercises, and rest

- After TTO: protected (partial) weight bearing with crutches and the brace locked in extension for approximately 6 weeks to protect the bone cut, as directed by Dr. Fliegel
- Do not place a pillow under the knee

Range of Motion (Protected)

- Heel prop to maintain full extension; seated assisted knee flexion and heel slides as comfortable
- Patellar mobilizations by your therapist, with NO lateral (outward) glides
- If you are not progressing toward 90° of flexion, notify our office before your 6-week visit

Exercises

- Quadriceps sets; your therapist may use electrical stimulation to help re-educate the muscle
- Straight leg raises with the brace locked in extension (after TTO, only as directed), pillow squeezes, and ankle pumps at least 10 times each hour
- Ice 15–20 minutes several times a day; compression stocking below the knee as directed

Advancement Criteria

- Full passive knee extension
- Good quadriceps set with visible terminal knee extension
- Pain and swelling controlled
- Incision healing well; sutures removed at your first post-operative visit

PHASE II: PROTECTED MOTION (2–6 Weeks)

Goals

- Protect the reconstruction — avoid falls, twisting, and pivoting
- Maintain full extension; achieve at least 90° of flexion by 6 weeks
- Wean from crutches (MPFL reconstruction alone) and build quadriceps control

Brace and Weight Bearing

- MPFL reconstruction: wean from crutches as tolerated; keep the brace locked for walking until your leg control is stable, then unlock as directed
- After TTO: continue protected weight bearing with the brace locked in extension until cleared at the 6-week visit

Range of Motion

- Continue Phase I range-of-motion work, progressing toward 90° of flexion by 6 weeks
- Stationary bicycle with no resistance once motion allows a full revolution
- Gentle hamstring and calf stretching

Strengthening

- MPFL reconstruction (around weeks 4–6): limited-range leg press and mini squats, step-ups, clamshells, bridges, heel raises, and hip strengthening with tubing
- Standing terminal knee extension, weight shifts, and early balance work
- After TTO: limit strengthening to quadriceps sets, side-lying hip abduction, and exercises for the other limbs until cleared

Precautions

- Avoid falls, twisting, and pivoting on the knee
- No running, jumping, or knee extension machine, and avoid any exercise that causes pain or grinding at the kneecap

Advancement Criteria

- Knee flexion of at least 90°
- Full straight leg raise without extension lag
- No increase in pain or swelling
- After TTO: X-rays showing bone healing at the 6-week visit

PHASE III: PROGRESSIVE STRENGTHENING (6–12 Weeks)

Goals

- Progress to full range of motion
- Walk normally without brace or crutches
- Safely progress closed-chain strengthening and single-leg control

Range of Motion

- Discontinue the brace when directed by Dr. Fliegel, typically around 6 weeks; after TTO, progress to full weight bearing once cleared
- Progress to full range of motion and walk with a normal heel-to-toe gait; no running, jumping, or pivoting yet

Strengthening

- VMO (inner quadriceps) strengthening, short arc quads, straight leg raises, and hip strengthening with ankle weights, starting at 1 pound and adding 1 pound per week up to 5 pounds
- Leg press, wall slides, and chair squats to about 45–60°, standing hamstring curls, and single-leg calf raises
- Step-up/step-down progression (3 to 6 to 9 inches), advancing only if there is no pain or grinding at the kneecap
- Balance training on unstable surfaces; stationary bicycle and swimming for conditioning

Precautions

- No running, jumping, pivoting, squats past 90°, or full-range knee extension machine; avoid exercises that overload the kneecap

Advancement Criteria

- Full range of motion equal to the other side
- Normal gait on all surfaces, including stairs
- Single-leg step-down, wall slide, and squat with good control and no kneecap pain

PHASE IV: ADVANCED STRENGTHENING AND RUNNING (12–20 Weeks)

Goals

- Regain full, symmetric lower extremity strength
- Begin a structured running program, typically around 12 to 16 weeks, with surgeon clearance
- Begin low-level plyometrics: straight-line, forward/backward, and side-to-side jumping, progressing as tolerated

Strengthening

- Leg press, hamstring curls, Roman chair, hip abductor/adductor machine, and calf raises: 3 sets of 15, 3 times per week
- Single-leg progression: step-ups, single-leg wall slides, and single-leg squats (limit knee bend to 45–60°), adding dumbbells once 3 sets of 10 are easy
- Lunges and the Stairmaster may be added once cleared, if pain-free at the kneecap

Running Progression

- Begin once quadriceps strength is approximately 80% of the other side and you can jog 100 feet without a limp
- Progress from treadmill walk/jog intervals to treadmill running, then track running (straights, then turns), then road running

Avoid

- Running on back-to-back days early in the progression
- Pain, swelling, or grinding at the kneecap during running or jumping — if it occurs, return to the previous step

PHASE V: AGILITY AND RETURN TO SPORT (16 Weeks – 6+ Months)

Goals

- Advance to structured speed, agility, and direction-change training
- Advance plyometrics to single-limb and multi-plane tasks
- Achieve full, unrestricted return to sport with symmetrical performance

Progression

- Plyometrics progressing from double-leg to single-leg: side-to-side BOSU jumps, box hops, and single-leg squats on a trampoline

- Running drills: shuttle sprints, stop-and-go, zig-zag, sideways and backward running, then sprinting with cutting and pivoting (typically 16 to 20 weeks)
- Single-leg exercises with perturbations, and single-leg balance with ball toss
- Return to sport typically 5 to 6 months after MPFL reconstruction and often 6 months or longer after TTO: non-contact practice, then full practice, then competition; a patellar stabilizing brace may be recommended

Return-to-Sport Criteria

- Single-leg hop tests within 10–15% of the other side
- Quadriceps, hamstring, and hip strength at least 90% of the other side
- No apprehension, pain, or swelling with cutting and jumping; surgeon clearance obtained

Key Rehabilitation Principles

- Continue quadriceps, hip, and single-leg strength training 2 times per week after returning to sport — strong thigh and hip muscles help keep the patella tracking well long-term.
- Activities to avoid until cleared: resisted knee extension through a full range, deep squats and lunges, running before Phase IV criteria are met, and pivoting or cutting before Phase V. After a TTO, protected weight bearing for the first 6 weeks is essential to let the bone heal.
- Contact our office for fever, increasing redness or drainage from the incision, significant calf swelling or pain, uncontrolled pain, or inability to straighten the knee.
- Please arrange to return to Dr. Fliegel's office 7 to 10 days after surgery, again at 6 weeks, and again at 3 months.