

KNEE

Tibial Tubercle Osteotomy (TTO)

Surgery Date: _____

Progressions are time- and criterion-based and depend on osteotomy configuration, fixation, bone healing, concurrent procedures, patient factors, and clinician evaluation. The operative note and surgeon instructions take precedence. Contact the surgeon before advancing if healing, symptoms, or procedure-specific restrictions are unclear.

Phase I (Weeks 0 - 6): Immediate Postoperative / Osteotomy Protection

Brace

- Hinged knee brace locked in full extension for ambulation and sleeping unless the surgeon directs otherwise.
- Unlock only for supervised range-of-motion exercises.
- Brace progression depends on quadriceps control and surgeon clearance.

Weight Bearing

- Toe-touch weight bearing with crutches for 6 weeks.
- Do not advance weight bearing until the surgeon has evaluated clinical and radiographic healing.
- Avoid falls, twisting, pivoting, and unprotected ambulation.

Range of Motion

- Weeks 0-2: PROM/AAROM 0-30 degrees.
- Weeks 2-4: progress to 0-60 degrees.
- Weeks 4-6: progress to 0-90 degrees.
- Restore full extension; do not force flexion. Distalization or concurrent cartilage procedures may require slower progression.

Rehabilitation Goals

- Protect the osteotomy and fixation.
- Control pain and effusion.
- Restore full knee extension and quadriceps activation.
- Maintain hip, core, ankle, and contralateral-limb strength.

Therapeutic Exercise

- Ankle pumps, quadriceps sets, and straight-leg raise only without extension lag.
- Hip strengthening and core stabilization with the brace on as needed.
- Patellar mobility only as directed when concurrent MPFL reconstruction or cartilage treatment is present.

Precautions / Contact Surgeon

- No running, jumping, impact loading, open-chain resisted knee extension, or pivoting.
- Contact the surgeon for wound concerns, increasing pain/swelling, loss of motion, calf symptoms, a fall, or inability to perform a straight-leg raise.

Phase II (Weeks 6 - 12): Protected Loading / Motion Restoration

Progression Criteria

- Surgeon review with satisfactory clinical and radiographic osteotomy healing.
- Pain and effusion controlled; full extension; improving quadriceps control.

Weight Bearing / Brace

- Progress weight bearing gradually with crutches; goal of full weight bearing and normalized gait by approximately 8 weeks when cleared.
- Unlock and discontinue the brace only when cleared and the patient demonstrates adequate quadriceps control without extension lag.

Range of Motion

- Progress toward full, symmetrical motion as tolerated after clearance.
- Continue to avoid forced flexion or motion that increases pain or effusion.

Therapeutic Exercise

- Stationary bicycle when motion permits and the surgeon clears.
- Progressive quadriceps, hamstring, hip, and core strengthening.
- Begin controlled closed-chain loading, balance, and proprioception within healing and symptom limits.
- Avoid impact activity and aggressive anterior-knee loading.

Phase III (Weeks 12 - 20): Strength / Movement Control

Progression Criteria

- Radiographic healing confirmed and full weight bearing with a normalized gait.
- Full or near-symmetrical motion; trace or no effusion; no reactive pain after exercise.

Therapeutic Exercise

- Progress resistance training and single-leg control.
- Step-up, step-down, squat, and leg-press progressions with appropriate alignment and load.
- Advance cardiovascular conditioning with bicycle, elliptical, pool, or other low-impact methods.
- Begin a graded running program no earlier than approximately 16 weeks and only after surgeon clearance and criteria are met.

Criteria to Initiate Running

- Radiographic osteotomy healing confirmed.
- Full, pain-free range of motion and no reactive effusion.
- Normalized gait and single-leg movement mechanics.
- Quadriceps strength at least 70-80% of the opposite limb, using an appropriate objective test.

Phase IV (Weeks 20 - 36+): Return to Activity / Sport

Rehabilitation Goals

- Restore strength, power, endurance, confidence, and sport-specific movement quality.
- Progress from linear running to controlled change of direction, plyometrics, and sport-specific activity.

Return-to-Sport Criteria

- Radiographic healing and physician clearance.
- Full, pain-free, symmetrical motion with no reactive effusion.
- Quadriceps and hamstring strength at least 90% of the opposite limb.
- Functional hop or equivalent performance testing at least 90% limb symmetry with acceptable mechanics.
- Completion of graded sport-specific progression without pain, instability, apprehension, or swelling.
- Return is criterion-based and commonly requires 6-9 months or longer, especially with distalization, MPFL reconstruction, cartilage treatment, or other concurrent procedures.

Procedure-Specific Modifications

Concurrent Procedures

- When TTO is combined with MPFL reconstruction, the more protective restriction governs; follow the surgeon-selected combined plan.
- Cartilage restoration, meniscus repair, ligament reconstruction, distalization, revision surgery, or additional osteotomy may require different weight-bearing, motion, strengthening, and return-to-sport restrictions.
- This protocol must not be used as a substitute for the operative note or surgeon-selected protocol.

Evidence Basis

Evidence limitation: TTO rehabilitation is heterogeneous. Available accelerated-rehabilitation studies are mainly retrospective case series, and systematic reviews identify limited objective return-to-sport criteria. This protocol uses protected loading and radiographic healing gates.

1. Morgan C, et al. Effectiveness of an Accelerated Rehabilitation Protocol After Tibial Tubercle Osteotomy. *Orthop J Sports Med.* 2022;10(11). doi:10.1177/23259671221133105.
2. Chatterji R, et al. Return-to-Play Guidelines After Patellar Instability Surgery Requiring Bony Realignment: A Systematic Review. *Orthop J Sports Med.* 2020;8(12). doi:10.1177/2325967120966134.
3. Lampros RE, Tanaka MJ. Return to Play Considerations After Patellar Instability. *Curr Rev Musculoskelet Med.* 2022;15(6):597-605. doi:10.1007/s12178-022-09792-1.
4. Saper MG, et al. Tibial Tubercle Osteotomy in the Adolescent Patient. *JPOSNA.* Contemporary review; postoperative progression varies by osteotomy type and radiographic healing.
5. Evaluation of an Active Rehabilitation Program With Early Weightbearing and No Immobilization After Tibial Tubercle Distalization. *Orthop J Sports Med.* 2024. doi:10.1177/23259671241287169.
6. DeNovio AC, et al. Incidence of Complications, Recurrent Instability, and All-Cause Reoperations After Tibial Tubercle Osteotomy for Patellofemoral Instability: A Systematic Review and Meta-analysis. *Orthop J Sports Med.* 2025;13(9). doi:10.1177/23259671251374307.