The Physical Root

Total Knee Replacement Rehabilitation Protocol

Criteria-based guidance for primary total knee arthroplasty (TKA)

Purpose

A clinician-facing framework for safe, progressive rehabilitation after uncomplicated primary TKA. Timing is approximate. Progression is based on wound status, irritability, range of motion, quadriceps control, gait quality, function, and the operating surgeon's instructions.

Protocol at a glance

Phase	Typical timing	Primary priorities
0. Readiness	Before surgery	Education, baseline measures, equipment and discharge planning
1. Protection and activation	Day 0 to week 2	Safety, swelling control, extension, quadriceps activation, independent mobility
2. Motion and gait	Weeks 2 to 6	Normalize gait, restore functional ROM, build foundational strength
3. Strength and capacity	Weeks 6 to 12	Progressive resistance, balance, stairs, endurance, work demands
4. Return to participation	Week 12+	Independent training, occupational/recreational readiness, long-term joint health

Design principles

- Use a criteria-based approach rather than calendar time alone.
- Prioritize full knee extension early; advance flexion with symptom-guided dosing rather than forceful stretching.
- Monitor the 24-hour response. If pain, warmth, swelling, stiffness, or gait worsens and does not settle by the next day, reduce dose or intensity.
- Pair impairment treatment with meaningful tasks: transfers, walking, stairs, work, sleep, and valued activity.
- Escalate concerns early when recovery deviates from the expected trajectory.

1. Scope, precautions, and clinical decision rules

Applies to: adults after uncomplicated primary unilateral TKA. This document is not intended to supersede the operative report, surgeon communication, facility policy, or individualized restrictions.

Adapt or obtain explicit clearance for: revision TKA; bilateral procedures; extensor mechanism repair; fracture or oncologic reconstruction; constrained implants with special precautions; wound complications; neurological disease; substantial cardiopulmonary limitation; uncontrolled diabetes; dialysis; significant cognitive impairment; or other comorbidity affecting exercise safety.

Urgent and emergent escalation

Finding	Recommended action
Chest pain, severe shortness of breath, syncope, new confusion, or signs of stroke	Activate emergency response / call emergency services.
Possible pulmonary embolism: unexplained dyspnea, pleuritic chest pain, hemoptysis, marked tachycardia, or oxygen desaturation	Emergency medical evaluation. Do not continue therapy.
Possible deep vein thrombosis: new unilateral calf/thigh swelling, pain or tenderness, warmth, color change, or rapidly increasing limb girth	Stop treatment and follow the surgeon/facility pathway for same-day medical assessment. Do not massage the limb.
Possible infection or wound complication: drainage, dehiscence, spreading redness, increasing warmth, purulence, fever, chills, or an abrupt pain increase	Contact the surgeon promptly; same-day assessment when clinically concerning.
New motor/sensory deficit, foot drop, severe unremitting pain, loss of distal pulse, or disproportionate swelling	Urgent surgical or emergency evaluation.

Medication and wound boundaries

Physical therapy should reinforce, not independently alter, the surgeon's instructions for anticoagulation, analgesics, antibiotics, compression, dressings, bathing, or driving. Avoid lotions, topical agents, or direct scar work until the incision is fully closed and cleared.

Key monitoring variables

- Pain at rest and with loading; night pain; analgesic timing and adverse effects reported by the patient.
- Effusion/swelling, temperature, bruising, incision status, and distal neurovascular findings.
- Knee extension and flexion measured consistently; patellar mobility when incision status allows.
- Quadriceps activation, straight-leg raise lag, gait quality, assistive-device fit, transfers, stairs, and fall risk.
- Vital signs and exertional response when indicated; sleep, confidence, home support, and adherence.

2. Phase 0 - preoperative readiness

Typical timing: one or more sessions before surgery, when available.

Goals

- Set expectations for recovery and the criteria-based nature of progression.
- Record baseline ROM, strength/function, gait, device use, home barriers, work demands, and patient-reported outcome measures.
- Teach swelling management, positioning for extension, safe transfers, walker/crutch use, and the initial home exercise routine.
- Coordinate equipment, transportation, caregiver support, and discharge destination.

Suggested baseline measures

Knee extension/flexion; 5 Times Sit-to-Stand or 30-Second Chair Stand when safe; Timed Up and Go; usual gait speed or 6-Minute Walk Test as appropriate; stair performance; and a validated patient-reported measure such as KOOS-JR or PROMIS Physical Function.

3. Phase 1 - protection, symptom control, and activation

Typical timing: day 0 through week 2. **Visits:** based on setting, surgical pathway, medical need, and functional status.

Goals

- Protect the incision and reduce preventable complications.
- Achieve safe, independent bed mobility, transfers, household ambulation, and required stairs with the least restrictive safe device.
- Restore active quadriceps control and minimize extension loss.
- Progress flexion sufficient for transfers and basic activities without provoking persistent irritability.
- Establish an independent home program and clear escalation instructions.

Interventions

Domain	Examples and dosing guidance
Education / swelling	Frequent short bouts of walking; limb elevation with knee supported to encourage extension; compression and cryotherapy if permitted and sensation/circulation are intact. Avoid prolonged dependent positioning.
ROM	Low-load extension positioning (heel supported, knee unsupported); active/active-assisted heel slides; seated flexion; gentle patellar mobility only when incision status and surgeon guidance permit. Avoid aggressive, high-irritability stretching.
Activation	Ankle pumps; quadriceps sets; gluteal sets; short-arc or terminal knee extension as tolerated; straight-leg raise only when performed without a clinically meaningful lag. Consider NMES for poor quadriceps activation using an adequately strong, tolerable contraction and appropriate screening.
Function	Sit-to-stand from an appropriate surface; bed/chair/toilet transfer practice; gait training with walker or crutches; step-to stair sequence initially when needed.
Dose	Several brief sessions daily are often better tolerated than one long session. Use symptom response during exercise and over the following 24 hours to adjust volume.

Avoid

- A pillow or rolled towel directly behind the knee for prolonged rest.
- Forcing flexion through guarding or high pain.

- Walking without an assistive device when gait is unstable, antalgic, or the knee buckles.
- Open-chain resistance that exceeds tissue tolerance or worsens joint irritability.

Phase 1 progression criteria

Progress when most are present	Hold, regress, or communicate when
Incision is stable; swelling is controlled or trending down; pain is manageable; transfers and household gait are safe; active extension control is improving; knee extension is near neutral and flexion is progressing; home program is understood.	Worsening drainage/redness; systemic symptoms; escalating calf symptoms; repeated knee buckling; inability to manage the home setting; progressive ROM loss; severe pain or swelling after routine loading; absent functional progress.

ROM trajectory

A common clinical target is restoration of full or near-full extension during the first several weeks and functional flexion that continues to improve through weeks 4 to 6. Exact numbers vary with preoperative motion, implant/surgeon factors, swelling, tissue response, and goals. A plateau or loss of motion should trigger reassessment and timely communication, not simply more force.

4. Phase 2 - restore motion, gait, and foundational strength

Typical timing: weeks 2 to 6. Entry depends on medical stability, wound status, and functional readiness.

Goals

- Progress toward full active knee extension and functionally useful flexion.
- Walk safely with improving symmetry and transition to the least restrictive device without compensatory gait.
- Improve quadriceps, hip, and calf capacity for transfers, stairs, and community mobility.
- Reduce effusion and recover from exercise by the next day.
- Improve confidence and independence with the home program.

Interventions

Domain	Progression options
ROM / mobility	Continue extension and flexion mobility; stationary cycling for motion, initially partial revolutions if needed; soft-tissue or joint techniques selected from examination and applied without compromising wound healing.
Strength	Sit-to-stand; mini-squat or supported squat; bridge; heel raises; step-ups starting low; hip abduction/extension; resisted knee extension in a tolerable arc; hamstring work as appropriate. Progress load before adding excessive repetition.
Gait / balance	Device weaning based on gait quality, not convenience; weight-shift and stance-control drills; obstacle negotiation; tandem or narrow-base tasks with support; stair retraining.
Conditioning	Short, frequent walks progressing duration; recumbent or upright bike as ROM and transfer safety permit; low-impact aerobic work with modest perceived exertion.
Adjuncts	NMES when activation deficits persist. Blood-flow restriction may be considered only by trained clinicians after formal contraindication screening, individualized pressure determination, and medical coordination when indicated.

Device-weaning criteria

- No recurrent buckling or unsafe loss of balance.
- Adequate stance control and foot clearance.
- No clinically meaningful increase in trunk lean, hip hiking, circumduction, or shortened stance time.
- Symptoms and swelling remain stable during and after the transition.

5. Phase 3 - progressive strength, balance, and capacity

Typical timing: weeks 6 to 12. Some patients enter later because of irritability, comorbidity, preoperative deconditioning, or delayed motion.

Goals

- Build knee-extensor and lower-extremity strength toward the uninvolved side and age/activity expectations.
- Perform reciprocal stairs when feasible, with controlled ascent and descent.
- Increase walking speed, distance, and community confidence.
- Tolerate progressive work and household demands without a sustained effusion response.
- Transition from basic rehabilitation to a structured independent strengthening program.

Progressive loading menu

Capacity	Exercise examples	Progression signal
Knee extensor	Leg press; loaded sit-to-stand; squat to target; knee extension machine or band; step-up	Quality repetitions with controlled knee alignment and no sustained joint flare.
Eccentric control	Step-down; controlled lowering to chair; decline or supported squat when appropriate	Smooth descent, stable pelvis/trunk, tolerable next-day response.
Hip / posterior chain	Bridge variations; hip hinge; resisted hip abduction/extension; hamstring curl	Improving load tolerance without compensatory trunk strategy.
Calf / ankle	Bilateral to unilateral heel raise; ankle mobility; propulsion drills	Improved terminal stance and walking speed.
Balance / agility	Single-leg support with hand support as needed; multidirectional stepping; uneven-surface practice	Safe reactive control and reduced reliance on upper extremities.
Aerobic	Bike, elliptical, pool once wound is fully healed and cleared, progressive outdoor walking	Longer duration at a sustainable effort without prolonged symptom increase.

Loading framework

For strengthening, begin with a load that permits technically sound repetitions and leaves several repetitions in reserve. Progress one variable at a time: external load, range, repetitions, sets, lever arm, speed, or task complexity. Reassess pain, warmth, effusion, ROM, and function at the next visit. Exercise discomfort can be acceptable when mild and transient; escalating pain, altered mechanics, or a next-day flare indicates excessive dose.

Suggested progression criteria

- Near-full active extension and flexion adequate for personal goals, with no concerning loss of motion.
- Minimal or stable effusion and predictable recovery after progressive loading.
- Independent community gait without an unsafe deviation or device, unless a device remains appropriate for another condition.
- Repeated sit-to-stand and step tasks with controlled alignment.
- Objective improvement in a selected functional test and patient-reported function.

Common barriers and responses

Barrier	Clinical response
Persistent extension deficit	Recheck swelling, positioning, hamstring/calf contribution, patellar/tibiofemoral mobility, active control, exercise dose, and adherence; communicate early if plateauing.
Flexion plateau	Assess effusion, scar/wound status, fear/guarding, hip/ankle contribution, home setup and dosing; use frequent tolerable motion rather than force; discuss trajectory with the surgeon.
Quadriceps inhibition	Address effusion and pain; use high-intent strengthening, NMES when indicated, task-specific loading, and sufficient recovery.
Persistent antalgic gait	Return to the appropriate device temporarily; retrain stance control and propulsion; assess pain source, ROM, strength, balance, and leg-length perception.

6. Phase 4 - return to participation and long-term joint health

Typical timing: week 12 and beyond. Recovery of strength and confidence commonly continues for many months.

Goals

- Meet individualized work, household, caregiving, travel, and recreational demands.
- Develop a durable independent program for strength, aerobic fitness, mobility, and body-weight management when relevant.
- Use objective testing to identify residual asymmetry and guide safe progression.
- Maintain realistic expectations for kneeling, impact, swelling variability, and long-term implant care.

Participation guidance

Activity	Decision guidance
Driving	Requires surgeon clearance, no impairing medication, adequate reaction time and vehicle control, and compliance with local requirements. Right-sided procedures often require more time.
Work	Use a graded plan based on sitting, standing, walking, lifting, kneeling, stairs, travel, and shift length. Coordinate restrictions and accommodations with the surgeon/employer as appropriate.
Recreation	Low-impact activities such as walking, cycling, swimming after wound clearance, golf, and controlled strength training are commonly favored. Progress volume gradually.
Higher-impact / pivoting	Running, jumping, singles tennis, high-impact court sports, and contact activities require individualized surgeon discussion. Implant factors, prior experience, strength, balance, and risk tolerance matter.
Kneeling	May remain uncomfortable despite acceptable implant status. Once the incision is fully healed and cleared, graded exposure with cushioning can be attempted if needed.

Discharge or transition criteria

- Patient goals are met or a safe independent plan is established.
- No unresolved red flags or unexplained regression.
- ROM is stable and adequate for meaningful activities.
- Strength and functional testing show sufficient capacity for intended tasks, with residual deficits clearly addressed in the plan.
- The patient can self-monitor loading, swelling, and symptoms and knows when to seek reassessment.

Recommended reassessment battery

Select measures that match the patient and setting. Options include knee ROM; quadriceps strength by dynamometry when available; 30-Second Chair Stand or 5 Times Sit-to-Stand; Timed Up and Go; 10-Meter Walk Test; 6-Minute Walk Test; Stair Climb Test; single-leg balance; and KOOS-JR or PROMIS Physical Function. Use the same protocol and device at each comparison.

Return-to-activity rule

Clearance should be based on task capacity, movement quality, symptom stability, confidence, and surgeon guidance. A date on the calendar alone is not clearance.

7. Clinician documentation and communication checklist

At evaluation

- Procedure date, side, operative details available, surgeon, weight-bearing status, precautions, and follow-up date.
- Medical history, medications relevant to treatment safety, prior level of function, home environment, support, equipment, and goals.
- Incision and limb screen; pain/effusion; ROM; quadriceps activation; neurovascular status when indicated; transfers, gait, stairs, and fall risk.
- Baseline outcome measures and a plan for repeat testing.

At each progression point

- Objective change in ROM, swelling, strength/activation, gait, and functional performance.
- Exercise dose, external load, repetitions, sets, range, assistance, and response during and after treatment.
- Rationale for device change, return-to-work progression, or activity advancement.
- Education provided, patient understanding, adherence barriers, and shared decisions.
- Any communication with the surgeon or care team and the resulting plan.

Suggested communication triggers

Trigger	Examples
Immediate / emergency	Cardiopulmonary emergency signs, stroke signs, loss of distal perfusion, severe neurological change.
Same day	Concerning DVT signs, significant wound drainage/dehiscence, systemic infection signs, acute loss of function, uncontrolled pain.
Prompt non-emergent	ROM plateau or regression, recurrent buckling, inability to progress weight bearing/device, persistent high irritability, suspected medication adverse effect, failure to meet basic functional needs.
Routine	Clarification of activity restrictions, work status, driving, aquatic therapy, higher-impact recreation, or durable medical equipment.

Home-program communication principles

- Keep the program short enough to complete and specific enough to measure.
- Separate mobility, strengthening, walking/conditioning, and recovery instructions.
- Give a clear dose range and a symptom-response rule rather than “do as much as possible.”
- Update the program when an exercise is no longer challenging, no longer relevant, or repeatedly aggravating.
- Use teach-back and observe at least one full set of key exercises.

Quality marker

A successful protocol is not a checklist of exercises. It is a repeatable decision system that links examination findings, loading dose, functional goals, and the patient's response.

8. Evidence and protocol synthesis

This document is an original clinical synthesis. It reflects recurring elements in major academic rehabilitation pathways and professional guidance, including early mobility, swelling control, restoration of extension, progressive flexion, quadriceps activation, neuromuscular electrical stimulation when indicated, progressive resistance exercise, gait retraining, functional testing, and criteria-based return to activity.

Primary protocol models consulted

Source family	Contributions reflected in this synthesis
University of Delaware / Delaware Physical Therapy Clinic knee arthroplasty rehabilitation guidance	Criterion-based progression, objective functional testing, quadriceps recovery, gait and task performance.
Massachusetts General Hospital rehabilitation protocol for total knee arthroplasty	Phase structure, early precautions, mobility and exercise progression, return-to-function considerations.
The Ohio State University Wexner Medical Center total knee arthroplasty clinical practice guidance	Clinical decision making, red flags, ROM and loading progression, use of objective criteria and timely escalation.
APTA / Academy of Orthopaedic Physical Therapy clinical practice guidance for physical therapist management after TKA	Evidence-informed recommendations for preoperative education, early mobility, ROM, strengthening, NMES, function, and outcomes.
AAOS and contemporary enhanced-recovery principles	Patient education, complication awareness, progressive activity, interdisciplinary coordination, and long-term joint health.

Important interpretation note

Institutional protocols differ in phase timing, range-of-motion targets, exercise selection, and return-to-activity language. This protocol intentionally avoids treating any single milestone as universal. The operative report and direct surgeon instructions take precedence. Clinicians should verify the current edition of source protocols and applicable professional guidance before local adoption, because institutional documents can be revised.

MEDICAL AND LEGAL DISCLAIMER

For Educational and Informational Purposes Only	This rehabilitation protocol is provided by The Physical Root for general educational and professional informational purposes only. It does not constitute medical advice, diagnosis, treatment, a prescription, a guarantee of outcome, or a substitute for evaluation by a qualified healthcare professional.
No Professional Relationship	Accessing or using this document does not create a clinician-patient, therapist-patient, or any other professional relationship between the user and The Physical Root.
Notice to Clinicians	Total knee replacement procedures, patient health status, surgical techniques, surgeon preferences, precautions, and recovery trajectories vary significantly. The treating clinician must independently evaluate the patient, exercise professional judgment, practice within applicable licensure laws and standards, and adhere to the operative report, surgeon-specific instructions, facility policy, and current clinical evidence.
Notice to Patients	Do not begin, stop, or modify any exercise, medication, wound-care practice, assistive device usage, or activity restriction based solely on this document. Always consult directly with your treating physician or physical therapist regarding your specific recovery.
Medical Emergencies	Seek urgent or emergency medical care immediately for any concerning symptoms, including but not limited to: chest pain, difficulty breathing, fainting, suspected blood clots, fever with wound changes, rapidly increasing swelling, new neurological symptoms, or severe/unremitting pain.
Limitation of Liability & Non-Endorsement	To the fullest extent permitted by law, The Physical Root and this document's contributors disclaim all liability for any loss, injury, or damages arising from the use or misuse of this information. No protocol can eliminate all risks. Additionally, external institutions named in the source synthesis have not reviewed, endorsed, sponsored, or approved this derivative document; their names are used solely to identify educational source frameworks.