TOTAL KNEE ARTHROPLASTY (TKA) POST-OP CLINICAL PRACTICE GUIDELINE

Progression is time and criterion-based, dependent on soft tissue healing, patient demographics and clinician evaluation. Contact Ohio State Orthopaedic Surgery Adult Reconstruction Division (614-293-2663) if questions arise.

Overview

Total knee arthroplasty (TKA), also known as a total knee replacement, is an elective surgical procedure to treat patients who experience pain and dysfunction from an arthritic knee joint. TKA is an effective option if the patient's pain does not respond to conservative treatment and has caused a decline in their health, quality of life, or ability to perform activities of daily living. This procedure removes the arthritic structures that make up the knee joint and replace them with artificial implants.

With advancements in modern medicine, there have been several effective surgical approaches developed for TKA. The surgeon will determine the best surgical approach to use for each individual. Patients are encouraged to participate in early mobilization while adhering to precautions in order to improve function and limit post-operative complications.

Disclaimer: Progression is time and criterion-based, dependent on soft tissue healing, patient demographics and clinician evaluation. If you are working with an Ohio State Sports Medicine patient and questions arise, please contact our office at (614) 293-2385.

Summary of Recommendations

Expectations	• *Outpatient rehabilitation is expected for every patient after discharge from hospital. Home Heath may be performed initially to increase mobility and achieve community distance ambulation prior to outpatient rehab.*

Precautions	• Signs of DVT *(Refer directly to ED)*
	  ○ Localized tenderness along the distribution of deep venous system
	  ○ Entire LE swelling
	  ○ Calf swelling >3cm compared to asymptomatic limb
	  ○ Pitting edema
	  ○ Collateral superficial veins
	• Mechanical block or clunk *(Refer to surgeon or joint APP team for re-evaluation)*
	• Lack of full knee extension by 4-6 weeks *(Refer to surgeon/or APP team for re-evaluation)*
	• AD required for ambulation after post-op week 6 (MD follow up visit)

Weight Bearing Progression	• ROM: Full active knee extension; no pain on passive overpressure • Strength: Able to perform strong quad isometric with full tetany and superior patellar glide and able to perform 2x10 SLR without quad lag • Effusion: 1+ or less is preferred (2+ acceptable if all other criteria are met) • 60 sec of SL stance without compensation or pain • Normalized gait pattern without assistive device – focus on TKE • Able to ascend/descent stairs with handrail or AD use Goal: DC AD by post-op week 3-6 weeks

Range of Motion Progression	• Equalize knee ext AROM for symmetry
	• Knee flex A/PROM:
	  ○ 60-90 by 2 weeks
	  ○ 100 by 6 weeks
	  ○ 120 by 8-12 weeks

Functional Testing	• 30-second Chair Stand Test • Gait Speed • TUG • Functional Reach Test • 6-min Walk Test **Functional strength testing should be reserved for patients returning high-level activity*
Patient Reported Outcomes	Collect at least one of the following at initial evaluation, every 6 weeks and discharge. Be consisted with which outcome tool is collected. • Knee Injury and Osteoarthritis Outcome Score (KOOS) • International Knee Documentation Committee (IKDC) • Lower Extremity Functional Scale (LEFS)
Criteria to Discharge Assistive Device	• ROM: Full active knee extension; no pain on passive overpressure • Strength: Able to perform strong quad isometric with full tetany and superior patellar glide and able to perform 2x10 SLR without quad lag • Effusion: 1+ or less is preferred (2+ acceptable if all other criteria are met) • Weight Bearing: Demonstrates pain-free ambulation without visible gait deviation
Considerations Regarding Running and Plyometrics	1. **High impact activities such as plyometrics and running are generally not advised following total joint replacements. First priority following these surgeries is to prevent damage to the new artificial joint. Patients are advised to participate in low impact exercise/activities. ***Patients considering plyometrics with intent to resume running/sport should consult with their physician. *****

RED/YELLOW FLAGS

Red flags are signs/symptoms that require immediate referral for re-evaluation. Yellow flags are signs/symptoms that require modification to plan of care.

Red Flags	• Signs of DVT *(Refer directly to ED)*
	  ○ Localized tenderness along the distribution of deep venous system
	  ○ Entire LE swelling
	  ○ Calf swelling >3cm compared to asymptomatic limb
	  ○ Pitting edema
	  ○ Collateral superficial veins
	• Mechanical block or clunk *(Refer to surgeon/or joint APP team for re-evaluation)*
	• Lack of full knee extension by 4-6 weeks *(Refer to surgeon/or joint APP team for re-evaluation)*

Yellow Flags	• Persistent reactive pain or effusion following therapy or ADLs ○ *Decrease intensity of therapy interventions, continue effusion management and provide patient education regarding activity modification until reactive symptoms resolve*

PHASE I: Day 1 Post-Op until D/C of Assistive Device (0-6 weeks)

Goals	• Protect healing tissue • Pain and edema control (recommend compression garments/shorts to assist) • DVT prevention • Improve pain-free ROM • Normalize muscle activation • Ambulate independently without AD • Independent with all ADLs

Precautions/Red Flags	• Signs of DVT *(Refer directly to ED)*
	  ○ Localized tenderness along the distribution of deep venous system
	  ○ Entire LE swelling
	  ○ Calf swelling >3cm compared to asymptomatic limb
	  ○ Pitting edema
	  ○ Collateral superficial veins
	• Mechanical block or clunk *(Refer to surgeon or joint APP team for re-evaluation)*
	• Lack of full knee extension by 4-6 weeks *(Refer to surgeon/or APP team for re-evaluation)*
	• AD required for ambulation after post-op week 6 (MD follow up visit)

AD Progression	• Walker → less restrictive (cane) → no device as tolerated • Crutch use: 2→ 1→ 0 as tolerated • Goal: use of AD to minimize compensatory gait
Criteria for Community Ambulation without AD	• ROM: Full active knee extension; no pain on passive overpressure • Strength: Able to perform strong quad isometric with full tetany and superior patellar glide and able to perform 2x10 SLR without quad lag • Effusion: 1+ or less is preferred (2+ acceptable if all other criteria are met) • 60 sec of SL stance without compensation or pain • Normalized gait pattern without assistive device – focus on TKE • Able to ascend/descent stairs with handrail or AD use • Goal: DC AD by post-op week 3
Return to Driving Progression	• MD clearance • Usually 4-8 weeks post-op • D/C Narcotics • Driving step test •
Edema Control	• Cryotherapy at least 5x daily for the first week • Cryotherapy at least 3x daily for week 1-6 • Compression hose post-op for 30 days (optional) • If returning to work in a predominantly seated position, elevation of knee recommended 10 min per hour (at least).

Range of Motion/Stretching	• Equalize knee ext AROM for symmetry
	• Knee flex A/PROM
	  ○ 60-90 deg by 2 weeks
	  ○ 100 deg by 6 weeks
	  ○ 120 deg by 8-12 weeks
	• Stationary bicycle/recumbent stepper for ROM – no resistance
	• Manual patellar mobility, manual tibiofemoral mobility

Neuromuscular Control	This section is 1st priority→ do not progress to strengthening until muscle activation and isolated control is normalized • quadriceps, glutes, transverse abdominus, hamstrings

PHASE I: Day 1 Post-Op until D/C of Assistive Device (0-6 weeks) - continued

NMES Parameters → can be used post-op day 2 and following	• NMES pads are placed on the proximal and distal quadriceps • Patient: Seated in long sitting (knees extended) • The patient is instructed to relax while the e-stim generates at least 50% of their max volitional quadriceps contraction OR maximal tolerable amperage without knee joint pain • 10-20 seconds on/ 50 seconds off x 15 min	
Therapeutic exercise	Early Exercises • heel slides (seated or supine) • SAQ, LAQ • SLR – 4W on table, SL balance • Ankle pumps	Late Exercises • Step ups (fwd and side) • Mini squats/sit-to-stand • Prone HS curls • Heel raises
Aquatic Therapy	• With MD clearance, begin aquatic therapy once incision is healed (~4 weeks post-op) • Caution required with ambulation on pool desk due to slippery surfaces • Focus on knee ROM, normalizing gait, hip strengthening and stability • Can return to easy lap swimming (with the exception of elementary backstroke and breaststroke) – no flip turns at this time	
Criteria to Progress to Phase II	• Normalized gait pattern for community ambulation (≥800 ft) without AD • Knee ext normalized, knee flexion to 110 degrees • SLR 2x10 without quad lag • Minimal to no reactive pain and swelling with ADLs and PT exercises • Muscle activation and isolation is normalized	

PHASE II: D/C of AD to Pain Free ADLs (6-12 weeks)

Goals	• Restore full PROM and AROM • Progressively improve strength of the affected LE musculature (core and LE muscles) • Normalize postural/pelvic and LE control with DL and SL activities • Normalize gait at preferred walking speed for community distances • Tolerate ADLs without pain or limitation	
Precautions	• OK to progress strengthening exercises and functional tasks as appropriate pending no reactive pain or effusion • Increase aerobic conditioning/endurance related tasks monitoring reactive edema	
Range of Motion/Stretching	A/PROM: • 100 by 6 weeks • 120 by 8-12 weeks • Continue bicycle for ROM	
NMES Parameters	• NMES pads are placed on the proximal and distal quadriceps • Patient: Seated in long sitting (knees extended) • The patient is instructed to relax while the e-stim generates at least 50% of their max volitional quadriceps contraction OR maximal tolerable amperage without knee joint pain • 10-20 seconds on/ 50 seconds off x 15 min	
Cardiovascular Exercises	• May progress time on upright bike as tolerated (ensure pt can perform 30 min with no resistance and without symptoms prior to adding resistance. Decrease time to </= 15 min when adding resistance) • May begin elliptical when pt demonstrates adequate quad control, hip and knee extension, gluteal activation • Encourage continued progression of low impact activities for cardiovascular fitness and community endurance	
Therapeutic Exercise	Early Exercises: • Wall squats • Mini lunges • Step ups- progress to single leg step ups • Step downs • 4 way hip • Leg Press with light resistance, higher reps • Open Chain knee extension	Late Exercises: • Full squat to 70 degrees • Side steps with band • Heel Taps • Resisted walking • Advanced bridges • SLS and balance progressions (unstable surface, ball toss, EC, etc)
Criteria for Discharge **(or to Progress to Phase III once MD clearance is provided)**	• Symmetrical and pain free knee ROM to meet the demands of patients activities • Good (4/5) LE strength • Symmetrical DL squat to at least 70 degrees knee flexion • Good quality movement as graded on Forward Step Down Test (**Appendix A**) • Normalized gait pattern for community distances of ambulation **Criteria for discharge from PT is less rigorous for those not returning to sport. Ensure the patient is able to perform all ADLs and recreational activities without pain, reactive effusion, and with appropriate functional mechanics.***	

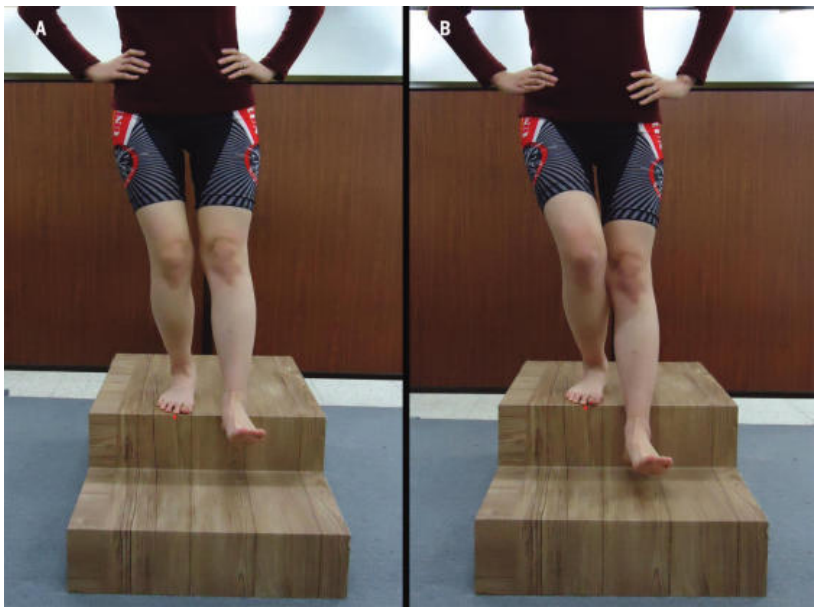
PHASE III: Pain Free ADLs to Return to Recreational Activities (12-24 weeks)

This phase is only required for patients who wish to participate in recreational sport outside of general therapeutic exercise. Patients who don't plan on sport participation can be discharged with maintenance program following completion of Phase II.

MD clearance is required for participation in impact activities.

Goals	• Correct abnormal/compensatory movement patterns with higher level multi-planer strengthening activities • Optimize neuromuscular control/balance/proprioception • Increase volume/intensity of aerobic activities; begin to restore low impact and/or sport-specific cardiovascular fitness • Initiate progressive plyometric activities (per clearance of physician) • Progressively return to sport or prior/desired level of function
Precautions	• Avoid sacrificing quality for quantity during strengthening • Ensure patient maintains full flexibility and pain-free ROM as strength continues to increase • Monitor/minimize reactive edema when increasing demand of task • Closely monitor return to sport progression
Range of Motion	• ROM should be checked periodically to ensure that loading the knee with new exercises does not alter neuromuscular response and normal joint mechanics • If ROM goals are not achieved by week 12, terminal stretches should be initiated
Therapeutic Exercise	• Continue progressive LE and core strengthening (DL→ SL for closed and open chain exercises) • LE strengthening tasks progressed to multi-planer movements emphasizing core stability and hip/knee control • Core strength tasks progressed to emphasize rotational tasks (chops/lifts, etc) • Proprioception progressed with variability of surfaces, perturbations, UE or trunk movements • Progression towards sport-specific tasks as indicated
Cardiovascular Exercise	• Dynamic Warm Up initiated • *Upright Bike/Elliptical progression (per PT and patient preference)* • *Swimming progression (per PT and patient preference)*
Plyometrics and Running	**High impact activities such as plyometrics and running are generally not advised following total joint replacements. First priority following these surgeries is to prevent damage to the new artificial joint. Due to lack of evidence on how high impact activities affect the integrity of artificial joint replacement, patients are advised to participate in low impact exercise/activities. Patients considering plyometrics with intent to resume running should consult with their physician.** • **See Appendix B (only for appropriate patients with MD approval)**

Appendix A: Forward Step Down Test

Definition of errors	Interpretation of errors	
• **Arm strategy:** subject uses an arm strategy in an attempt to recover balance (1 point) • **Trunk movement:** trunk leans right or left (1 point) • **Pelvic plane:** pelvis rotates or elevates on one side compared to the other (1 point) • **Knee position:** knee deviates medially and the tibial tuberosity crosses an imaginary vertical line over 2nd toe (1 point); knee deviates medially and the tibial tuberosity crosses an imaginary vertical line over medial boarder of the foot (2 points) • **Balance:** subject steps down on the uninvolved side or the subject's tested leg becomes unsteady (1 point)	0-1 errors	Good quality mechanics
	2-3 errors	Medium quality mechanics
	4+ errors	Poor quality mechanics

Reference: Park K, Cynn H, Choung S. Musculoskeletal predictors of movement quality for the forward step-down test in asymptomatic women. *J Orthop Sports Phys Ther.* 2013;43(7):504-510.

Appendix B

Plyometrics Patients considering plyometrics with intent to resume running should **consult with their physician** before beginning this phase.	**High impact activities such as plyometrics and running are generally not advised following total joint replacements. First priority following these surgeries is to prevent damage to the new artificial joint. Due to lack of evidence on how high impact activities affect the integrity of artificial joint replacement, patients are advised to participate in low impact exercise/activities.** Criteria to initiate plyometric program: • ***Physician clearance at last check-up required*** • Full, functional, pain-free ROM • >80% quad and hamstring strength compared to uninvolved LE • Squat 150% BW (leg press or barbell squat) • 10 forward and lateral step downs from 8" step with proper alignment (**Appendix A**) • Progressive weight bearing, DL→ SL demands • Shuttle plyometrics (DL→SL) • Forward hop and hold (uninvolved→ involved) • DL mini hops/place jumps • Proper take off/landing mechanics emphasized → NO knee valgus, good pelvic stability, soft/quiet landing with equal distribution of force • Modified agility work can be initiated if appropriate form/tolerance to activity in progressive plyometrics
Criteria for Return to Sport	• ***Physician clearance at last check-up required*** • Strength: >90% compared to uninvolved LE • >90% BW with SL leg press • Demonstrates ability to simulate functional sport-specific movement • Patient reported outcome measures: Score >/= 90%

Return to Running

Walk/jog progression can be initiated towards end of phase if patient demonstrates:

- Full, functional, pain-free ROM
- > 80% quadriceps, hamstring, and hip (using hand-held dynamometer) strength compared to uninvolved leg-abductors, adductors, extensors, external rotators
- Squat 150% BW (barbell squat or leg press)
- 10 forward and lateral step downs from 8" step with proper alignment (see appendix D)
- Hop and hold with proper mechanics (uninvolved→involved x10 repetitions)
- Ability to tolerate 200-250 plyometric foot contacts without reactive pain/effusion
- No gross visual asymmetry and rhythmic strike pattern with treadmill or over ground running

Phase	Walk/Run Ratio	Total Time
1	4 min / 1 min	10-20 min
2	3 min / 2 min	10-20 min
3	2 min / 3 min	10-20 min
4	1 min / 4 min	10-20 min
5	• Jog every other day until able to run 30 consecutive minutes • Begin with 5 min walking warm up • End with 5 min walking cool down	

General Guidelines

- Allow at least one day of rest between runs
- Gradual increase in distance is priority before increased pace
- It is common for runners to experience increased pain and/or reactive edema at least x1 during this return to run progression. When pain occurs, runner must stop running immediately and rest at least 1 day before restarting program. With restart, perform last walk/jog ratio cycle completed pain free x2 before attempting the previously painful ratio cycle.

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Completion date: December 2019

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