



Knee Matrix-Associated Autologous Chondrocyte Implantation (MACI) Tibiofemoral Joint Post-Operative Guidelines

Phase 1: Weeks 0-2

PRECAUTIONS

- Weight bearing
 - 20% foot flat weight bearing (FFWB) with bilateral axillary crutches for 2 weeks
- Range of motion (ROM): 0 – 90 weeks 0-2
- Brace Guidelines
 - Ambulation with brace locked and bilateral axillary crutches for 2 weeks
 - **Sleep with brace locked in extension for 2 weeks**

TREATMENT RECOMMENDATIONS

- ROM: immediate after surgery
 - Emphasize full knee extension immediately
 - Heel prop multiple times per day
 - LE stretching (hamstring/gastrocnemius/soleus)
 - Patellar mobilization as indicated (all planes)
- Strengthening
 - Quadriceps re-education: Quad sets, SLR with NMES
 - Initiate primary core stabilization/Kinetic linking program
 - Abdominal sets, pelvic bracing, clam shells
 - Ankle progressive resistive exercises (PRE)
 - Consider blood flow restriction (BFR) program
- Independent with home exercise program (HEP) that addresses primary impairments

CRITERIA FOR ADVANCEMENT

- Maintain knee ROM: 0°-90°
- SLR flexion without extensor lag
- Adherence to post-operative restrictions
- Independent with HEP

EMPHASIZE

- Ambulation with brace locked in extension and 20% FFWB
- Improving quadriceps activation
- Full knee extension
- Improving patellar mobility



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Phase 2 (Weeks 2-6)

PRECAUTIONS

- WB restrictions
 - Weeks 2-4: partial weight bearing up to 50% with crutches
 - Weeks 4-6: 75% WB with crutches
- Progress ROM as tolerated
- Brace guidelines
 - Locked in extension x 6 weeks with ambulation (off for supine ROM)

TREATMENT RECOMMENDATIONS

- ROM/Soft Tissue: goal knee ROM 0 – 130 by week 6
 - Supine hip flexor stretch when tolerated
 - Maintain passive knee extension, patellar mobility
- Strengthening
 - Continue Quadriceps re-education with NMES as needed, BFR as needed
 - Bilateral Leg Press
 - 60° → 0° arc (week 2-4)
 - 90° → 0° arc (week 4-6) *depending on ROM gains*
 - Initiate core stabilization/Kinetic linking program
 - Standing bilateral heel raises-Week 2-3
 - Short crank bicycle progressing to upright bike with adequate ROM
 - Multiplanar gluteal/core/hip strengthening
 - Bridges with elastic band
 - Side lying clamshells → standing clamshells
 - Weight shift exercises with upper extremity (UE) support
 - Bilateral weight bearing proprioception exercises
 - Single leg (SL) balance/proprioceptive activities after proper quad control
 - Hydrotherapy week 4+ if incisions healed
 - Underwater treadmill/anti-gravity treadmill gait training if gait pattern continues to be abnormal

CRITERIA FOR ADVANCEMENT

- Full weight bearing with crutches, discharge brace
- Full ROM, normal patellar mobility
- Proximal strength > 4/5
- Independent with HEP



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Phase 3 (Weeks 7-12)

PRECAUTIONS

- Unlock brace (if adequate quad control) → wean and d/c when nonantalgic gait

TREATMENT RECOMMENDATIONS

- ROM/Soft Tissue: continue from Phase II
- Strengthening
 - Progress stationary bicycle time
 - Initiate interval bicycle program between weeks 10-12 to help with fitness training
 - Progress to elliptical
 - Single leg pawing on retrograde treadmill
 - Multiplanar gluteal/core/hip strengthening
 - Three point step/hip clocks, lateral monster walks
 - Romanian Dead Lift (RDL): double leg → single leg
 - Initiate open kinetic chain (OKC) knee extension (multiple angle isometrics, avoid lesion) → progress to isotonic
 - Progress to eccentric leg press (2 up/1 down)
 - Emphasis on SLOW ECCENTRIC LOWERING and good alignment
 - Chair/Box Squats
 - Band around knees to promote gluteal activation and avoid valgus breakdown
 - Progress to adding weights as appropriate (PREs)
 - Introduce step-up progression (week 6-8): Start with 4" step → 6" step → 8" step
 - Front lunges → traveling lunges
 - Progressive gluteal/hip strengthening
 - SL wall push, windmills, clamshells in modified side plank (knee down), bridges
 - Progress balance/proprioception
 - Rockerboard, SL rebounder, sport-specific balance
 - Core/kinetic linking progression
 - Progress BFR program to more weight bearing activities (i.e. squats, leg press)
 - Introduce eccentric step down program (week 8-12): Start with 4" step → 6" → 8"

MINIMUM CRITERIA FOR ADVANCEMENT

- Chair/box squats with proper form and without complaints of pain
- SL stance > 30 sec with proper form and control
- Demonstrate ability to ascend 8" step with proper form, no pain
- Descend 6" step with good eccentric control, no pain



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Phase 4 (Weeks 12-20)

TREATMENT RECOMMENDATIONS

- ROM/Soft Tissue: full ROM without limitations
- Strengthening
 - Continue to progress with squat program (PREs), eccentric leg press, suspension system squats (double leg → single leg)
 - Progress step-ups/downs by increasing height and adding weights (intrinsic load)
 - Advanced proprioception training (perturbations)
 - Continue to progress with aquatic program if available
 - Stair machine/stair climber
 - Continue with core/kinetic linking progression
 - Progress isotonic knee extension OKC – progress to isokinetics at high speeds
 - Initiate running progression with anti-gravity treadmill or pool running - weeks 16-18

CRITERIA FOR ADVANCEMENT

- **80% limb symmetry** (quadriceps and hamstring) with hand-held dynamometry and functional testing
- Movement without asymmetrical deviations and a hip dominant strategy



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Phase 5 (Weeks 20+)

PRECAUTIONS

- Avoid pain with advanced strengthening, and plyometric activity
- Be cautious of patellofemoral overload with increased activity level
- Monitor overall load and volume

TREATMENT RECOMMENDATIONS

- Advanced strength program 3-4 times/week
 - Cardiovascular endurance training with continued low load methods
 - Gluteal activation exercises
 - Chair/box squats
 - Leg press (DL/SL)
 - Multiplanar hip strengthening
 - Front/side/back lunges
 - RDL (DL/SL)
 - Advanced kinetic linking progression
- Plyometric program (DL → SL) individualized per sport and patient need
- Progress strength and flexibility through entire kinetic chain (hips, knees, ankle)
- Agility and balance drills
- Progress with sport specific programs
- Progress running program: interval treadmill program
- Strength maintenance program

CRITERIA FOR DISCHARGE / RETURN TO SPORT

- **90% limb symmetry** (quadriceps and hamstring) with functional testing
- Isokinetic test > 90% limb symmetry (if available)
- Independent with gym strengthening and maintenance program
- Movement without asymmetrical deviations and a hip dominant strategy
- Lack of apprehension with sports specific movement (e.g. acceleration/deceleration, cutting)