

KNEE ARTICULAR CARTILAGE OSTEOCHONDRAL AUTOGRAFT (OATS) POST-OPERATIVE GUIDELINES

The following osteochondral autograft guidelines were developed by HSS Rehabilitation.

Progressions in this guideline are both criteria-based and can be modified for individual patient needs. Phases and time frames are designed to give the clinician a general sense of progression. The rehabilitation program following an osteochondral autograft emphasizes early, controlled motion to prevent knee stiffness and to avoid disuse atrophy of the musculature. The program should be a balance of managing prior deficits, tissue healing and appropriate interventions to maximize flexibility, strength, and pain-free performance of functional activities. This model should not replace clinical judgment.

These types of patients may have additional alignment issues that may have caused their initial cartilage breakdown. Be aware if concomitant surgical procedures have been performed. Defer to surgeon for additional direction.

Monitor swelling throughout the rehab process. If persistent swelling occurs, monitor load volume and consult with referring physician.

Follow physician's modifications as prescribed.

KNEE ARTICULAR CARTILAGE OSTEOCHONDRAL AUTOGRAFT (OATS) POST-OPERATIVE GUIDELINES

Phase 1: Weeks 0-2

PRECAUTIONS

- Range of motion (ROM): progress as tolerated (DO NOT FORCE ROM)
 - 0-90° over first 2 weeks
- Adhere to weight bearing restrictions
 - 20% foot flat weight bearing (FFWB) with bilateral axillary crutches for 3 weeks
- Brace Guidelines
 - Ambulation with brace locked and bilateral axillary crutches for 3 weeks
 - **Sleep with brace locked in extension for 1 week**
- Avoid pillow under knee to prevent knee flexion contracture
- Control post- operative swelling

ASSESSMENT

- Lower Extremity Functional Scale (LEFS)
- Numeric pain rating scale (NPRS)
- Patellar mobility
- Swelling (girth and description)
- Inspection of incision
- Quality of quadriceps contraction
- Lower extremity (LE) flexibility
- LE active ROM (AROM) and passive ROM (PROM)
- Gait assessment

TREATMENT RECOMMENDATIONS

- ROM/Soft Tissue
 - Immediate ROM after surgery
 - **Do not force ROM**
 - Emphasize full knee extension immediately
 - Heel prop multiple times per day
 - LE stretching (hamstring/gastrocnemius/soleus)
 - Patellar mobilization as indicated (all planes)
 - Patient education

- Strengthening
 - Quadriceps re-education
 - Quad sets, straight leg raises (SLR) with neuromuscular electrical stimulation (NMES)
 - SLRs (all planes)
 - Emphasize no extension lag during exercise
 - Initiate primary core stabilization/Kinetic linking program
 - Abdominal sets
 - Pelvic bracing
 - BKFO
 - Clam shells
 - Ankle progressive resistive exercises (PRE)
 - Consider blood flow restriction (BFR) program with FDA approved device and qualified therapist if patient cleared by MD
- Independent with home exercise program (HEP) that addresses primary impairments

CRITERIA FOR ADVANCEMENT

- Maintain knee ROM: 0°-90°
- Control post-operative pain/swelling
- 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
- Controlling pain/effusion
- Improving patellar mobility

KNEE ARTICULAR CARTILAGE OSTEOCHONDRAL ALLOGRAFT (OCA) POST-OPERATIVE GUIDELINES

Phase 2 (Weeks 2-6)

PRECAUTIONS

- Progress ROM as tolerated: **do not force motion**
- Adhere to weight bearing restrictions
 - Weeks 3-5: partial weight bearing up to 50% with crutches
 - Weeks 5-6: weight bearing as tolerated
- Brace guidelines
 - Weeks 2-3: Locked in extension for ambulation
 - Weeks 3-5: Unlock brace when proper quad control is established
 - Discharge brace after week 5 (may use knee sleeve or unloader brace at this point if needed)
- Avoid pillow under knee to prevent knee flexion contracture
- Control post-operative swelling

ASSESSMENT

- LEFS
- NPRS
- Patellar mobility
- Swelling (girth and description)
- Inspection of incision
- Quality of quadriceps contraction
- LE flexibility
- LE AROM and PROM
- Gait assessment

TREATMENT RECOMMENDATIONS

- ROM/Soft Tissue
 - ROM goals (USE AS A GUIDELINE)
 - Week 3- 0-105°
 - Week 4- 0-115/120°
 - Week 6- 0-130° (progressing to full ROM)
 - Continue exercises from phase 1
 - Heel slides against wall should there be difficulty gaining ROM
 - Step knee flexion stretch
 - Supine hip flexor stretch when tolerated

- Maintain passive knee extension
- Maintain patellar mobility
- Continue LE soft tissue treatment as needed
- Continue LE stretching per phase 1
- Strengthening
 - Continue Quadriceps re-education with NMES as needed
 - Continue blood flow restriction (BFR) program if patient cleared by MD
 - 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 (110-115° of 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 obtained
 - Hydrotherapy when incisions are healed for gait, proximal strengthening, functional movements, balance and edema control- week 4-6
 - Underwater treadmill/anti-gravity treadmill gait training if gait pattern continues to be abnormal

CRITERIA FOR ADVANCEMENT

- Full weight bearing with crutches, discharge brace
- Demonstrate a normal gait pattern without deviations
- Progressing toward full ROM
- Normal patellar mobility (all planes)
- Proximal strength > 4/5
- Minimal edema
- Well controlled pain
- Independent with HEP

EMPHASIZE

- Proper gait pattern
- Continued full knee extension
- Controlling pain and effusion

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Phase 3 (Weeks 6-12)

PRECAUTIONS

- Progress to full ROM
- Avoid pain with therapeutic exercises and functional activities
- Continue to control post-operative swelling

ASSESSMENT

- LEFS
- NPRS
- Patellar mobility
- Swelling (girth and description)
- Inspection of incision
- Quality of quadriceps contraction
- LE flexibility
- LE AROM and PROM
- Gait assessment
- Movement assessment

TREATMENT RECOMMENDATIONS

- ROM/Soft Tissue
 - Gradual increase of ROM to full
 - Continue ROM exercises from Phase 2
 - Prone knee flexion stretch
 - Maintain full passive knee extension
 - Continue patellar mobilization as needed
 - Continue with LE soft tissue program as needed
 - Continue with LE stretching program (hip, hamstring, gastrocnemius/soleus)
 - Add hip flexor and quad stretching
 - Initiate foam rolling program

- Strengthening
 - Progress stationary bicycle time
 - Initiate interval bicycle program between weeks 10-12 to help with fitness training
 - Progress to elliptical
 - Single leg pawing → retrograde treadmill
 - Multiplanar gluteal/core/hip strengthening
 - Continue exercises from phase II
 - 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)
 - Progressing to isotonics (PRE)
 - Progress to eccentric leg press (2 up/1 down)
 - Emphasis on SLOW ECCENTRIC LOWERING and good alignment
 - Suspension training squats
 - Chair/Box Squats
 - Band around knees to promote gluteal activation and avoid valgus breakdown
 - Promote movement through hips and proper form.
 - Progressively lower seat height per strength gains
 - Progress to adding weights as appropriate (PREs)
 - Introduce step-up progression (week 6-8)
 - Start with 4" step → 6" step → 8" step
 - Emphasize proper movement pattern (no hip drop, no valgus breakdown)
 - Progress to adding weights as appropriate (PREs)
 - Emphasize good control
 - Front lunges → traveling lunges (DON'T PUSH ROM)
 - Progressive gluteal/hip strengthening
 - Continue phase 2 exercises
 - SL wall push
 - Windmills
 - Clamshells in modified side plank
 - Bridge progression
 - Progress balance/proprioception
 - Rockerboard
 - SL rebounder (Progress to foam pad/ ½ foam roller)
 - Sports 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" step → 8" step (assisted with railing if necessary)
 - Emphasize proper movement pattern (no hip drop, no valgus breakdown)
 - Emphasize good control
 - Progress to adding weights as appropriate (PREs)

MINIMUM CRITERIA FOR ADVANCEMENT

- Full pain-free ROM
- 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
- Independent with HEP

EMPHASIZE

- Minimal swelling
- Control volume and load with functional activities
- Emphasis on proper movement strategy/quality of movement

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Phase 4 (Weeks 12-20)

PRECAUTIONS

- Avoid pain with therapeutic exercises and functional activities
- Control post-operative edema
- Monitor overall load and volume

ASSESSMENT

- LEFS
- NPRS
- Patellar mobility
- Swelling (girth and description)
- Quality of quadriceps contraction
- LE flexibility
- Strength assessment: isokinetic testing, hand-held dynamometry
- Movement assessment

TREATMENT RECOMMENDATIONS

- ROM/Soft Tissue
 - Patient should demonstrate full ROM without limitations
 - Continue LE soft tissue treatment as needed
- Strengthening ****EMPHASIZE ECCENTRIC STRENGTH AND CONTROL****
 - Continue to progress with squat program (PREs)
 - Continue to progress with eccentric leg press
 - Progress with suspension system squats
 - Eccentric double leg squats
 - Single leg squats focusing on control and technique
 - 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
 - Continue with LE stretching
 - Progress isotonic knee extension OKC – progress to isokinetics at high to moderate speeds

- Initiate running progression with anti-gravity treadmill or pool running - weeks 16-18
 - Must have good eccentric control with 8" step down
 - Monitor for swelling

CRITERIA FOR ADVANCEMENT

- 80% limb symmetry (quadriceps and hamstring) with hand-held dynamometry and functional testing
- No pain/inflammation after activity
- Movement without asymmetrical deviations and a hip dominant strategy
- Independent with HEP

EMPHASIZE

- Minimal swelling
- Control volume and load with functional activities
- Eccentric control with activity
- Emphasis on proper movement strategy/quality of movement

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Phase 5 (Weeks 20+)

PRECAUTIONS

- Avoid pain with advanced strengthening, and plyometric activity
- Avoid pain with progression of return to running program
- Be cautious of patellofemoral overload with increased activity level
- Continue to control post-operative swelling
- Monitor overall load and volume

ASSESSMENT

- LEFS
- NPRS
- LE flexibility
- Strength assessment: hand-held dynamometry, isokinetic testing
- Return to sport testing, e.g., hop testing
- Movement assessment
- Apprehension with sports specific movement

TREATMENT RECOMMENDATIONS

- Advanced strength program 3-4 times/week
 - Cardiovascular endurance training with continued low load methods
 - Bicycle/elliptical/stair machine/rower
 - Gluteal activation exercises
 - Chair/box squats
 - Leg press (DL/SL)
 - Multiplanar hip strengthening
 - Front/side/back lunges
 - RDL (DL/SL)
 - Advanced kinetic linking progression
 - Chops/lifts
 - LE stretching/foam rolling program
- 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
- Return to running program at month 6
 - MUST HAVE GOOD ECCENTRIC CONTROL WITH 8" STEP DOWN
 - Progress with interval treadmill program (be cautious of overloading the knee)
- Strength maintenance program
 - Bicycle/elliptical lower resistance
 - Gluteal activation exercises
 - Chair/box squats
 - Leg press
 - Multiplanar hip strengthening
 - Front/side/back lunges
 - SL RDL
- LE stretching: foam rolling
- Plyometric program: DL → SL
- Progress strength and flexibility through entire kinetic chain (hips, knees, ankle)
- Progress with cardiovascular endurance training with continue low load methods
- Progress with agility and balance drills
- Progress with sports specific programs

CRITERIA FOR DISCHARGE

- 90% limb symmetry (quadriceps and hamstring) with **hand-held** dynamometry and functional testing
- Isokinetic test \geq 90% limb symmetry (IF AVAILIBLE)
- 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)

EMPHASIZE

- Monitor volume in sports related activities

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