ORTHOPEDICS & SPORTS MEDICINE
BAYCARE CLINIC

DR. JONATHON HENRY
OSTEOARTICULAR TRANSFER SYSTEM (OATS) POST-OP THERAPY PROTOCOL

The following document is an evidence-based protocol for knee arthroscopy with an osteoarticular transfer system (OATS). Review procedural notes and referral notes to identify size and location of lesion, as this may affect the protocol outlined below. The protocol is both chronologically and criterion based for advancement through four post-operative phases:

- Phase 1 : Proliferation
- Phase 2 : Transition
- Phase 3 : Remodeling
- Phase 4 : Return to sports functional program

Graft choice:

- Autograft
  - Graft of choice if healthy cartilage available
  - Location: medial or lateral femoral condyle, patellofemoral

- Allograft
  - Used if unable to harvest autograft cartilage or size defect is greater than available autograft tissue
  - Location: medial or lateral femoral condyle

	Weightbearing	**Crutches or assistive device**	**Brace**	**ROM Limitations**
Autograft	Toe touch weight bearing (TTWB)	Use for first 4-6 weeks, with gradual tapering to follow	Femoral condyle: unlocked 0-30º Patellofemoral: locked at 0º	0 º-90º knee flexion until 6 weeks post-op
Allograft	Toe touch weight bearing (TTWB)	Use for first 4-6 weeks, with gradual tapering to follow	Femoral condyle: unlocked 0-30º Patellofemoral: locked at 0º	0 º-90º knee flexion until 6 weeks post-op

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Phase 1 – Phase (0-6 weeks)
(continued on next page)

Goals for Phase 1	Criteria for Progression to Phase 2
• Protect healing surfaces • Restore full range of motion and patellar mobility • Control postoperative pain • Control edema • Promote quadriceps function and control	• Minimal pain with Phase 1 exercises • Knee ROM ~90° • Perform straight leg raise without lag sign

Post-Operative Physical Therapy
- 1st visit to occur within 3 days of surgery
    - Review initial post-operative exercises

Brace
- Femoral condyle lesion
    - **0-2 weeks**: 0-30° degrees
    - **2-6 weeks**: increase ROM by 10° as quad function improves
- Patellofemoral lesion
    - **0-2 weeks**: Locked at 0°
    - **2-6 weeks**: Increase ROM by 20° as quad function improves

Weight Bearing Precautions
- Femoral Condyle/Patellofemoral lesions
    - **0-4 weeks**: TTWB
    - **4-5 weeks**: Partial 50% WB
    - **5-6 weeks**: Partial 75% WB
    - Goal: Full weight bearing by week 6

ROM
- **0-6 weeks**: 0-90°, emphasis on extension
- **6+ weeks:** weeks: restore normal range of motion

Stretching
- Emphasis on terminal knee extension
    - Towel prop extensions, calf stretch, prone hangs

Manual Therapy
- Pain dominant mobilizations
    - Consider location of lesion prior to completion of tibiofemoral or patellar mobilizations
- Scar mobilization, soft tissue mobilization, lymph edema massage as needed

NMES
- Quadriceps re-education if needed
    - Consider home unit if insurance permits

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Phase 1 – Phase (0-6 weeks)

AAROM
- Stationary bike may begin at week 4
    - Rocking for range of motion only, no resistance
    - Relatively high seat height to protect range of motion as listed
- Wall slides (supine), assisted heel slides

AROM
- Knee AROM to tolerance within limitations
    - No active knee extension for patellofemoral lesions

Strengthening
- Ankle pumps
- Lower extremity isometrics (calf sets, glute sets, hamstrings, etc)
- Quadriceps strength
    - Quadriceps sets
    - Prone terminal knee extension
- Open kinetic chain hip strength including straight leg raises – all planes with goal of no lag sign
    - Brace to be worn if lag sign present
- Core stabilization exercises
- Resisted terminal knee extension, prone → standing as able

Proprioception
- Weight shifts within WB status as listed above
- Progression to double leg balance and tandem balance, as able

Cardiovascular
- Upper body ergometer

Aquatics
- Initiate aquatic therapy when surgical incisions have healed
    - Focus on normalizing weight bearing and gait, within restrictions above
    - Consider alternating between land and water-based sessions if available

Modalities
- Instruct on cryotherapy use – at least three times per day for 20-30 minutes with leg elevated above heart
- NMES unit at home if significant quadriceps lag present
- Compression to be worn during all waking hours
    - May remove to sleep

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Phase 2 – Transition Phase (6-12 weeks)
(continued on next page)

Goals for Phase 2	Precautions for Phase 2	Criteria for Progression to Phase 3
• Restore full ROM and normal gait • Control with single leg stance and able to withstand for > 15 seconds • Increase activities of daily living • Discontinue brace	• Avoid CKC knee flexion past 60° • Limit pain and post-activity soreness to no more than 24 hours after exercise • Avoid post-exercise swelling • No impact activities • Avoid twisting and pivoting activities	• Minimal pain with Phase 2 exercises • Normal neuromuscular firing patterns of knee musculature • Normalized gait pattern with proper lower extremity biomechanics OR ability to unilateral WB without pain • Full pain-free knee ROM

Brace
- May discharge once patient has progressed back to full weight bearing, achieves 90° of flexion and demonstrates single leg stance control
- May continue to be worn during at risk activity

Weight Bearing
- Femoral condyle lesion
  - **6-8 weeks**: WBAT & discontinue crutches as tolerated
- Patellofemoral
  - **Week 6**: WBAT & discontinue crutches as tolerated

ROM
- Progress ROM to tolerance with goal of restoration at week 8

Stretching
- Continue stretching of all lower musculature as needed

Manual Therapy
- Patellar mobilizations – all directions
- Motion dominant tibiofemoral mobilizations to restore full ROM
- Scar mobilization, soft tissue mobilization, lymph edema massage as needed

Strengthening (continued on next page)
- **Week 6 for patellofemoral, week 8 for femoral condyle lesions**
  - Continue phase 1 strengthening exercises
  - Continue focus on closed kinetic chain quadriceps strength with progression from bilateral to unilateral
    - Knee flexion < 60°
    - Leg press, squats, step-up/downs, lateral stepping, multidirectional lunges, etc.
    - Focus on avoidance of knee valgus

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Phase 2 – Transition Phase (6-12 weeks)

- Progress closed kinetic strength hamstring to open kinetic chain as able
- Multi-planar hip strengthening
- Blood flow restriction training
  - Continue 2-3 times per week utilizing 3-5 exercises
- Introduce endurance protocol as necessary
- Core stabilization

Proprioception

- Double leg → single leg balance
  - Progress stable to unstable surfaces
  - Add perturbation & dual tasking, as able

Cardiovascular

- Stationary bike
- Aquatics: flutter kicks, deep water running

Aquatics

- Continue phase 1 aquatics with appropriate gait progressions & protected weight bearing strengthening exercises

Modalities

- Utilize cryotherapy and other modalities as needed

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Phase 3 – Remodeling Phase (12-24 weeks)

Goals for Phase 3	Precautions for Phase 3	Criteria for Progression to Phase 4
• No pain • No edema • Return to normal ADL's • Improve muscular strength and endurance • Quadriceps girth within 2 cm of contralateral • Improve single leg neuromuscular control	• Limit pivoting and twisting activities • Limit pain and post-activity soreness to no more than 24 hours after exercise • Avoid post-exercise swelling • No impact activities	• Minimal pain with Phase 3 exercises • No apprehension with basic plyometric and agility activity • Initiated return-to-running progression with proper lower extremity biomechanics and without pain

Stretching
- Continue stretching of all lower musculature as needed

ROM
- Continue ROM as needed

Strengthening
- Continue Phase 2 strengthening exercises
- Functional leg strengthening
  - Squats, multi-directional lunges, step-ups, retro step-ups, leg press, deadlifts
  - Progress to single leg exercise
- Progressive hip and hamstring strengthening
  - Multi-directional band walks and stability training
  - Introduce eccentric hamstring strength training
- Core stabilization
  - Focus on rotational patterns

Proprioception
- Incorporate unstable surfaces and dynamic movement patterns with functional strengthening progression
- Incorporate dual tasking and sport-specific progressions

Advanced Gait Re-Training
- Initiate sub-maximal return-to-running progression
  - Patellofemoral lesions (>16 weeks)
  - Femoral condyle lesions (>20 weeks)
- Utilize Alter-G treadmill or underwater treadmill if available

Cardiovascular
- Stationary bike, elliptical, Nordic track, swimming

Work Conditioning
- Consider at 16-20 weeks if physically demanding occupation

Modalities
- Utilize cryotherapy, thermotherapy, and electrical modalities as needed

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Phase 4 – Return-to-Sport Functional Program (24+ weeks)

Goals for Phase 4	Criteria for Return-to-Sport and Activity
• Pain-free running • Gradual return to full unrestricted activity	• Full, pain free knee ROM • Normal lateral step-down test without compensation • Successful completion of return-to- sport testing • Lower Extremity Functional Scale score of 80/80 • Reports confidence in lower extremity with sport specific activities (Tampa Scale vs ACL-RSI?)

Independent Gym Based Program (HEP)
- Stretching as needed
- Single leg strength, stabilization, and power development with emphasis on dynamic knee control
- Continue incorporation of core integrated exercises with functional strengthening progression

Agility & Plyometrics
- Advanced agility and plyometric drills
  - Sagittal → Frontal → Rotational
  - Double leg → Single leg
  - Ascending → Descending → Repetitive box jumps/hops
  - Incorporate dual tasking and sport-specific progressions

Sport-Specific Training
- Initiate sport-specific training programs
  - Interval sport programs for running, cycling, swimming, skating, throwing, golfing, etc.
  - Olympic/power weight-lifting exercises
- Transition to Athletic Republic program if competitive or recreational athlete with goals for return-to-sport
- Progress return-to-running program
  - Progress distances, speed intervals, surfaces, hill training, and sprint work if appropriate

Return-to-Sport Guideline
- Pass a return-to-sport test including:
  - Y-balance < 4 cm of uninvolved side
  - Strength testing ≥ 90% of uninvolved side
  - Hop testing ≥ 90% of uninvolved side
  - Full speed sport specific drills without pain or compensation
- Return to moderate impact sport activity such as jogging at 8 months post-operatively
- Return to high impact contact sporting activities such as basketball and soccer at 10 months post-operatively