NICHOLAS J. AVALLONE, M.D.

www.dravallone.com

Rehabilitation following osteochondral autograft transplantation

DISCLAIMER: The intent of this protocol is to provide therapists with guidelines for rehabilitation of patients that have undergone surgery with Dr. Avallone. It is from the protocol presented in **JOSPT 36 (10) 774-794** and is specific to his operative technique. **PTs are encouraged to read this article**. It is not intended to serve as a substitute for sound clinical decision making. Therapists should consult with Dr. Avallone if they require assistance in the progression of post-operative patients.

Phase 1. Proliferation phase (weeks 0-6)

Goals
- Protection of healing tissue from load and shear forces
- Decrease pain and effusion
- Restoration of full passive knee extension
- Gradual improvement of knee flexion
- Regaining quadriceps control

Brace
- Locked at 0° during weight-bearing (WB) activities
- Sleep in locked brace for 2-4 wk

Weightbearing (WB)
- WB status varies based on lesion location and size
  - For femoral condyle lesions:
    - Weeks 2-4: non-WB; if large lesion (>5cm^2) MD may need to delay WB up to 4 wk
    - Weeks 3-4: progress to toe touch WB (approximately 9.1-13.6 kg)
    - Week 6: Progress to partial WB (approximately 25%-50% body weight)
  - For patellofemoral lesions:
    - Immediate toe-touch WB at 25% body weight with brace locked in full extension.
    - Weeks 2-3: progress to 50% WB
    - Weeks 4-5: progress to 75% WB

Range of motion (ROM)
- CPM
  - Initiate CPM day 1 for total of 8-12 hours/day (0°-60°; if patellofemoral lesion >6.0 cm^2, 0°-40°)
  - Progress CPM ROM as tolerated 5°-10° per day
  - May continue CPM for total of 6-8 hours/day for up to 6 weeks
  - D/C CPM when
- Initiate ROM exercises day 1
- Patellar mobilization (4-6 times per day)
- Motion exercises throughout the day
- Passive knee flexion ROM at least 2-3 times daily
- Passive knee ROM as tolerated
- Knee Flexion ROM goals:
  - For femoral condyle lesions, minimum knee flexion ROM goal is 90° by 1-2 wk, 105° by week 3, 115° by week 4, and 120°-125° by week 6
  - For patellofemoral lesions, minimum knee flexion ROM goal is 90° by weeks 2-3, 105° by weeks 3-4, and 120° by week 6
- Knee Extension ROM goal: full passive extension immediately
- Stretch hamstrings and calf

Strengthening program
- CONTRAINDICATION:
  - No active knee extension exercises for patellofemoral lesions
  - No weight-bearing exercises for femoral condyle lesions
- Ankle pump using elastic tubing
- Quadriceps setting
- Multi-angle isometrics (cocontractions Q/H)

- Straight leg raises (4 directions)
- Active knee extension 90°-40° for femoral condyle lesions, if no articulation of lesion in this ROM, week 4 (no resistance)
- Electrical muscle stimulation and/or biofeedback during quadriceps exercises
- Stationary bicycle when ROM allows, low resistance
- Isometric leg press at week 4 (multi-angle)
- May begin use of pool for gait training and exercises week 6
- Initiate weight shifting exercises with knee in extension weeks 3-4 for patellofemoral lesions

Functional activities
- Gradual return to daily activities
- If symptoms occur, reduce activities to reduce pain and inflammation
    - Extended standing should be avoided

Swelling control
- Ice, elevation, compression, and modalities as needed to decrease swelling

Criteria to progress to Phase 2
- Full passive knee extension
- Knee flexion to 120°
- Minimal pain and swelling

Phase 2. Transition phase (weeks 6-12)

Goals
- Gradually increase to full ROM and WB
- Gradually improve quadriceps strength/endurance
- Gradual increase in functional activities

Brace
- Discontinue brace at 6 wk, consider unloading brace for femoral condyle lesions

Weightbearing
- Progress WB as tolerated
    - For femoral condyle lesions: 75% body weight with crutches at 6-7 wk, and progress to full WB at 8-10 wk, may need to delay full WB up to 14 wk if large lesion, discontinue crutches at 8-10 wk
    - For patellofemoral lesions progress to full WB and discharge crutches at 6-8 wk

ROM
- Gradual increase in ROM
- Maintain full passive knee extension
- Progress knee flexion to 125°-135° by weeks 8-10
- Continue patellar mobilization and soft tissue mobilization, as needed
- Continue stretching program

Strengthening exercises
- Initiate weight shifts weeks 6-8 for femoral condyle lesions
- Initiate mini-squats 0°-45° by weeks 6-8 for patellofemoral lesions
- WB exercises (leg press) weeks 8-10 for femoral condyle lesions: mini-squats 0°-45°, front lunges, step-ups, wall squats; may need to delay WB exercises up to 14 wk if large lesions
- Leg press weeks 8-10 (0°-90° for femoral condyle; 0°-60° for patellofemoral, progressing to 0°-90° as tolerated)
- Toe-calf raises weeks 10-12
- Progress active knee extension: begin resistance from 0°-90° with femoral condyle lesions progressing 0.45 kg every 10-14 d; for patellofemoral lesions begin with 0°-30° (minimal articulation) at week 12 and progress to deeper angles as tolerated
- Stationary bicycle (gradually increase time)
- Balance and proprioception drills
- Continue use of electrical stimulation and biofeedback as needed
- Continue use of pool for gait training and exercise

Functional activities
- As pain and swelling diminish, the patient may gradually increase functional activities
- Gradually increase standing and walking

Criteria to progress to Phase 3
- Full ROM
- Acceptable strength level
    - Hamstrings within 20% of contralateral extremity

    - Quadriceps within 30% of contralateral extremity
- Balance testing within 30% of contralateral extremity
- Able to bike for 30 min

Phase 3. Remodeling phase (weeks 12-26)

Goals
- Improve muscular strength and endurance
- Increase functional activities

ROM
- Patient should exhibit 125°-135° flexion, no restrictions

Exercise program
- Continue progressing exercises
- Leg press 0°-90°
- Bilateral squats (0°-60°)
- Unilateral step-ups progressing from 5.1 to 20.3 cm
- Forward lunges
- Begin walking program on treadmill
- Non-WB knee extension (0°-90°) as tolerated, do not progress to heavy resistance with patellofemoral lesions, must monitor symptoms of pain and crepitation
- Bicycle
- Stairmaster
- Swimming
- Nordic-Trak/elliptical

Functional activities
- Increase walking (distance, cadence, incline, etc)

Maintenance program
- Initiate at weeks 16-20
    - Bicycle, low resistance
    - Progressive walking program
    - Pool exercises for entire lower extremity
    - Straight leg raises into flexion
    - Leg press
    - Wall squats
    - Hip strengthening (abduction/adduction)
    - Front lunges
    - Stretch quadriceps, hamstrings, gastrocnemius

Criteria to progress to Phase 4
- Full nonpainful ROM
- Strength within 80%-90% of contralateral extremity
- Balance and/or stability within 75%-80% of contralateral extremity
- No pain, inflammation, or swelling

Phase 4. Maturation phase (weeks 26-52)

Goals
- Gradual return to full unrestricted functional activities

Exercises
- Continue maintenance program progression 3-4 times per wk
- Progress resistance as tolerated
- Emphasis on entire lower extremity strength and flexibility
- Progress agility and balance drills
- Impact loading program should be individualized to the patient's needs
- Progress sport programs depending on patient variables

Functional activities
- Patient may return to various sport activities as progression in rehabilitation and cartilage healing allows. Generally, low-impact sports, such as skating, rollerblading, and cycling, are permitted at about 6-8 mo. Higher-impact sports such as jogging, running, and aerobics may be performed at 8-10 months. High-impact sports such as tennis, basketball, and baseball, are allowed at 12-18 months.