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Postoperative Rehabilitation Guidelines
Matrix-Assisted Chondrocyte Implantation (MACI)
Trochlea

The following protocol is intended as a general guideline for physical therapist, athletic trainer, and patient after Matrix-assisted chondrocyte implantation (MACI). These guidelines are designed to facilitate the expedited and safe return to athletic or professional activity and is based on a review of the current scientific principles of knee rehabilitation. For the treating health care provider this protocol should not serve as a substitute for individualized clinical decision making during the patient's post-operative course following MACI. It should rather take into consideration the individual's physical findings, progression, and possible post-operative limitations. If the therapist or patient requires assistance or encounters any postoperative complication they should consult with **the surgeon**.

GUIDELINES

PHASE I - PROTECTION PHASE (WEEKS 0-6)

Goals:

- Protect healing tissue from load and shear forces • Restore full passive knee extension
- Regain quadriceps control • Decrease pain and effusion
- Gradually improve knee flexion

Brace:

- Locked at 0° during ambulation and weight-bearing activities
- Sleep in locked brace for 4 weeks

Weight Bearing:

- WBAT with brace locked in full extension for isolated trochlea MACI

Range of Motion:

Strengthening Program:

Functional Activities:

- Gradual return to daily activities
- If symptoms occur, reduce activities to reduce pain and inflammation
- Extended standing should be avoided
- Use caution with stair climbing

Swelling Control:

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

Criteria to Progress To Phase II:

- Full passive knee extension • Knee flexion to 115°-120°

- Minimal pain and swelling • Voluntary quadriceps activity

Trochlea Rehabilitation Guidelines₁ (Intended for small lesions [$<5\text{cm}_2$] with no concomitant procedure)

For concomitant procedures, large lesions ($\geq 5\text{cm}_2$), OCD, uncontained or multiple lesions, please see

additional considerations in the Rehabilitation Guideline Variations below.

- Immediate motion exercise days 1-2
- Full passive knee extension immediately
- Initiate CPM on day 1 for total of 6-8 hours/day (0° - 60° ; if lesion $> 6\text{ cm}_2$ 0° - 40°) for first 2-3 weeks
- Progress CPM ROM as tolerated 5° - 10° per day
- May continue use of CPM for total of 6-8 hours per day for 6 weeks
- Patellar mobilization (4-6 times per day)
- Motion exercises throughout the day
- Passive knee flexion ROM 2-3 times daily
- Knee flexion ROM goal is 90° by 2-3 weeks
- Knee flexion ROM goal is 105° by 3-4 weeks, and 120° by week 6
- Stretch hamstrings, calf
- Ankle pump using rubber tubing
- Quad setting
- Straight leg raises (4 directions)
- Toe-calf raises by week 2
- Stationary bicycle when ROM allows
- Biofeedback and electrical muscle stimulation, as needed
- Isometric leg press by week 4 (multi-angle)
- Initiate weight shifts by weeks 2-3
- May begin pool therapy for gait training and exercise by week 4

PHASE II - TRANSITION PHASE (WEEKS 6-12)

Goals:

- Gradually increase ROM
- Gradually improve quadriceps strength/endurance
- Gradually increase functional activities

Brace:

- Discontinue brace by 6 weeks

Weight-Bearing:

- Progress weight-bearing as tolerated
- Progress to full weight-bearing by 6-8 weeks
- Discontinue crutches by 6-8 weeks

Range of Motion:

- Gradually increase ROM
- Maintain full passive knee extension
- Progress knee flexion to 120° - 125° by week 8
- Continue patellar mobilization and soft tissue mobilization, as needed
- Continue stretching program

Strengthening Exercises:

- Closed kinetic chain exercises (leg press 0° - 60°) by week 8
- Initiate mini-squats 0° - 45° by week 8
- Toe-calf raises at week 6
- Open kinetic chain knee extension without resistance

- Begin knee extension 0°-30° then progress to deeper angles
- Stationary bicycle (gradually increase time)
- Stair machine by week 12
- Balance and proprioception drills
- Initiate front and lateral step-ups by weeks 8-10
- Continue use of biofeedback and electrical muscle stimulation, as needed

Functional Activities:

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

Criteria to Progress To Phase III:

- Full range of motion
- Acceptable strength level
 - Hamstrings within 20% of contralateral leg
 - Quadriceps within 30% of contralateral leg
- Balance testing within 30% of contralateral leg
- Able to walk 1-2 miles or bike for 30 minutes

PHASE III: REMODELING PHASE (WEEKS 12-32)

Goals:

- Improve muscular strength and endurance
- Increase functional activities

Range of Motion:

- Patient should exhibit 125°-135° flexion

Exercise Program:

- Leg press (0°-60°; progress to 0°-90°)
- Bilateral squats (0°-60°)
- Unilateral step-ups progressing from 2" to 6"
- Forward lunges
- Walking program on treadmill
- Open kinetic chain knee extension (90°-40°) – progress 1 lb every 2 weeks beginning week 20 if no pain or crepitation – must monitor symptoms
- Bicycle
- Stair machine
- Swimming
- Ski machine/Elliptical trainer

Functional Activities:

- As patient improves, you may increase walking (distance, cadence, incline, etc.)
- Light running can be initiated toward end of phase based on physician evaluation

Maintenance Program:

- Initiate by weeks 16-20
- Bicycle – low resistance, increase time
- Progressive walking program
- Pool exercises for entire lower extremity
- Straight leg raises
- Leg press
- Wall squats
- Hip abduction / adduction
- Front lunges
- Step-ups
- Stretch quadriceps, hamstrings, calf

Criteria to Progress to Phase IV:

- Full non-painful ROM
 - Strength within 80%-90% of contralateral extremity
 - Balance and/or stability within 75%-80% of contralateral extremity
 - Rehabilitation of functional activities causes no or minimal pain, inflammation or swelling.
- Please see accompanying full Prescribing Information inside back pocket. 13

PHASE IV - MATURATION PHASE (8-15 MONTHS)

Goals:

- Gradually return to full unrestricted functional activities

Exercises:

- Continue maintenance program progression 3-4 times/week
- Progress resistance as tolerated
- Emphasis on entire lower extremity strength & flexibility
- Progress agility and balance drills
- Progress walking program as tolerated
- Impact loading program should be specialized to the patient's demands
- No jumping or plyometric exercise until 12 months
- 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 swimming, skating, in-line skating, and cycling are permitted at about 6 months. High impact sports such as jogging, running, and aerobics may be performed at 8-9 months for small lesions or 9-12 months for larger lesions. High impact pivoting sports such as tennis, basketball, football, and baseball may be allowed at 12-18 months. Individual results may vary. Many patients are able to participate in sports with some limitations.