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

**Femoral condyle – Small Lesions**

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**.

**MACI IMPLANTATION**

**Femoral Condyle Rehabilitation Guidelines<sub>1</sub>** (Intended for small lesions [ $<5\text{cm}$ ] with no concomitant procedure)

**GUIDELINES**

**PHASE I - PROTECTION PHASE (WEEKS 0-6)**

**Goals:**

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

**Brace:**

- Locked at 0° during weight-bearing activities

- Sleep in locked brace for 2-4 weeks

**Weight-Bearing:**

- Non-weight-bearing for 1-2 weeks, may begin toe-touch weight bearing immediately per physician instructions
- Toe touch weight-bearing (approx. 20-30 lbs) weeks 2-3
- Partial weight-bearing (approx. 1/4 body weight) at weeks 4-5

**Range of Motion:**

- Motion exercise 6-8 hours post-operative
- Full passive knee extension immediately
- Initiate Continuous Passive Motion (CPM) day 1 for total of 8-12 hours/day (0°-40°) for 2-3 weeks
- Progress CPM Range of Motion (ROM) as tolerated 5°-10° per day
- May continue CPM for total of 6-8 hours per day for up to 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 1-2 weeks
- Knee flexion ROM goal is 105° by 3-4 weeks and 120° by week 5-6
- Stretch hamstrings and calf

**Strengthening Program:**

- Ankle pump using rubber tubing
- Quad setting
- Multi-angle isometrics (co-contractions Q/H)
- Active knee extension 90°-40° (no resistance)
- Straight leg raises (4 directions)
- Stationary bicycle when ROM allows
- Biofeedback and electrical muscle stimulation, as needed
- Isometric leg press by week 4 (multi-angle)
- May begin use of pool for gait training and exercises by week 4

**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 edema modalities as needed to decrease swelling

**Criteria to Progress To Phase II:**

- Full passive knee extension • Knee flexion to 120°
- Minimal pain and swelling • Voluntary quadriceps activity

**PHASE II - TRANSITION PHASE (WEEKS 6-12)**

**Goals:**

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

**Brace:**

- Discontinue post-operative brace by week 6
- Consider unloading knee brace

**Weight-Bearing:**

- Progress weight-bearing as tolerated
- Progress to full weight-bearing by 8-9 weeks
- Discontinue crutches by 8-9 weeks

**Range of Motion:**

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

**Strengthening Exercises:**

- Initiate weight shifts week 6
- Initiate mini-squats 0°-45° by week 8
- Closed kinetic chain exercises (leg press)
- Toe-calf raises by week 8
- Open kinetic chain knee extension progress 1 lb/week
- Stationary bicycle, low resistance (gradually increase time)
- Treadmill walking program by weeks 10-12
- Balance and proprioception drills
- Initiate front and lateral step-ups and wall squats by weeks 8-10
- Continue use of biofeedback and electrical muscle stimulation, as needed
- Continue use of pool for gait training and exercise

**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: MATURATION PHASE (WEEKS 12-26)****Goals:**

- Improve muscular strength and endurance
- Increase functional activities

**Range of Motion:**

- Patient should exhibit 125°-135° flexion

**Exercise Program:**

- Leg press (0°-90°)
- Bilateral squats (0°-60°)
- Unilateral step-ups progressing from 2" to 8"
- Forward lunges
- Walking program
- Open kinetic chain knee extension (0°-90°)
- Bicycle
- Stair machine
- Swimming
- Ski machine/Elliptical trainer

**Functional Activities:**

- As patient improves, increase walking (distance, cadence, incline, etc.)

**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. 9

**PHASE IV - FUNCTIONAL ACTIVITIES PHASE (WEEKS 26-52)**

**Goals:**

- Gradual 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 and flexibility
- Progress agility and balance drills
- Impact loading program should be specialized to the patient's demands
- 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.