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### Autologous Chondrocyte Implantation (ACI) – Femoral Condyle

**\*\*\*If the patient had a concomitant procedure, please see the appropriate combined protocol.**

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

#### **Functional Activities:**

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

#### **Maintenance Program:**

- |   |  |
|---|--|
| • Initiate by weeks 16-20                   | • Leg press                            |
| • Bicycle – low resistance, increase time   | • Wall squats                          |
| • Progressive walking program               | • Hip abduction / adduction            |
| • Pool exercises for entire lower extremity | • Front lunges                         |
| • Straight leg raises                       | • 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.

### **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.