
Autologous Chondrocyte Implantation (Trochlea) Physical Therapy Protocol

Phase I: Protection (Weeks 0 to 6)

Goals

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

Weight Bearing

- Toe touch weight bearing (approximately 20 to 30 pounds) immediately with brace locked into extension
- 25 percent weight bearing with two crutches at week one
- 50 percent weight bearing with two crutches at week two
- 75 percent weight bearing with two crutches at week four
- Progress to full weight bearing at week six (wean from crutches as gait normalizes)

Brace

- Locked at 0 degrees during weight bearing activities for four weeks
- Sleep in locked brace for four weeks
- Discontinue brace at week six

Range of Motion

- No immediate limitation on passive range of motion (below are minimum recommendations)
- 0 to 90 degrees at weeks one to two
- 0 to 120 degrees at weeks three to four

Functional Activities

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

Exercises

- Full passive knee extension
- No open chain knee extension
- Continuous passive motion
 - Initiate on day one (0 to 40 degrees; progressing 5 to 10 degrees each day) for two to three weeks
 - May continue for six to eight hours a day for up to six weeks
- Patellar mobilizations (four to six times a day)
- Hamstring stretches
- Calf stretches
- Ankle strengthening with Theraband
- Quad sets
- Four-way straight leg raises

- Stationary bike (when range of motion allows)
- Neuromuscular electrical stimulation as needed
- Initiate weight shifts at week four
- Isometric leg press (multi-angle) at week four
- Pool for gait training at week four
- Cryotherapy with elevation for pain and inflammation every hour for 20 minutes

Phase II: Transition (Weeks 6 to 12)

Criteria to Progress to Phase II

- Full passive knee extension
- Knee flexion to 115 to 120 degrees
- Minimal pain and swelling

Goals

- Gradually increase range of motion
- Gradually improve quadriceps strength/endurance
- Gradually increase functional activities

Range of Motion

- Progress to full range of motion at week eight

Functional Activities

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

Exercises

- Continue exercises as listed above
- No open chain knee extension
- Step ups
- Balance and proprioception drills
- Progress knee flexion to full range of motion by week eight
- Calf/toe raises
- Leg press (0 to 60 degrees) at week eight
- Mini squats (0 to 45 degrees) at week eight
- Increase closed kinetic chain exercises
- Stationary bike (increasing time as tolerated)
- Elliptical/StairMaster at week 12
- Continue cryotherapy for pain management

Phase III: Remodeling (Weeks 13 to 32)

Criteria to Progress to Phase III

- Full range of motion
- Appropriate strength level (hamstrings within 10 percent and quadriceps within 10 to 20 percent of contralateral side)
- Balance testing within 30 percent of contralateral side
- Able to walk for two miles or bike for 30 minutes

Goals

- Improve muscular strength and endurance
- Increase functional activities

Functional Activities

- As patient improves, increase walking (distance, cadence, incline, etc.)
- Light running can be initiated toward the end of the phase based on Dr. Kendall's decision

Exercises

- Continue exercises as listed above
- Leg press (0 to 90 degrees)
- Lateral step downs
- Wall squats (0 to 60 degrees)
- Forward lunges
- Terminal knee extensions
- Lateral walks with resistance
- Long arc quads (90 to 40 degrees)
- Walking program on treadmill
- Swimming
- Elliptical/NordicTrak/StairMaster

Maintenance Program Starting at Weeks 16 to 20

- Bicycle (low resistance)
- Progressive walking program
- Pool exercises for lower extremities
- Four-way straight leg raises
- Leg press
- Wall squats
- Hip abduction/adduction
- Lunges
- Hamstring stretches
- Quadriceps stretches
- Calf stretches
- Progress to full open knee extensions if pain free

Phase IV: Maturation (Months 8 to 15)

Criteria to Progress to Phase IV

- Full, non-painful range of motion
- Strength within 90 percent of contralateral side
- Balance and stability within 75 percent of contralateral side
- No pain, inflammation or swelling

Goals

- Gradual return to unrestricted functional activities

Functional Activities

- Patient may return to various sport activities as progressing in rehabilitation and cartilage healing allows
 - **6 Months:** Low impact sports such as golf, swimming, skating, roller-blading and cycling
 - **8 to 9 Months:** Higher impact sports such as running, jogging and aerobics
 - **12 Months:** High impact sports such as tennis, basketball, football and baseball

Exercises

- Continue maintenance program three to four times a 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
- No jumping or plyometric exercise until 12 months
- Progress sport programs depending on patient variables