



Autologous Chondrocyte Implantation

Carticel®

Precautions: NWB with crutches and a hinged brace for 3 weeks. Brace is to be worn at all times until initiating PT. Patient will still be required to sleep with the brace on for 4-6 weeks post-op. Pain may limit advancement of exercise or exercises may need to be modified for specific patients.

Phase I (1 – 5 days post-op)

- Wound care: Observe for signs of infection
- Modalities: PRN for pain and inflammation (ice, IFC)
- Brace: Hinged brace locked in full extension (including while sleeping)
- Gait: NWB
- ROM: 0-30 degrees maximum
 - Passive positional stretches for extension and flexion
 - CPM in prescribed by physician
 - Ankle AROM

Phase II (5 days – 4 weeks post-op)

- Wound care: Observe for signs of infection and begin scar management techniques when incision is closed
- Modalities:
 - NMED to quads if unable to perform quad sets and extensor lag with SLR
 - IFC and ice for pain and edema prn
 - sEMG neuromuscular re-education for quad sets
- Brace: Hinged brace locked in full extension during WB activities at all times. Brace may be removed in PT clinic for NWB exercises
- Gait: NWB
- ROM:
 - Femoral Condyle
 - Weeks 1-2: 90 degrees
 - By week 3: 105 degrees
 - Patellofemoral
 - Weeks 2-3: 90 degrees
 - Weeks 3-4: 105 degrees

- Strengthening:
 - Femoral Condyle
 - Weeks 0-2: Quad sets, 4 way SLR, hamstring isometrics, LAQ AROM 90-40 degrees
 - Exercise in brace if poor quad control
 - Weeks 2-6: Bilateral closed chain strengthening, but avoid WB on graft
 - Discuss graft with physician
 - Patellofemoral
 - Weeks 0-4: Quad sets, 4 way SLR, hamstring isometrics, No open chair AROM (SAQ, LAQ)
 - Weeks 2-3: Add weight shifting with brace locked in full extension
 - Exercise in brace if poor quad control
- Conditioning:
 - UBE
 - Stationary bike with well leg

Phase III (4 weeks – 10 weeks post-op)

- Wound care: Continue scar mobilizations
- Modalities:
 - Continue e-stim for re-education or edema
 - sEMG to continue (for balance of VL to VMO or overall contraction)
 - Continue PRN (ice, IFC)
- Brace:
 - Open to 30 degrees, unless otherwise noted by physician
 - At 6 weeks, wean from post-op brace
 - At 10 weeks, D/C brace
- Gait:
 - Normalize gait pattern on level surfaces and progress to step-over-step pattern on stairs
 - Femoral Condyle:
 - At 6 weeks, 50% WB
 - At 8-9 weeks, progress to FWB and D/C crutches
 - Patellofemoral:
 - By 6-8 weeks, progress to FWB and D/C crutches
- ROM:
 - Patellar mobility
 - Emphasize full extension
 - Femoral Condyle
 - By 4 weeks, 115 degrees

- By 6 weeks, 120-125 degrees
- By 8 weeks, 125-135 degrees
- By 12 weeks, full ROM
- Patellofemoral:
 - By 4 weeks, 105 degrees
 - By 6 weeks, 120 degrees
 - By 8 weeks, 125-135 degrees
 - By 12 weeks, full flexion
- Strengthening:
 - Continue phase I
 - Femoral Condyle:
 - Progress bilateral closed chain exercises
 - Mini squats/Leg press 0 – 45 degrees
 - Forward and lateral step ups
 - Start at 2 inches, gradually advancing
 - Add treadmill walking
 - Progress speed in forward direction to fast walk then add retro
 - Patellofemoral:
 - Initiate closed chain isometrics
 - Start weight shifting in full extension when WB
 - Conditioning:
 - Stationary bike
 - UBE
 - Pool, if available

Phase IV (10+ weeks post-op)

- Wound care: Continue scar mobs
- Modalities:
- Edema:
- Gait: Full WB
- Brace: At 10 weeks, D/C brace
- ROM: By 12 weeks, full ROM
- Strengthening:
 - Femoral Condyle:
 - Increase weights and reps of previous exercises and increase ROM of strengthening machines
 - Standing squats/Leg press 0-60 degrees
 - Stepper/Elliptical/Ski machine

- Initiate balance and proprioceptive activities
- At 12 weeks, increase to a jog on treadmill
- Patellofemoral:
 - Open chain hamstring strengthening 0-30 degrees
 - At 10 weeks, open chain extensions may begin with 0 to light resistance
 - Add treadmill walking; progress speed in forward direction to fast walk, then add retro
 - Initiate balance and proprioceptive activities
- Testing: Functional tests 30-25% deficit

12 – 24 weeks post-op

- Femoral Condyle: At this stage many patients will be able to transition to a maintenance program where they will continue to increase strength and balance. Plyometric activities may begin at 18 weeks. ROM on closed chain exercises can also increase to 90+ degrees. Functional testing <25% for non-athletes and <20% for athletes
- Patellofemoral: At 13 weeks, initiate single leg closed chain strengthening. Increase to incline walk. Jogging may start.

24 – 52 weeks post-op

- Sport specific training can be initiated. Running and cutting drills on a field or court may also start with the confirmation from physician. Single leg loading should be emphasized. Patient variables and type of sport will be a determining factor on the advancement of some phases of the protocol.

Adapted From:

- 1) Reinold MM, Wilk KE et al. Rehabilitation Guidelines: Autologous Chondrocyte Implantation using Carticel. Genzyme Corporation; Cambridge MA. 5/2006.
- 2) Cole BJ. Autologous Chondrocyte Implantation (femoral condyle only) Rehabilitation Protocol. 2003
- 3) Cole BJ. Autologous Chondrocyte Implantation (trochlea/patella) Rehabilitation Protocol. 2003
- 4) Reinold MM, Wilk KE et al. Current Concepts in the Rehabilitation Following Articular Cartilage Repair Procedures in the Knee. J Orthop Sports Physical Therapy 2006;36:774-794
- 5) Maffet MW. ACI Rehab Protocol
- 6) NYU Hospital for Joint Diseases. ACI Rehab Protocol