



Carticel Implantation Rehabilitation Protocol

Autologous Cultured Chondrocytes

Phase 1 (0-6 weeks post-op)

Rehabilitation Goals

- Protect healing tissue from load and shear forces
- ROM: full knee extension, gradually improve knee flexion to ~120°
- Regain adequate quadriceps control

PRECAUTIONS

- Wear brace at all times (except while using the CPM)

Crutches

Partial weight bearing (with brace on) per the schedule below

- Weeks 1-2: Partial weight-bearing @ 0-10% body weight
- Weeks 3-4: Partial weight-bearing @ 25-50% body weight
- Weeks 5-6: Partial weight-bearing @ 50-75% body weight

Brace

- Locked at 0° extension during ambulation and other weight-bearing activities for 6

Wound

- Post-op dressing remains intact until post-op day #3 (~72 hours after surgery)
- May begin showering after post-op day #3 (no need to cover incision site)
- ***Do NOT** submerge knee in tub or pool for 4 weeks*
- Bilateral compression stockings for 3-7 days: unilateral use thereafter as needed
- Suture/staple removal @ 7-10 days per Ortho/PT



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Rehabilitation

- Frequent use of cryocuff and/or ice with lower extremity elevated
- Begin patellar mobilizations (10 reps each direction TID) after suture/staple removal
- Begin scar massage after incision site sloughs/scar is formed

Weeks 1-2

- Calf pumping with tubing
- Static quad sets (with estim until patient able to do 10 SLRs without extension lag)
- SLRs (in brace): All directions - may add light weight when pain free

CPM Use

Assisted Heel Slides 2-3x daily

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| <ul style="list-style-type: none"> • Weeks 1-2: begin at 0-30° and add 5-10° per week (8-12 hours daily) • Weeks 3-6: add 10-15° per week as tolerated (6-8 hours daily) | <ul style="list-style-type: none"> • Weeks 1-2: 0-90° • Weeks 3-4: 0-105° • Weeks 5-6: 0-120° |
|--|--|

- Supine passive extension with towel under heel
- Gentle hamstring stretching

Weeks 3-4

- Seated ankle disk training
- Seated bilateral calf raises - progress to standing bilateral calf raises
- UBE and/or well leg cycle

Weeks 5-6

- Stationary bike when ROM allows - begin with 5-10 minutes and progress gradually
- Short arc quads - may add light weights as tolerated
- Multi-angle leg press isometrics
- Beginning level pool exercises: only gait training & deep water jogging (No "whip" kicking)



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Phase 2 (7-12 weeks post-op)

Rehabilitation Goals

- Normal gait and stair ambulation
- ROM: full knee extension, gradually improve knee flexion to 125-130°
- > 80% hamstring strength and \geq 70% quadriceps and compared to the uninvolved side

PRECAUTIONS

- Gradually increase standing and walking time
- **NO** jogging/running until 6 months post-op

Crutches

Progress gradually to full weight-bearing and D/C crutches during weeks 7-8 post-op

Brace

None required

Rehabilitation

- Continue phase I exercises as needed
- Progress to the following exercises and increase intensity gradually when patient is ready (i.e., no increase in knee pain or effusion since the previous exercise session)
- Note: all strengthening should be done with the brace on, starting with low weights, high repetitions, and in a painless ROM

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Phase 2 (7-12 weeks post-op)

Weeks 7-8

- Stationary bike for conditioning
- Bilateral heel raises – progress to single leg
- Gait training (cone walking, marching, retrowalking, exercise band, etc.)
- Double leg mini-squats (0-45°) - progress to single leg
- General LE stretching (calf, HS, quads, HF, hip adductors)

Weeks 9-10

- Progressive strengthening
(calf press, leg press (0-60°), knee extensions(0-30°), squats (0-45°), HS curls)
(first set: 30 repetitions, then 1 additional sets at the same weight to muscle failure)
- Front and lateral step-ups – (start with 2” and progress gradually)
- Progressive standing balance exercises (body blade, plyoball, platform training, etc.)
(progress in duration, intensity, double leg to single leg, etc.)
- Progressive pool program as tolerated

Weeks 11-12

- Progressive strengthening
(calf press, leg press (0-60°), knee extensions(0-45°), squats (0-60°), HS curls)
(first set: 20 repetitions, then 2 additional sets at the same weight to muscle failure)
- Along with stationary bike, gradually add elliptical and/or stair-master for conditioning

Follow-Up

- PT: Bi-monthly
- Ortho: ~12 weeks post-op;
- Supervised rehabilitation: 2-3 x per week as needed

Documentation

- Precautions, pain level, medications, modalities
- Effusion
- Knee ROM & quadriceps function
- Gait



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Phase 3 (4-6 months post-op)

Rehabilitation Goals

- Full non-painful knee ROM
- > 80% quadriceps and hamstring strength compared to the uninvolved side
- Balance within 75-80% of the uninvolved side

PRECAUTIONS

- ***NO** participation in contact/collision sports or military schools*
- ***NO** jogging/running until 6 months post-op*

Brace

None Required

Rehabilitation

- Continue phase II exercises as needed
- Progress in duration and intensity of exercise only if there is no increase in knee pain or effusion since the previous exercise session.

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Phase 3 (4-6 months post-op)

Weeks 13-19

- Aerobic conditioning (biking, elliptical, stairmaster, swimming)
- General LE stretching: 10-15 minutes (calf, HS, quads, HF, hip adductors)
- Progressive strengthening (calf press, leg press, squats (0-60°), HS curls, hip abd/add) (first set: 10 repetitions, then 2 additional sets at the same weight to muscle failure)
- Forward lunges
- Treadmill walking program (may vary speeds, add incline/decline, etc.)
- Progressive balance training as needed

Weeks 20-26

- Knee extensions (90°-40°): *monitor closely* - progress 1 lb every 2 weeks if no pain or crepitation

Follow-Up

- PT: Monthly
- Ortho: ~6 months post-op;
- Supervised rehab: 2-3 x per week as needed

Documentation

- Pain level & medications
- Effusion
- Knee ROM & quadriceps function



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Phase 4 (7-12 months post-op)

Rehabilitation Goals

- Gradually return to full unrestricted functional activities

PRECAUTIONS

- ***NO** jumping/hopping until 12 months post-op
- ***NO** participation in contact/collision sports until 18 months post-op

Rehabilitation

- Continue phase III exercises as needed
- Progress in duration and intensity of exercise only if there is no increase in knee pain or effusion since the previous exercise session

Weeks 27-32

- Warm-up: 5-10 minutes (bike, elliptical, stairmaster)
- General LE stretching: 5-10 minutes (calf, HS, quads, HF, hip adductors)
- Progressive balance training as needed
- Progressive strengthening (calf press, leg press, squats (0-60°), HS curls, hip abd/add) (first set: 8-10 repetitions, then 2 additional sets at the same weight to muscle failure)
- Jogging on treadmill: start with 5 minutes per session. Do not exceed 10 minutes per session or 30 minutes per week for 1 months after initiation of jogging program.

Weeks 33-52

- Progressive jogging program (increase time and/or distance no more than 10-20% per wk)
- Progressive functional training: Begin at 25-50% intensity and progress gradually (agility drills, directional jogging, cariocas, shuffles, etc.)

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Phase 4 (7-12 months post-op).

Follow-Up

- PT: Monthly
- Ortho: ~12 months post-op;
- Supervised rehab: 1-2 x per week as needed – mostly home exercise program

Documentation

- Pain level - medications and modalities
- Effusion
- Knee ROM & quadriceps function
- Hop for distance

Miscellaneous

- **NO** return to contact/collision sports until ~12 months post-op per PT/ortho
- The 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. Higher impact sports such as jogging, running, and aerobics may be allowed at 8-9 months for small lesions or 9-12months for larger lesions. Higher impact sports such as tennis, basketball, and baseball may be allowed at 12-18 months.

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