

## Carticel Implantation

### Femoral Condyle Rehabilitation Guidelines<sup>1</sup>

(Intended for small lesions [ $<5\text{cm}^2$ ] with no concomitant procedure)

For concomitant procedures, large lesions ( $\geq 5\text{cm}^2$ ), OCD, uncontained or multiple lesions, please see additional considerations in the Rehabilitation Guideline Variations section starting on page 16.

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

### Goals:

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

### Brace:

- Locked at  $0^\circ$  during weight-bearing activities
- Sleep in locked brace for 2-4 weeks

### Weight-Bearing:

- Non-weight-bearing for first week, 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 6 hours/day ( $0^\circ$ - $40^\circ$ ) for 2-3 weeks
- Progress CPM range of Motion (ROM) as tolerated  $5^\circ$ - $10^\circ$  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  $90^\circ$  by 1-2 weeks
- Knee flexion ROM goal is  $105^\circ$  by 3-4 weeks and  $120^\circ$  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  $90^\circ$ - $40^\circ$  (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

## Carticel Implantation

### Femoral Condyle Rehabilitation Guidelines<sup>1</sup> continued

#### Swelling Control:

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- Ice, elevation, compression, and edema modalities as needed to decrease swelling

#### Brace:

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- Locked at 0° during weight-bearing activities
- Sleep in locked brace for 2-4 weeks

#### Criteria to Progress To Phase II:

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

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

#### Goals:

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

#### Brace:

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

#### Weight-Bearing:

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- Progress weight-bearing as tolerated
- Progress to full weight-bearing by 8-9 weeks
- Discontinue crutches by 6 weeks

#### Range of Motion:

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- 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 Program:

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- 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:

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

## Carticel Implantation

### Femoral Condyle Rehabilitation Guidelines<sup>1</sup> continued

#### Criteria to Progress To Phase III:

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- 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:

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- Improve muscular strength and endurance
- Increase functional activities

#### Range of Motion:

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- Patient should exhibit 125°-135° flexion

#### Exercise Program:

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- 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:

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

#### Maintenance Program:

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- 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:

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- 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



## Carticel Implantation

### Trochlea Rehabilitation Guidelines<sup>1</sup> continued

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

### Goals:

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- Gradual return to full unrestricted functional activities

### Exercises:

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- 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:

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- 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.

## Carticel Implantation

### Trochlea Rehabilitation Guidelines<sup>1</sup>

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

### Goals:

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

### Brace:

- Locked at  $0^\circ$  during ambulation and weight-bearing activities
- Sleep in locked brace for 2-4 weeks

### Weight-Bearing:

- Immediate partial weight-bearing in full extension, as tolerated
- 25% body weight with brace locked
- 50% body weight by week 2 in brace
- 75% body weight by weeks 3-4 in brace

### Range of Motion:

- Immediate motion exercise days 1-2
- Full passive knee extension immediately
- Initiate CPM on day 1 for total of 8-12 hours/day ( $0^\circ - 60^\circ$ ; if lesion  $> 6\text{ cm}^2$   $0^\circ - 40^\circ$ ) for first 2-3 weeks
- Progress CPM ROM as tolerated  $5^\circ - 10^\circ$  per day
- May continue use of CPM for total of 6 hours per day for 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  $90^\circ$  by 2-3 weeks
- Knee flexion ROM goal is  $105^\circ$  by 3-4 weeks, and  $120^\circ$  by week 6
- Stretch hamstrings, calf

### Strengthening Program:

- Ankle pump using rubber tubing
- Quad setting
- Straight leg raises (4 directions)
- Toe-calf raises by week 2
- Stationary bicycle when ROM allows
- Biofeedback and electrical muscle stimulation, as needed
- Isometric leg press by week 4 (multi-angle)
- Initiate weight shifts by weeks 2-3
- May begin pool therapy for gait training and exercise 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
- Use caution with stair climbing

### 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  $115^\circ - 120^\circ$
- Minimal pain and swelling
- Voluntary quadriceps activity



## Carticel Implantation

### Trochlea Rehabilitation Guidelines<sup>1</sup> continued

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

##### Goals:

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

##### Brace:

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- Discontinue brace by 6 weeks

##### Weight-Bearing:

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- Progress weight-bearing as tolerated
- Progress to full weight-bearing by 6-8 weeks
- Discontinue crutches by 6-8 weeks

##### Range of Motion:

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- Gradually increase ROM
- Maintain full passive knee extension
- Progress knee flexion to 120°-125° by week 8
- Continue patellar mobilization and soft tissue mobilization, as needed
- Continue stretching program

##### Strengthening Exercises:

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- Closed kinetic chain exercises (leg press 0°-60°) by week 8
- Initiate mini-squats 0°-45° by week 8
- Toe-calf raises at week 6
- Open kinetic chain knee extension without resistance
- Begin knee extension 0°-30° then progress to deeper angles
- Stationary bicycle (gradually increase time)
- Stair machine by week 12
- Balance and proprioception drills
- Initiate front and lateral step-ups by weeks 8-10
- Continue use of biofeedback and electrical muscle stimulation, as needed

##### Functional Activities:

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- 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

## Carticel Implantation

### Trochlea Rehabilitation Guidelines<sup>1</sup> continued

#### PHASE III - REMODELING PHASE (WEEKS 12-32)

##### Goals:

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- Improve muscular strength and endurance
- Increase functional activities

##### Range of Motion:

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- Patient should exhibit 125°-135° flexion

##### Exercise Program:

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- Leg press (0°-60°; progress to 0°-90°)
- Bilateral squats (0°-60°)
- Unilateral step-ups progressing from 2" to 6"
- Forward lunges
- Walking program on treadmill
- Open kinetic chain knee extension (90°-40°) – progress 1 lb every 2 weeks beginning
- Week 20 if no pain or crepitation – must monitor symptoms
- Bicycle
- Stair machine
- Swimming
- Ski machine/elliptical trainer

##### Functional Activities:

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- As patient improves, you may increase walking (distance, cadence, incline, etc.)
- Light running can be initiated toward end of phase based on physician evaluation

##### Maintenance Program:

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- 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



## Carticel Implantation

### Trochlea Rehabilitation Guidelines<sup>1</sup> continued

## PHASE IV - MATURATION PHASE (8-15 MONTHS)

### Goals:

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- Gradually return to full unrestricted functional activities

### Exercises:

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- Continue maintenance program progression 3-4 times/week
- Progress resistance as tolerated
- Emphasis on entire lower extremity strength & flexibility
- Progress agility and balance drills
- Progress walking program as tolerated
- 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

### Functional Activities:

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- 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.