



**Lahey Hospital
& Medical Center**

Rehabilitation Protocol:

**Distal Femoral and Proximal Tibial
Microfracture**

Department of Orthopaedic Surgery

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◀ Overview

In the knee the articular cartilage at the femoral condyles, tibial plateau and patella can be damaged or torn during athletic trauma or injury causing an articular cartilage lesion. This results in the articular cartilage losing the normal smooth gliding articulation and the ability to resist compressive forces at the joint. These changes can cause pain, swelling, loss of motion, weakness and reduced function or performance.

Microfracture is a surgical procedure performed to assist with cartilage regeneration. This procedure consists of the surgeon debriding any frayed tissue or flaps at the margin of the lesion. After this, the calcified chondral layer is debrided to expose the underlying subchondral bone. Removal of this layer allows the surgeon to pick holes into the bone with an awl called microfractures which will mature to form into fibrocartilage.

The rehabilitation process is important for success of the microfracture procedure. Avoiding weight bearing exercises and performing frequent ROM exercises are a crucial part of the early rehabilitation process. Adherence to an aggressive physical therapy program following surgery appears to enhance the success of the procedure. Specific time frames, restrictions and precautions are given to protect healing tissues and the surgical repair/reconstruction. Individuals with lesions that are larger or in predominately weight bearing locations will progress more slowly than those with smaller non weight bearing lesions.

◀ **Phase I** **0–6 Weeks**

Goals

- Protect the cartilage transfer-avoid weight bearing if instructed to do so
- Ensure wound healing
- Attain and maintain full knee extension
- Gain knee flexion to 90 degrees
- Decrease knee and leg swelling
- Promote quad muscle control

Precautions

- Weight bearing as ordered by surgeon
- No Resisted Closed Chain exercises x 6 weeks
- No Resisted Open Chain exercises x 6 weeks
- No impact activities until 12 weeks post-operative
- Limit Knee flexion with strengthening to 45 degrees
- Avoid loading knee at deep flexion angles

Weeks 0–2

- **Cardiovascular**
 - Stationary bicycle for ROM, seat adjusted high, no resistance
- **ROM**
 - Extension -5 degrees to flexion 30-40 degrees with gradual increase to 90 degrees (10 hrs/day)
- **Therapeutic Exercise**
 - Patellar mobilization (teach patient)
 - Ankle pumps
 - Quad set
 - Electrical stimulation in full extension with quad sets and SLR
 - Heel slides (supine and sitting)
 - 4 way Straight leg raise (SLR) with knee in brace
 - No Resisted Closed Chain exercises x 6 weeks
 - No Resisted Open Chain exercises x 6 weeks
- **Gait**
 - Non-Weight Bearing with crutches
 - Brace locked in full extension x 6 weeks
- **Modalities**
 - Electrical stimulation in full extension with quad sets and SLR
 - Cryotherapy

Weeks 2-4

- **Cardiovascular**
 - Stationary bicycle for ROM, seat adjusted high, no resistance
- **ROM**
 - Extension -5 degrees to flexion 30-40 degrees with gradual increase to full ROM
 - D/C CPM once patient is independent with stationary bicycle
 - AAROM->AROM as tolerated
 - Patellar Mobilization
 - Scar massage when incision healed
- **Therapeutic Exercise**
 - Ankle pumps
 - Quad set
 - Electrical stimulation in full extension with quad sets and SLR
 - Heel slides (supine and sitting)
 - Co-contractions quads / hamstrings at 0, 30, 60, 90 degrees
 - 4 way Straight leg raise (SLR), no knee brace
 - No Resisted Closed Chain exercises x 6 weeks
 - No Resisted Open Chain exercises x 6 weeks
- **Gait**
 - TTWB with crutches
 - Brace locked in extension x 6 weeks
- **Modalities**
 - Electrical stimulation in full extension with quad sets and SLR
 - Cryotherapy

Weeks 4-6

- **Cardiovascular**
 - Stationary bicycle for ROM, seat adjusted high
- **ROM**
 - PROM->AAROM->AROM to regain full ROM
 - Patellar Mobilization
 - Scar massage when incision healed
- **Therapeutic Exercise**
 - Ankle pumps
 - Quad set
 - Electrical stimulation in full extension with quad sets and SLR
 - Heel slides (supine and sitting)
 - Co-contractions quads / hamstrings at 0, 30, 60, 90 degrees
 - 4 way Straight leg raise (SLR), no knee brace
 - Standing: Double leg heel raises to single leg
 - Standing SLR x 4 with Theraband (standing on uninvolved LE)
 - No Resisted Closed Chain exercises x 6 weeks
 - No Resisted Open Chain exercises x 6 weeks
- **Gait**
 - TTWB with crutches
 - Brace locked in extension x 6 weeks
- **Modalities**
 - Electrical stimulation in full extension with quad sets and SLR
 - Cryotherapy

◀ Phase II – Intermediate Phase Weeks 6 – 12

Goals

- No effusion
- Full knee extension
- Single leg stand control
- Normalize gait
- Regain full motion
- Regain full muscle strength
- Good control and no pain with functional movements, including step up/down, squat, partial lunge (staying less than 60° of knee flexion)

Precautions

- No impact activities until 12 weeks post-op
- Limit knee flexion with strengthening to 45 degrees
- Avoid
 - Loading knee at deep flexion angles
 - Post-activity swelling
 - Stair stepper, deep knee bends and squats

Weeks 6-8

- **Cardiovascular**
 - Stationary bicycle
 - Non-impact endurance training
 - Nordic track
 - Swimming
 - Deep water run
 - Cross trainer
 - Treadmill – Forwards and backwards walking
- **ROM**
 - Full AROM and PROM
 - Patellar Mobilization
 - Scar massage when incision healed
- **Therapeutic Exercise**
 - 4 way Straight leg raise (SLR), no knee brace
 - Standing: hamstring curl and toe raises
 - Standing SLR x 4 with Theraband (standing on uninvolved LE)
 - Hamstring curls – Carpet drags or rolling stool (closed chain)
 - Non-impact balance and proprioceptive drills
 - Hip and core strengthening
 - Stretching for patient specific muscle imbalances
- **Gait**
 - WBAT
 - Unlock brace
 - D/C crutches when gait is normal
- **Modalities**

- Cryotherapy

Weeks 8-12

- **Cardiovascular**
 - Stationary bicycle with minimal resistance
 - Non-impact endurance training
 - Nordic track
 - Swimming
 - Waist deep water walking or slow jogging
 - Cross trainer
 - Treadmill – walking progression program -> progress to 2 miles at 15 min/mile pace
 - Elliptical trainer
- **ROM**
 - Full AROM and PROM
- **Therapeutic Exercise**
 - 4 way Straight leg raise (SLR) with progression of weight 1-5lbs
 - Standing: hamstring curl and toe raises
 - Standing SLR x 4 with Theraband (standing on uninvolved LE)
 - Hamstring curls – Carpet drags or rolling stool (closed chain)
 - Proprioceptive training
 - BAPS, ball toss, body blade
 - Hip and core strengthening
 - Forward, lateral and retro step ups
 - Wall squats
 - Stretching for patient specific muscle imbalances including quad stretches
 - AVOID: stair stepper, deep knee bends and squats
- **Gait**
 - Normal gait on all surfaces
- **Modalities**
 - Cryotherapy

Progression Criteria to Advance to Phase III

- Normal gait on all surfaces
- Full range of motion
- No effusion
- Ability to carry out functional movements without unloading affected leg or pain, while demonstrating good control
- Single leg balance greater than 15 seconds

◀ Phase III Week 12+

Goals

- Regain full muscle strength
- No thigh atrophy
- Gradual return to full activity
- Walk 2 miles at 15 min/mile pace

Precautions

- Avoid pain at patellar tendon site
- Build up resistance and repetitions gradually
- Perform exercises slowly avoiding quick direction changes and impact loading
- Exercise frequency should be 2-3 times per week to build strength
- Be consistent and regular with the exercise schedule
- DO NOT:
 - Knee extension weights with machine
 - Running
 - Jumping
 - Pivoting or cutting
 - Lunges
 - Stairmaster

- **Cardiovascular**

- Bike indoors brace off, outdoors brace on
- Non-impact endurance training
- Nordic track
- Swimming
- Waist deep water walking or slow jogging
- Cross trainer
- Treadmill – walking progression program -> progress to 2 miles at 15 min/mile pace
- Elliptical trainer

- **Therapeutic Exercise**

- Continue appropriate previous exercises with progressive resistance
- Squat to chair
- Seated leg press
- Resisted hamstring curl
- Step up and down exercises

Months 3-4

- **Cardiovascular**

- Bike indoors brace off, outdoors brace on
- Swimming
- Waist deep water jogging
- Cross trainer
- Treadmill – walking progression program
- Elliptical trainer

- **Therapeutic Exercise**

- Continue appropriate previous exercises with progressive resistance
- Agility drills / Plyometrics
- Sit-up progression
- Progressive weight training program



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- Transition to home / gym program
- Return to all activities
- NO RETURN TO SPORTS UNTIL 6 MONTHS POST-OPERATIVE

Rehabilitation Protocol for Tibiofemoral Microfracture Rehabilitation Guidelines: Summary Table

Post –op Phase/Goals	Range of Motion	Interventions/Activities	Precautions
<p>Phase I 0 - 6 weeks after surgery</p> <p>Goals:</p> <ul style="list-style-type: none"> • Protect the cartilage transfer-avoid weight bearing if instructed to do so • Ensure wound healing • Attain and maintain full knee extension • Gain knee flexion to 90 degrees • Decrease knee and leg swelling • Promote quad muscle control 	<p>Weeks 0-2</p> <ul style="list-style-type: none"> • Extension -5 degrees to flexion 30-40 degrees with gradual increase to 90 degrees (10 hrs/day) 	<ul style="list-style-type: none"> • Stationary bicycle for ROM, seat adjusted high, no resistance <p>Manual Therapy</p> <ul style="list-style-type: none"> • Patella Mobilization <p>Therapeutic Exercise</p> <ul style="list-style-type: none"> • Ankle pumps • Quad set • Electrical stimulation in full extension with quad sets and SLR • Heel slides (supine and sitting) • 4 way Straight leg raise (SLR) with knee in brace <p>Gait</p> <ul style="list-style-type: none"> • Non-Weight Bearing with crutches • Brace locked in full extension x 6 weeks <p>Modalities</p> <ul style="list-style-type: none"> • Electrical stimulation in full extension with quad sets and SLR • Cryotherapy 	<ul style="list-style-type: none"> • Weight bearing as ordered by surgeon • No Resisted Closed Chain exercises x 6 weeks • No Resisted Open Chain exercises x 6 weeks • No impact activities until 12 weeks post-operative • Avoid loading knee at deep flexion angles • Limit knee flexion with strengthening to 45 degrees

Post –op Phase/Goals	Range of Motion	Interventions/Activities
Weeks 2-4	Extension -5 degrees to flexion 30-40 degrees with gradual increase to full ROM D/C CPM once patient is independent with stationary bicycle AAROM-> AROM as tolerated	<ul style="list-style-type: none"> • Stationary bicycle for ROM, seat adjusted high, no resistance Manual Therapy <ul style="list-style-type: none"> • Patellar Mobilization • Scar massage when incision healed Therapeutic Exercise <ul style="list-style-type: none"> • Ankle pumps • Quad set • Electrical stimulation in full extension with quad sets and SLR • Heel slides (supine and sitting) • Co-contractions quads / hamstrings at 0, 30, 60, 90 degrees • 4 way Straight leg raise (SLR), no knee brace Gait <ul style="list-style-type: none"> • TTWB with crutches • Brace locked in extension x 6 weeks Modalities <ul style="list-style-type: none"> • Electrical stimulation in full extension with quad sets and SLR • Cryotherapy
Weeks 4-6	PROM-> AAROM-> AROM to regain full ROM	<ul style="list-style-type: none"> • Stationary bicycle for ROM, seat adjusted high Manual Therapy <ul style="list-style-type: none"> • Patellar Mobilization • Scar massage when incision healed Therapeutic Exercise <ul style="list-style-type: none"> • Ankle pumps • Quad set • Electrical stimulation in full extension with quad sets and SLR • Heel slides (supine and sitting) • Co-contractions quads / hamstrings at 0, 30, 60, 90 degrees • 4 way Straight leg raise (SLR), no knee brace • Standing: double leg heel raises progress to single leg • Standing SLR x 4 with Theraband (standing on uninvolved LE) Gait <ul style="list-style-type: none"> • TTWB with crutches • Brace locked in extension x 6 weeks Modalities <ul style="list-style-type: none"> • Electrical stimulation in full extension with quad sets and SLR

Post –op Phase/Goals	Range of Motion	Interventions/Activities	Precautions
<p>Phase II 6 - 12</p> <p>Goals: No effusion</p> <p>Full knee extension</p> <p>Single leg stand control</p> <p>Normalize gait</p> <p>Regain full motion</p> <p>Regain full muscle strength</p> <p>Good control and no pain with functional movements, including step up/down, squat, partial lunge (staying less than 60° of knee flexion)</p>	<p>Weeks 6-8 Full AROM and PROM</p>	<ul style="list-style-type: none"> • Stationary bicycle • Non-impact endurance training • Nordic track • Swimming • Deep water run • Cross trainer • Treadmill – Forwards and backwards walking <p>Manual Therapy</p> <ul style="list-style-type: none"> • Patellar Mobilization • Scar massage when incision healed <p>Therapeutic Exercise</p> <ul style="list-style-type: none"> • 4 way Straight leg raise (SLR), no knee brace • Standing: hamstring curl and toe raises • Standing SLR x 4 with Theraband (standing on uninvolved LE) • Hamstring curls – Carpet drags or rolling stool (closed chain) • Non-impact balance and proprioceptive drills • Hip and core strengthening • Stretching for patient specific muscle imbalances <p>Gait</p> <ul style="list-style-type: none"> • WBAT • Unlock brace • D/C crutches when gait is normal <p>Modalities</p> <ul style="list-style-type: none"> • Cryotherapy 	<p>No impact activities until 12 weeks post-operative</p> <p>Avoid loading knee at deep flexion angles</p> <p>Limit knee flexion with strengthening to 45 degrees</p> <p>Avoid post activity swelling</p> <p>Avoid stair stepper, deep knee bends and squats</p>

Post –op Phase/Goals	Range of Motion	Interventions/Activities
Weeks 8-12	Full AROM and PROM	<ul style="list-style-type: none"> • Stationary bicycle with minimal resistance • Non-impact endurance training • Nordic track • Swimming • Waist deep water walking or slow jogging • Cross trainer • Treadmill – walking progression program -> progress to 2 miles at 15 min/mile pace • Elliptical trainer <p>Therapeutic Exercise</p> <ul style="list-style-type: none"> • 4 way Straight leg raise (SLR) with progression of weight 1-5lbs • Standing: hamstring curl and toe raises • Standing SLR x 4 with Theraband (standing on uninvolved LE) • Hamstring curls – Carpet drags or rolling stool (closed chain) • Proprioceptive training <ul style="list-style-type: none"> • BAPS, ball toss, body blade • Hip and core strengthening • Forward, lateral and retro step ups • Wall squats • Stretching for patient specific muscle imbalances including quad stretches • AVOID: stair stepper, deep knee bends and squats <p>Gait</p> <ul style="list-style-type: none"> • Normal gait on all surfaces <p>Modalities</p> <p>Cryotherapy</p> <p>Progression Criteria to Advance to Phase III</p> <ul style="list-style-type: none"> • Normal gait on all surfaces • Full range of motion • No effusion • Ability to carry out functional movements without unloading affected leg or pain while demonstrating good control <p>Single leg balance greater than 15 seconds</p>

Post –op Phase/Goals	Range of Motion	Interventions/Activities	Precautions
Phase III 12 + weeks Goals: <ul style="list-style-type: none"> • Regain full muscle strength • No thigh atrophy • Gradual return to full activity • Walk 2 miles at 15 min/mile pace 	12 + weeks	<ul style="list-style-type: none"> • Bike indoors brace off, outdoors brace on • Non-impact endurance training • Nordic track • Swimming • Waist deep water walking or slow jogging • Cross trainer • Treadmill – walking progression program -> progress to 2 miles at 15 min/mile pace • Elliptical trainer Therapeutic Exercise <ul style="list-style-type: none"> • Continue appropriate previous exercises with progressive resistance • Squat to chair • Seated leg press • Resisted hamstring curl • Step up and down exercises • Bike indoors brace off, outdoors brace on • Swimming • Waist deep water jogging • Cross trainer • Treadmill – walking progression program • Elliptical trainer 	<ul style="list-style-type: none"> • Avoid pain at patellar tendon site • Build up resistance and repetitions gradually • Perform exercises slowly avoiding quick direction changes and impact loading • Exercise frequency should be 2-3 times per week to build strength • Be consistent and regular with the exercise schedule Do Not Perform: <ul style="list-style-type: none"> • Knee extension with weight machine • Running • Jumping • Pivoting or cutting • Lunges • Stairmaster • Step exercise with impact

Post –op Phase/Goals	Interventions/Activities
Months 3-4	Therapeutic Exercise <ul style="list-style-type: none"> • Continue appropriate previous exercises with progressive resistance • Agility drills / Plyometrics • Sit-up progression • Progressive weight training program • Transition to home / gym program • Return to all activities

	<ul style="list-style-type: none">• NO RETURN TO SPORTS UNTIL 6 MONTHS POST-OPERATIVE
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