

# Postoperative rehabilitation <sup>[1-3]</sup>

## Phase 1

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### *Acute Management/Early Motion and Basic Movement Retraining*

#### *Goals*

1. Achieve full active knee extension equal to the uninvolved side with active Vaste Medialis recruitment.
2. Eliminate swelling.
3. Restore the ability to control the leg while weight bearing.
4. Achieve at least 90° of knee flexion.
5. Be able to straight leg raise.
6. Normalize walking patterns with the assistance of crutches and/or a brace.

If hamstring graft, no active hamstring exercises until 2 weeks and no open chain resisted hamstring curls until 4 weeks post-op.

#### *Type of exercises:*

—Range of Motion (ROM) Exercises (Heel-slides to improve knee flexion.)

—Soft tissue treatments to patella, patella tendon, incisions, and posterior musculature to improve range of motion and decrease fibrosis.

—Muscle Activation with quad sets, straight leg raises and double leg mini squats (ROM 0–60°). Use manual facilitation techniques or electrostimulation when voluntary contraction of the quadriceps is not possible.

—Core Body Training and Neuromuscular Training. Encourage a correct quality of performance (e.g. trunk lateroflexion, hip- and knee flexion, dynamic knee valgus and

knee-over-toe) during strength training and walking. Use implicit learning techniques instead of explicit learning techniques.

—Ambulation like diagonal weight shifting, backward stepping and step-overs

### *Criteria to start phase 2:*

—Closed wound

—No knee pain with phase 1 exercises (VAS)

—Minimal synovitis or effusion

—Normal mobility (left=right) of the patellofemoral joint

—Knee extension of at least 0 ° and a 120–130° flexion

—Voluntary control of the quadriceps

—Active dynamic gait pattern without crutches

—Correct qualitative performance of phase 1 exercises.

## Phase 2

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### *Basic Strength and Proprioception*

#### *Goals*

1. Restore proper body alignment and control with basic movements, such as walking without assistance, squats, stationary lunges and single-leg balance.
2. Build lower extremities and core body strength
3. Develop increased proprioception, starting with stationary postures and then progressing to movements.
4. Achieve active range of motion equal to the uninvolved Knee.

#### *Type of exercises:*

—Range of Motion (ROM) and stationary bike

—Soft tissue treatments

—Gait Drills

—Functional Strengthening (add weight or resistance with exercises), Single-leg/unilateral workouts (i.e. on weight machines, squats, side and forward step-downs).

—increase depth of balance exercises

—Neuromuscular training: Increase difficulty of neuromuscular and perturbation training

—Core Body and increase intensity with aerobic machines.

Carefully monitor exercises for signs of diminished eccentric control, weakness, or poor ability to stabilize against varus/valgus moment with loading exercises.

### *Criteria to start phase 3:*

—Correct qualitative performance of phase 2 exercises

—Limb Symmetry Index (LSI) >80% for quadriceps and hamstring strength

—LSI >80% for a hop test battery, preferably using the hop test battery of Gustavsson

## **Phase 3**

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*Dynamic Neuromotor Strength, Endurance and Coordination*

### *Goals*

1. Increase the strength of the involved leg.
2. Develop eccentric neuromuscular control to allow acceptance of impact activities without increasing symptoms.
3. Develop dynamic flexibility to allow for proper alignment during activities of increasing speed.
4. Full range of motion is expected.

### *Type of exercises:*

—Range of Motion

—Dynamic Agility Drills: begin with small strides at low velocity, gradually increasing the velocity.

—Functional Strengthening. The recommended strengthening exercises are closed chain: squat, lunge.

—Landing and Takeoff Drills: before initiating impact activities the patient should not have any swelling, have full knee extension, be able to balance on one leg for 10 seconds and be able to perform a single leg squat to approximately 45–60° of knee flexion with good posture and control.

—Balance exercises with challenge postural control and duration: balance board activities, swim strokes, single leg balance with eyes closed

-Core Body and cardiovascular conditioning

## Phase 4

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### *Athletic Enhancement and Return to Activity*

This phase can be initiated when the goals of Phase 3 are met. This phase will usually begin 12–16 weeks after surgery.

### *Goals*

1. Progress from double leg impact control to single leg impact control.
2. Develop proper technique and appropriate neuromuscular control with start and stop movements and change of direction movements.
3. Eliminate apprehension that may exist with complex movements related to sports.

### *Type of exercises:*

—Dynamic Warm Up: will help with increasing core body temperature, mental alertness, elasticity of the muscular system and activation of the neuromuscular system.

—Multi-planar Landing Control and Neuromuscular Reaction: Jump rotations, fast feet and lunge, multi-planar leap and land, stop and go, hopping.

—Functional movements and strengthening: one-legged squat, single leg dead lift, lateral lunge walk, power step up.

—Advanced Core Training and begin for jogging.

## Reference

1. van Melick N, van Cingel RE, Brooijmans F, et al. Evidence-based clinical practice update: practice guidelines for anterior cruciate ligament rehabilitation based on a systematic review and multidisciplinary consensus. *Br J Sports Med* 2016;50(24):1506-15 doi: 10.1136/bjsports-2015-095898
2. Shelbourne KD, Nitz P. Accelerated rehabilitation after anterior cruciate ligament reconstruction. *The American Journal of Sports Medicine* 1990;18(3):292-99
3. Kruse LM, Gray B, Wright RW. Rehabilitation after anterior cruciate ligament reconstruction: a systematic review. *The Journal of Bone and Joint Surgery. American Volume* 2012;94(19):1737-48 doi: 10.2106/JBJS.K.01246