

CHAPTER FOUR

Exercise Therapy for Patients with Knee OA

Knee Exercise Protocol Knee Home Exercise Programme

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Knee Exercise Protocol

General Guidelines

SECTION 1: CORE PROTOCOL EXERCISES

Four components: Aerobic/warmup; Strengthening; Stretching; Neuromuscular control

Each participant performs all four components of the programme

Aerobic: To be performed for up to 10 minutes at moderate level as warm-up

Strengthening: All strengthening exercises must be performed.

Dose: 3 sets of 10 repetitions with a 3 second hold

Stretching: All stretches must be performed each session, until goals are met.

Dose: 2 minutes total with 20-60 sec hold times

Goals: The following stretches can be discontinued when the goal is met

- Hamstring stretch **discontinued** after meeting 90/90 test. Patient must achieve 150° of knee extension (neutral = 180°) or greater with hip at 90°
- Calf stretch **discontinued** after meeting 10° ankle DF with knee extended and 20° DF with knee bent

Neuromuscular control: Choose the 3 most challenging exercises the patient can achieve safely.

Dose: 6 minutes total exercise, 2 minutes each exercise, 3 exercises. May do 3 different exercises or repeat any exercise more than once, and count the repeat as a new exercise.

SECTION 2: ADDITIONAL IMPAIRMENTS-BASED EXERCISES

Additional techniques: For those patients who test positive for additional impairments at the initial assessment, the following exercises may be prescribed based on the clinical judgment of the clinician. Dose parameters follow the guidelines listed above for strengthening and stretching

SECTION I

CORE PROTOCOL EXERCISES

AEROBIC EXERCISE

- Cycling or Treadmill walking is performed up to 10 minutes with the patient achieving Level 13 of the Borg Perceived Exertion rate within 2 minutes of activity. Exercise is discontinued if patient reports an increase in pain ≥ 2 points on NPRS.
- NOTE: Follow monitoring rules, where applicable, for participants with identified cardiovascular risk.

STRENGTHENING EXERCISES

DOSE: Each strengthening exercise is done for 3 sets of 10 with a 3 second hold or until fatigue. Exercise is discontinued if patient reports an increase in pain ≥ 2 points on NPRS, however this should be avoided by ensuring appropriate starting intensity / resistance.

STRENGTHENING OF KNEE EXTENSORS I OPEN CHAIN PROGRESSION

LEVEL 1 – ISOMETRIC QUADS SET:

The participant is positioned in long sitting with the knee extended. Therapist instructs the participant to isometrically contract the quadriceps muscles bilaterally as vigorously as possible without reproducing pain. The exercise is performed on each limb. Progression → Progress to level 2 when 3 sets of 10 is no longer challenging, and the patient is performing activity with ease and good form.



LEVEL 2 – TERMINAL KNEE EXTENSION:

The participant is initially positioned in long sitting on the treatment table. The target limb is flexed over a bolster (e.g. rolled towel). The contralateral limb knee is flexed so that the foot is resting comfortably in a foot flat position on the table. The therapist instructs the participant to extend the knee of the target limb to full extension, then slowly lower until the foot returns to rest on the table. Progression → Progress to level 3 when 3 sets of 10 is no longer challenging, and the patient is performing activity with ease and good form. Alternate position in sitting.



LEVEL 3 – TERMINAL KNEE EXTENSION WITH CUFF WEIGHTS:

Progress from Level 2 by applying cuff weights to the ankles as tolerated, beginning with a 0.5kg load. The exercise is performed on involved limb only during treatment session, can be both limbs in HEP. *Progress further by adding greater kg cuff weights.* Alternative: Use theraband.



STRENGTHENING OF KNEE EXTENSORS 2 CLOSED CHAIN PROGRESSION

LEVEL 1 – TERMINAL KNEE EXTENSION IN STANDING, WITH RESISTIVE BAND:

Add this exercise to Level 3 (above) when the patient can do 3 sets of 10 comfortably, with good form, with 0.5kg.

The participant stands facing toward the exercise bar anchor with a resistive band looped behind a slightly flexed knee and around the anchor. The therapist instructs the participant to contract the gluteal and quadriceps muscles to fully straighten the hip and knee. Begin with a resistance band to achieve around 15 RM. The exercise is performed on each limb.

Progression → The level of resistance band is progressed sequentially. It is important to add more resistance each week whenever possible, so that 3 x 10 repetitions is an effort. You may need two loops of band as people progress.



LEVEL 2 – WEIGHT-REDUCED PARTIAL SQUATS:

The participant stands facing toward a plinth or table, partially supporting his/her body weight with arm support. The therapist instructs the participant to perform a partial squat, keeping the knees tracking lateral to the big toe, and return to upright.

Progression → Partial squats with the patient's back against the wall.



LEVEL 3 – STEP-UPS:

The participant stands in front of a step. Start with the 6.5cm step and progress as tolerated. The patient places the foot of the target limb on the step and brings the body over the foot to stand on the step with an extended knee. The participant is to minimize arm support assistance or push-off assistance from the contralateral limb. Slowly lower until the contralateral foot returns to fully weight-bear on the floor, then return the target limb alongside (i.e. the starting position). The exercise is performed on each limb. Be sure to provide directions to keep the knee over the 2nd metatarsal and keep the pelvis as level as possible to promote proper alignment and hip control during this task. NB: Hip control is important for knee OA patients.

*Progress to 13cm step. If possible, progress to 20cm step, provided this does not aggravate knee pain.



STRENGTHENING OF HIP EXTENSORS

LEVEL 1 – SUPINE GLUT SETS:
Patient is supine and performs an isometric glut contraction.

Progression → Patient is progressed to level 2 when 3 sets of 10 of level 1 exercise is no longer challenging and patient is performing activity with ease and good form.



LEVEL 2 – SUPINE BRIDGING:
Patient is supine with knees bent 90°. Patient actively performs a glut contraction while lifting the hips and pelvis off the floor to obtain a bridge position.

Progression → Patient is progressed to level 3 when 3 sets of 10 of level 2 exercise is no longer challenging and patient is performing activity with ease and good form.



LEVEL 3 – SUPINE UNILATERAL BRIDGING:
Patient is supine with knees bent 90°. Patient actively performs a glut contraction while lifting the hips and pelvis off the floor to obtain a bridge position. Unaffected knee is extended from flexed position and held. **Exercise may be progressed with adding cuff weights around extended ankle**



STRENGTHENING OF KNEE FLEXORS

LEVEL 1 – PRONE HAMSTRING CURLS:

The participant is positioned in prone on the treatment table. The participant flexes the knee from full extension to 90° of flexion, then returns limb to full knee extension position. Exercise is performed on each limb. Watch for excess lumbar movement.

Progression → Progress to level 2 when 3 sets of 10 is no longer challenging, and the patient is performing activity with good form.



LEVEL 2:

Cuff weights are applied to the distal leg.

Progression → Progress to level 3 when 3 sets of 10 is no longer challenging, and the patient is performing activity with good form.

LEVEL 3: STANDING KNEE FLEXION/HIP EXTENSION AGAINST RESISTIVE BAND OR WEIGHT:

The participant stands facing toward the exercise bar anchor with a resistive band looped behind her/his heel, and around the anchor. The therapist instructs the participant to contract the gluteal and hamstring muscles to slightly flex the knee and extend the hip. Begin with just enough resistance band to achieve around 15 RM. The exercise is performed on each limb.



STRETCHING EXERCISES

DOSE: 2 minute total for each stretch, comprising 20-60 seconds holds

CALF MUSCLE GROUP STRETCH

CALF STRETCH: Patient assumes a standing position with involved lower extremity placed behind the non-involved. Patient's arms are placed on wall and involved knee is kept straight with heel flat to the floor until stretch is felt.



ECCENTRIC CALF STRETCH (bilateral): Patient stands on step with heels unsupported. Using minimal supportr they lower their body weight so heels drop down below horizontal and a stretch is felt in the calf muscles.



ECCENTRIC CALF STRETCH (unilateral): Patient progresses the above exercise to single leg stance.



HAMSTRING MUSCLE GROUP STRETCH

HAMSTRING STRETCH:
Patient is positioned in either sitting or standing position. Affected leg is kept straight and patient attempts to reach toward the toes keeping the low back in a neutral position until a stretch is felt.



An alternative position is with the patient sitting on a chair. Affected leg is kept straight and patient reaches towards toes until a stretch is felt.



An alternative position is with the patient supine lying. The hip and knee are flexed to 90°. The patient supports the thigh in a vertical position using their hands or a towel. The knee is extended until a stretch is felt in hamstrings.



QUADRICEPS MUSCLE GROUP STRETCH

QUADRICEPS STRETCH:
Patient positioned prone and the knee bent into flexion.



They can use the other leg to push resistance.



They could use a belt or a towel to assist knee flexion.



NEUROMUSCULAR CONTROL EXERCISES

DOSE: Each patient is to perform at least 3 of the following exercises for duration of 2 minutes. Goal is 6 minutes of neuromuscular exercises. Exercises can be repeated if unable to perform 3 different activities. Exercise is discontinued if patient reports an increase in pain ≥ 2 points on NPRS. As function improves exercises should be progressed to remain challenging and variability could be increased.

STANDING WEIGHT SHIFTS

LEVEL 1 – FORWARD AND LATERAL WEIGHT SHIFTS EYES OPEN:

Patient assumes a standing position with feet side by side or in tandem stance. Purpose is to increase proprioception in the affected lower extremity by shifting weight onto the involved hip then return to neutral stance. Watch for compensations at the trunk or hip.



Progression → Patient advances to level 2 when 3 sets of 30 seconds are performed with ease and good form.

LEVEL 2 – FORWARD AND LATERAL WEIGHT SHIFTS EYES SHUT:

As above with eyes closed.

Progression → Patient advances to level 3 when 3 sets of 30 seconds are performed with ease and good form.



LEVEL 3 – TANDEM STANCE WEIGHT SHIFT EYES OPEN:

Patient assumes heel to toe position with involved hip forward. Weight is to be shifted onto the involved hip keeping the eyes open. **Progress to eyes closed if needed**



BALANCE

LEVEL 1 – DOUBLE LEG FOAM BALANCE:

Participant stands with both feet on a soft foam surface.

Progression → Patient advances to level 2 when 3 sets of 30 seconds are performed with ease and good form.



LEVEL 2 – DOUBLE LEG WOBBLE BOARD:

Participant stands with both feet on a wobble board surface.

Progression → Patient advances to level 3 when 3 sets of 30 seconds are performed with ease and good form



LEVEL 3 – SINGLE LEG STANCE ON FLOOR:

Participant stands on involved leg maintaining single leg balance. Perform 3 sets of 30 seconds. Watch for compensation at the hip or trunk.

May be progressed to single leg stance on foam or wobble board.

May be advanced with addition of ball toss or perturbations



SIDE-STEPPING

LEVEL 1 – SIDE-STEPPING:

Participant steps sideways keeping the toes pointing forward, moving right or left. Repeat by changing direction to return to starting position. Activities are performed along the exercise bar/safety rail along the mirrored wall.



Progression → Patient advances to level 2 when side stepping on level surface with ease.

LEVEL 2 – SIDE-STEPPING WITH OBSTACLES:

Same as above but add cones for patient to step over when performing activity.

Progression → Patient advances to level 3 when side stepping on level surface with obstacles can be performed with ease.



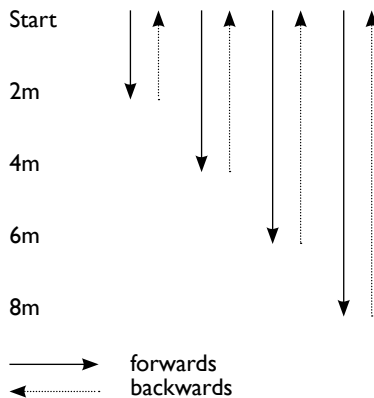
LEVEL 3 – CARIOCA (or BRAIDING):

Patient performs front cross-over stepping with side step, b) Back cross-over stepping with side step, and c) Alternate front and back cross-over steps (walking carioca). Repeat by changing direction to return to starting position.



SHUTTLE WALKING

Place 5 plastic cone markers at distances of 2m. The patient walks forward to first marker, then walks backward to return to start. Patient then walks to 4m marker forward, returns to start walking backward. The participant then walks to 6m marker, returns to start walking backward, then finish by walking to the end (8m).



STAIRS

Patient is asked to ascend/descend 3 stairs with alternating step pattern to increase strength and functional activity. May use upper extremity support if needed.



SECTION 2

ADDITIONAL IMPAIRMENTS-BASED EXERCISES

For those patients with additional impairments identified at the initial assessment, the following exercises may be prescribed based on the clinical judgment of the clinician. Dose parameters follow the guidelines listed above for strengthening and stretching.

STRENGTHENING OF ANKLE PLANTAR-FLEXORS

INDICATION: If inability to perform 3X10 bilateral calf raises (with full height and calcaneal inversion) or noticeable muscle atrophy compared to opposite side

LEVEL 1 – BILATERAL CALF RAISE AND LOWERING:

Patient is positioned in standing with both feet on the step.

Patient rises up on toes as high as possible, holding for 3 seconds, then returning to start position.

Progression → Patient is progressed to level 2 when 3 sets of 10 of level 1 exercise is no longer challenging and patient is performing activity with ease and good form.



LEVEL 2 – BILATERAL CALF RAISE, UNILATERAL LOWERING:

Patient is instructed to go up on toes bilaterally and lower only with the involved side with or without use of upper extremity support.

Progression → Patient is progressed to level 3 when 3 sets of 10 of level 2 exercise is no longer challenging and patient is performing activity with ease and good form.



LEVEL 3 – UNILATERAL CALF RAISE, UNILATERAL LOWERING:

Patient is instructed to raise up on involved side, lower with involved side with or without use of upper extremity support.

Exercise discontinued when patient is able to perform 20 unilateral calf raises with good form



WEAK HIP ABDUCTORS

INDICATION: If unable to perform 10 side-lying hip abduction repetitions, with good form.

LEVEL 1 – SUPINE HIP ABDUCTION:

Patient lies supine and actively abducts the involved hip through the available ROM.

Progression → Patient is progressed to level 2 when 3 sets of 10 of level 1 exercise is no longer challenging and patient is performing activity with ease and good form.



LEVEL 2 – STANDING HIP ABDUCTION:

Patient is standing and actively abducts the involved hip through the available ROM.

Progression → Patient is progressed to level 3 when 3 sets of 10 of level 2 exercise is no longer challenging and patient is performing activity with ease and good form.



LEVEL 3 – SIDELYING HIP ABDUCTION:

Patient is positioned in sidelying and actively abducts the involved hip through the available ROM. **Activity may be progressed with use of ankle weights to increase resistance**



WEAK EXTERNAL ROTATORS

INDICATION: If unable to perform 10 side-lying hip external rotation repetitions, with good form.

LEVEL 1 – CLAMSHELLS:

Patient is positioned in side-lying with knees bent 90°. Patient actively externally rotates the upper leg through the available ROM while maintaining the pelvis in neutral alignment and keeping the feet together.

Progression → Patient is progressed to level 2 when 3 sets of 10 of level 1 exercise is no longer challenging and patient is performing activity with ease and good form.



LEVEL 2 – CLAMSHELLS WITH RESISTANCE:

As above with theraband or a cuff weight around the knees to increase resistance.

Progression → Patient is progressed to level 3 when 3 sets of 10 of level 2 exercise is no longer challenging and patient is performing activity with ease and good form.



LEVEL 3 – CLAMSHELLS WITH INCREASED RESISTANCE:

As above with increased level of resistance using stronger theraband or heavier lift weight.



HIP FLEXOR/QUADRICEPS MUSCLE TIGHTNESS

INDICATION: If Thomas test is abnormal indicating shortened hip flexor muscles.

THOMAS TEST POSITION:

The patient sits at the edge of the plinth. Subject is told to place hands under uninvolved knee and bring knee to chest and lay back with assistance from examiner. The knee should only be pulled toward the chest enough to flatten the low back and sacrum on the table. The involved hip/knee is then allowed to extend.



****Modify position to side of bed depending on patient****

WEAK CORE STABILITY

INDICATION: If aberrant lumbar movement including catching, painful arc of motion or Gower's sign

LEVEL 1 – SUPINE

ABDOMINAL BRACING:

Patient is supine with knees bent and asked to brace the abdomen and hold for 8 seconds.

Progression → Patient is progressed to level 2 when 30 reps of 8 second holds is completed.



LEVEL 2 – SUPINE BRACING WITH HEEL SLIDES:

Same as above while performing an active heel slide keeping the abdomen braced.

Progression → Patient is progressed to level 3 when 20 reps per leg of 4 seconds holds is completed.



LEVEL 3 – SUPINE BRACING WITH LEG LIFTS:

Same as above while performing an active leg lift.



PRESCRIPTION OF ASSISTIVE DEVICE

Patient is prescribed an appropriate assistive device if safety is a concern of the assessing clinician.

