

Sports And Exercise Therapy

- Early To Intermediate Rehab
- BMST5003
- Early To Intermediate
Rehabilitation For Specific
Injury



Ligaments

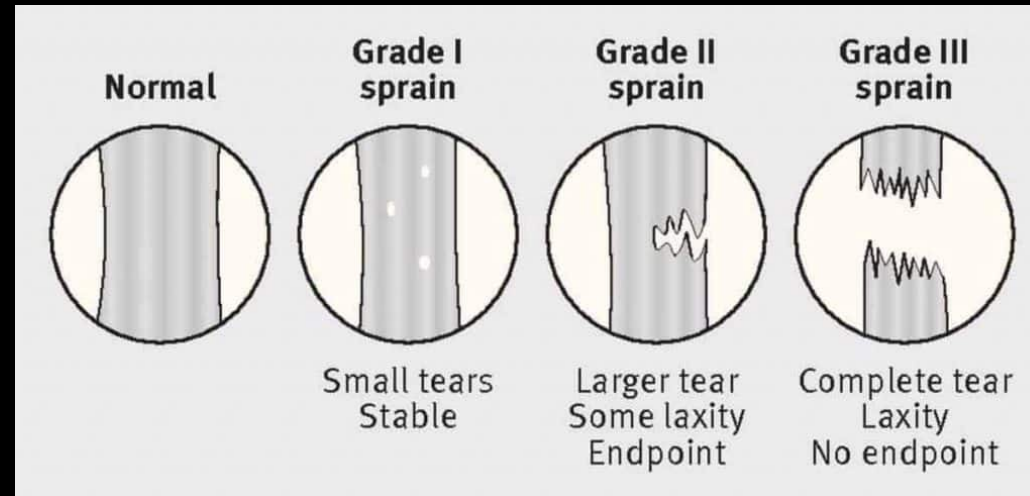
- As sports therapists, we frequently encounter various tissue injuries, one of the most common being an acute Anterior Cruciate Ligament injury (ACL) (Domnick, Raschke *et al.* 2016).
- Ligaments join bone to bone play a crucial role in stabilizing joints and preventing excessive movement by guiding movement through normal range of motion (Bobzin, Roberts *et al.* 2021). Have elastic properties but need to be strong at end of range (EOR)
- They are susceptible to damage due to the forces exerted on them during athletic activities (Zitnay, Weiss 2018).
- In this presentation, we will explore the intricacies of ACL injuries, their stress-strain curves, healing processes, and rehabilitation strategies for effective recovery.

Anterior Cruciate Ligament Loading

- Anterior Forces in relation to the Tibia on the Femur.
- ACL is loaded to a greater extent between 10° and 50° of flexion.
- Evidence of both knee Valgus and Varus loading.
- External Rotation but greater Internal Rotation.
- Near Full Extension (10°-30°) Sudden stops or changes in direction such as landing from a jump with straight leg.
- Knee Flexion (30° to 60° degrees) Vulnerable to rotational movements like twisting or pivoting.
- Knee Flexion (10°-60° degrees) Rapid deceleration

(Kiapour *et al.* 2016)

Understanding Ligament Injuries



- These structures are vulnerable to excessive forces, leading to various grades of injuries such as grade 1 tear, grade 2 tear or complete rupture grade 3. These injuries can occur due to sudden movements, excessive stretching, or traumatic impacts, resulting in varying degrees of damage to the ligament fibres (Kalkhoven, Watsford *et al.* 2020)
- Possible sites for Ligament damage are Bone-Ligament Interface if its at high speed or the core of the ligament at low speed (Vila Pouca, Parente *et al.* 2021)

Grade II Classification

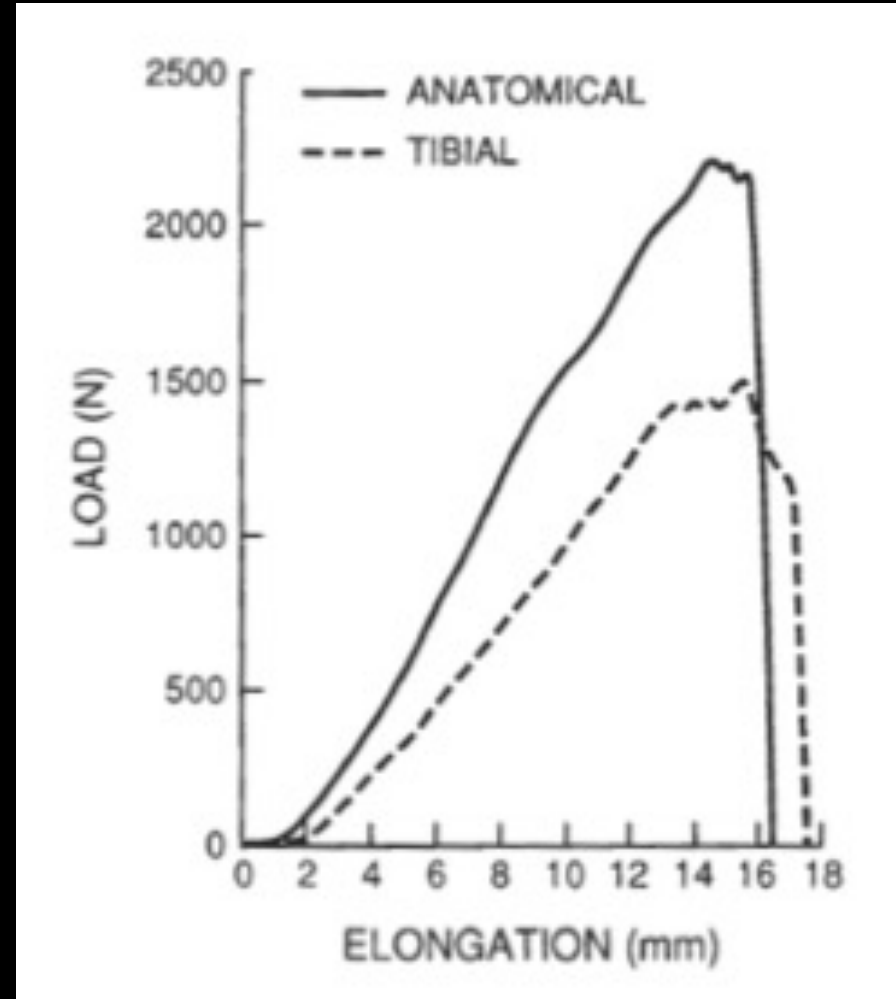
- Multilevel rupture with individual layers torn at different levels with macroscopic haemorrhage extended from the area of the anterolateral ligament and capsule to the posterolateral capsule (Ferretti, Monaco *et al.* 2017)
- The fibres of the ligament are partially torn or incomplete tear with haemorrhage.
- There is a little tenderness and moderate swelling with some loss of function.
- The joint may feel unstable or give out during activity.
- Increased anterior translation yet there is still a firm end point.
- Painful and pain increase with Lachman's and anterior draw test.

Associated Injuries

- Meniscal Lesions – Over 50%, if seen in combination with a medial meniscus tear and MCL injury it is termed O'Donohue's Triad (Nagano Y, *et al* 2009)
- MCL Tear due to the nature of the injury.
- Bone Contusions and Micro Fractures
- Chondral Injury at time of initial impact (Hollis *et al* 2012)

Ligament Injury and Stress-Strain Curves

- (Özer Kaya, 2020)
- Toe Region – initial phase, minimal deformation, returns to original shape.
- Linear Region – linear relationship between stress + strain. More deformation.
- Yield Region – Start of plastic deformation, may return to original shape.
- Plastic Deformation – Permanent changes, strain increases greater than stress.
- Failure Point – Complete failure or rupture. Integrity lost.
- Tolerate 1730N before failure (Markolf *et al* 1990)
- Grade 2



(Markolf *et al* 1990)

Healing Process and Load Tolerance

- Inflammatory Phase – 0-72 Hours – Constriction of blood vessels followed by dilated facilitating the arrival of immune cells and nutrients. Inflammatory cells help clean up the debris and damaged tissue.
- Proliferative Phase – 72hrs – 6weeks – Fibroblasts migrate to area and facilitate collagen production which is vital for ligament strength. Forms a scar tissue matrix bridging the torn ligament ends. Blood vessels start to grow.
- Remodeling Phase – 6weeks – Months/Years – Realignment and strengthening of collagen fibres in the scar tissue improving tensile strength. Over time the scar tissue will become more similar to the original ligament.
- Load Tolerance - crucial consideration, avoid excessive stress during inflammatory phase to prevent further harm. During the proliferative phase gradual loading maybe cautiously introduced.
- In most cases healing can be achieved without surgical intervention but can be slow and lead to the formation of scar tissue if not properly rehabbed.(Leong, Kator *et al.* 2020)
- Autograft is often used for intra articular ligaments such as the ACL (Yao, Fu *et al.* 2021). These have a high success rate however are associated with doner site morbidity

Considerations

- R.I.C.E
- Immediate Training of ROM and weight bearing exercises (Van Melick. N *et al* (2016))
- The use of crutches and/or a knee immobilizer could be appropriate in some patients. However extended use of the knee immobilizer should be limited to avoid quadriceps atrophy (Meuffels, D E. *et al* 2012)
- Conservative treatment of an ACL injury could be the best choice for sedentary patients. However, patients age, sportive activities and foremost subjective instability symptoms in daily life activities should be considered when deciding for or against ACL reconstruction (Konrads, C. *et al* 2016)
- If symptomatic instability of the knee is not reduced after physiotherapy nor after adjustment of activity, anterior cruciate ligament reconstruction is recommended. This might prevent multiple interventions because of further meniscal and cartilage damage (Meuffels, D E. *et al* 2012)
- Weight bearing and non-weight bearing activities are thought to produce the same amount of strain on the ACL (Bynum. E.B, Barrack, R.L and Alexander, A,H, 1997)



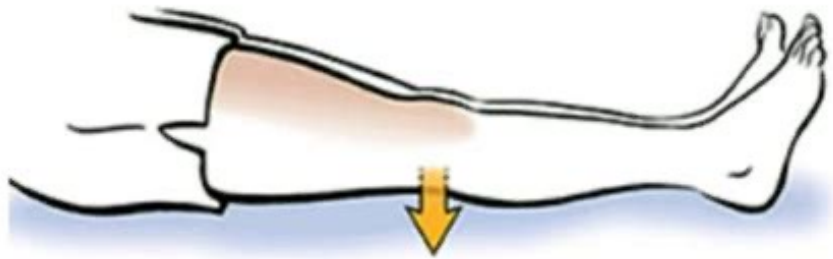
Rehabilitation Strategies for Ligament Injuries



Early Stages

Quadriceps

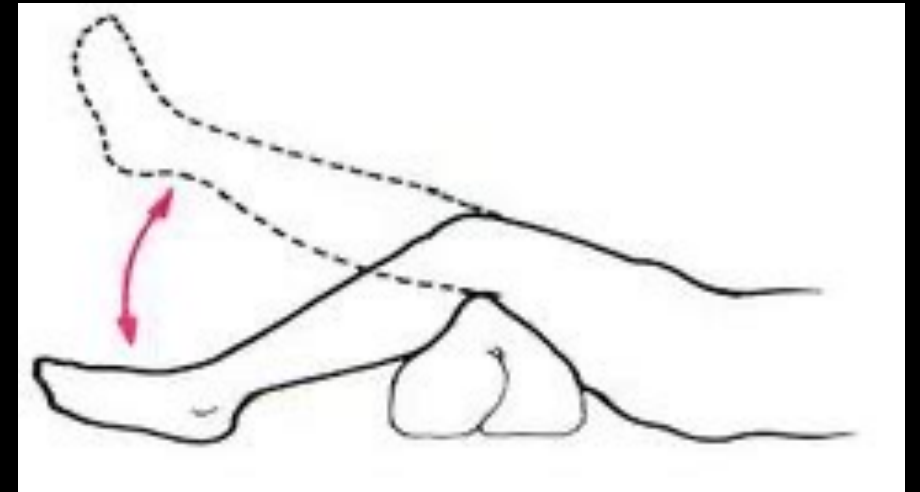
Isometric Hold



- Sit with one leg straight, squeeze your quadricep muscle (think about straightening your knee as you engage your quads). As you squeeze you should see your kneecap pull up slightly.
- Every day hold the contraction for 10secs and repeat 3 sets 6-12 reps. (Haff and Triplett, 2016).
- Regression – Reduce pressure
- Progression – Have an object that applies resistance under the knee
- For – Activation of muscles without joint movement. Help maintain and gradually increase strength. Performed without causing swelling.

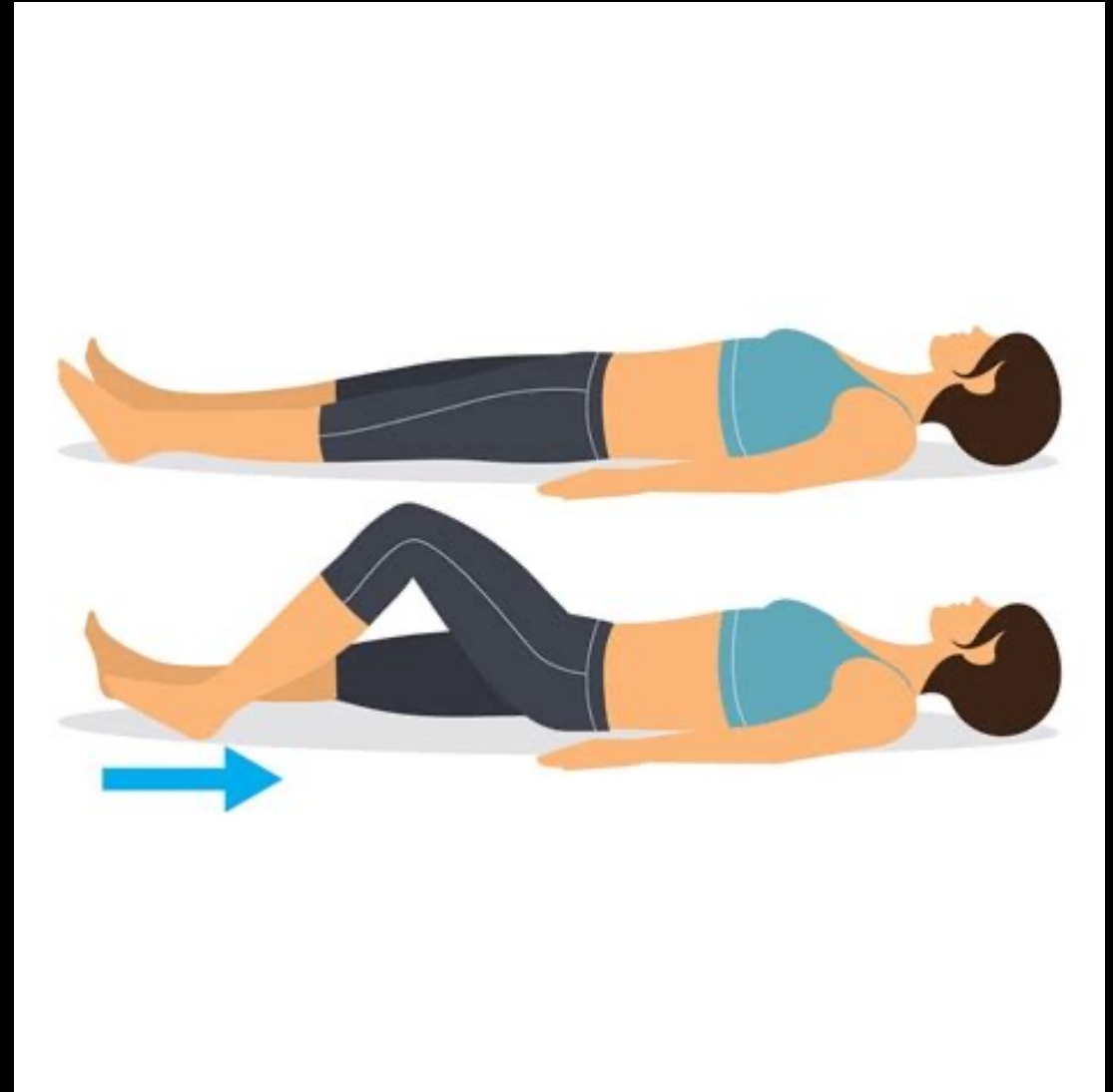
Short Arc Quad

- Position form roller or object under your knee. Straighten your leg by squeezing your quadriceps. Focus your attention on the working muscles. Move slowly and with control.
- Hold contraction for 1-2 secs,
- Every day 3 sets and 6-12 reps.
- Regression – PROM.
- Progression – Add ankle weight.
- Partial ROM, muscle activation, early mobilization.



Heel Slides

- Lying down hook a strap/towel around your foot. Bend your knee and slide your heel towards your butt, pulling on the strap to assist with movement.
- Everyday 3 sets 6-12 Reps
- Regression – PROM
- Progression – No strap and go as far as you can as long as pain is no more than 4/10
- For – Improve ROM, Early activation of surrounding muscles, neuromuscular activation.



Isometric Hamstring Bridge

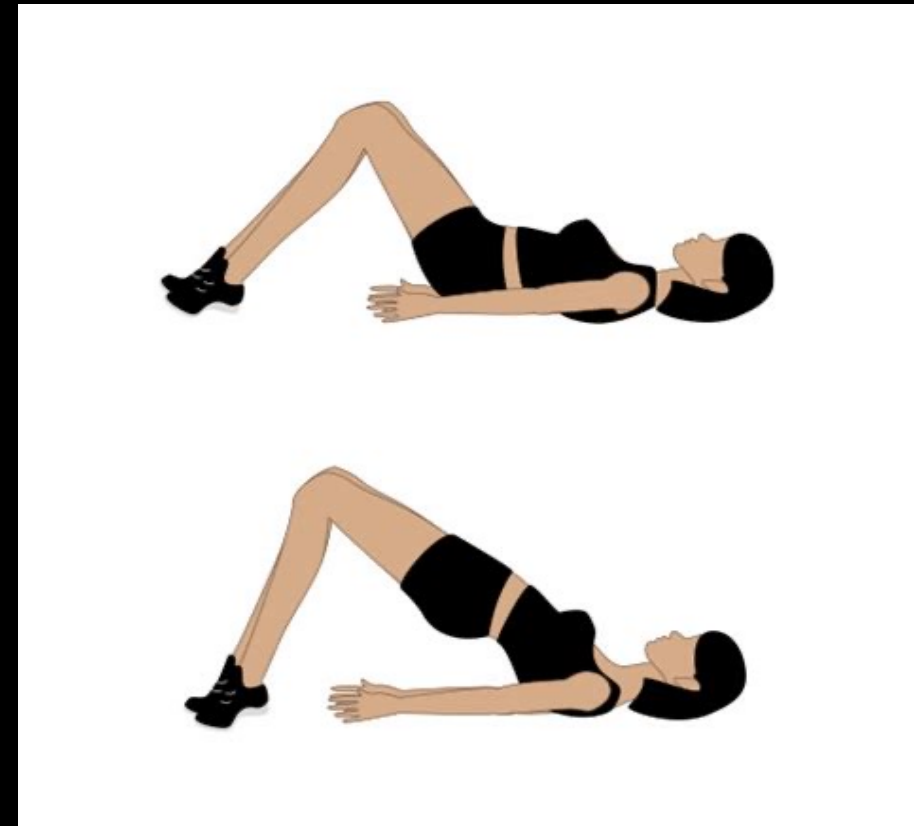
- Lie on back with knees bent to 90 degrees and feet flat on the floor. Arms by side, engage glutes and hamstrings ensuring a straight line from your shoulders to your knees.

3-4 Days per week, 3 sets 6-12 reps and hold for 10-30 seconds.

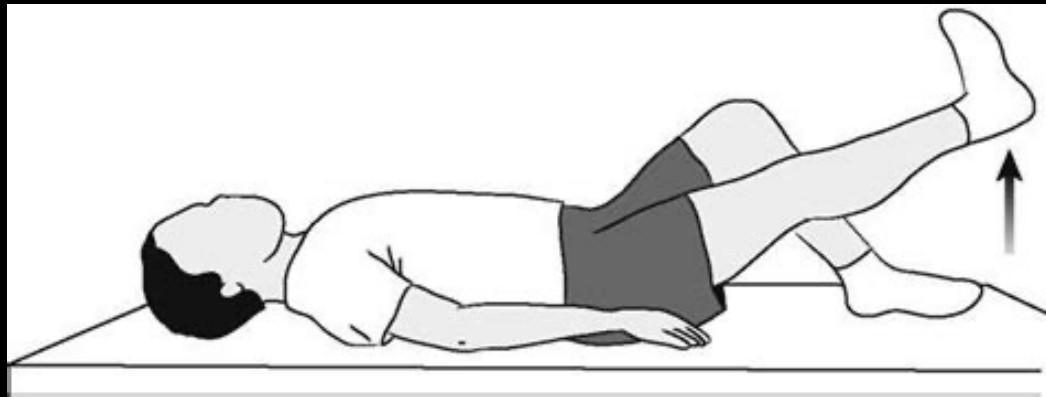
- Regression – Reduced ROM, use arms more for support.

- Progression – Bosu Ball

- For – Functional relevance, posterior chain strengthening, minimal stress on ACL.



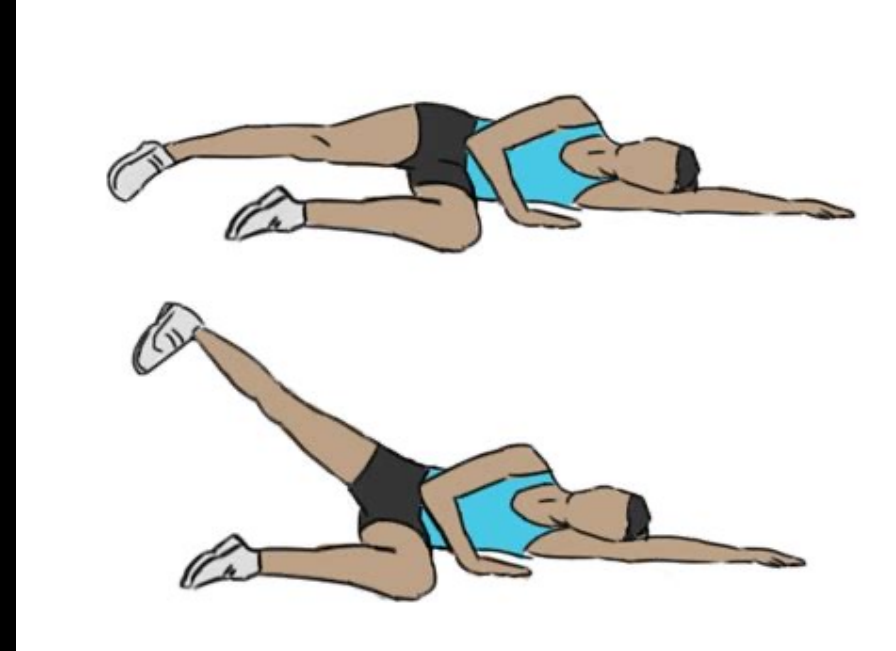
Supine Straight Leg Raises



- Lie on back with one leg bent, which will keep you from arching through the low back. Keeping your knee locked, slowly raise your straight leg to just above your opposite knee and then lower back to the floor.
- Everyday 3 sets and 6-12 reps.
- Regression – Reduce ROM.
- Progression – Resistance bands
- For – Muscle activation, functional movement and Neuromuscular control.

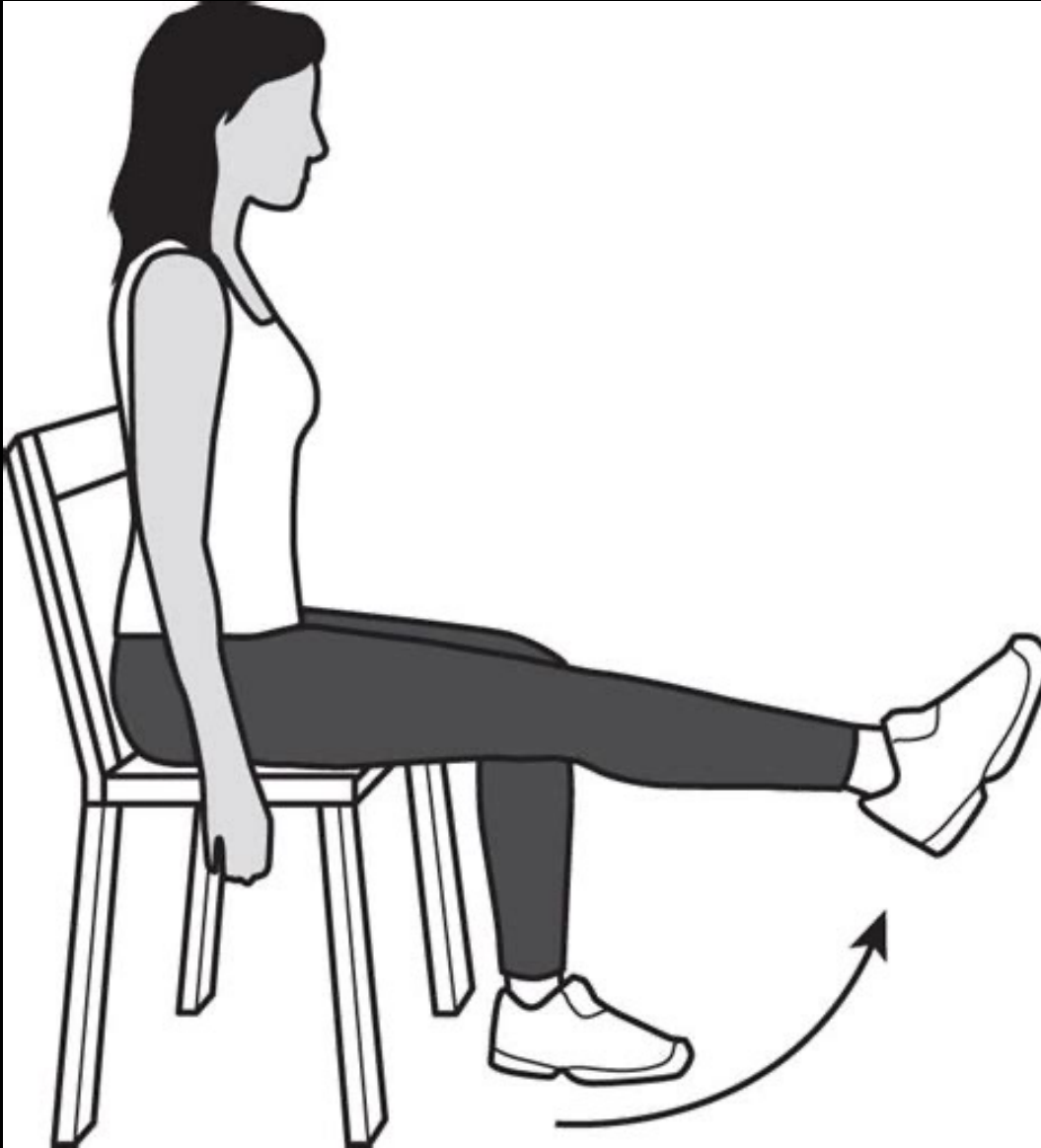
Side Lying Abduction

- Lie on side, rotate hips slightly towards floor, internally rotate your top leg. Lift top leg up and a backward angle. Keep spine neutral and pause at top for 1-2 seconds before lowering.
- Everyday 3 sets and 6-12 reps.
- - Regression – Reduce ROM.
- Progression – Resistance bands
- - For – Muscle activation, hip and pelvic stability. Minimal stress on the knee.





Intermediate Rehab

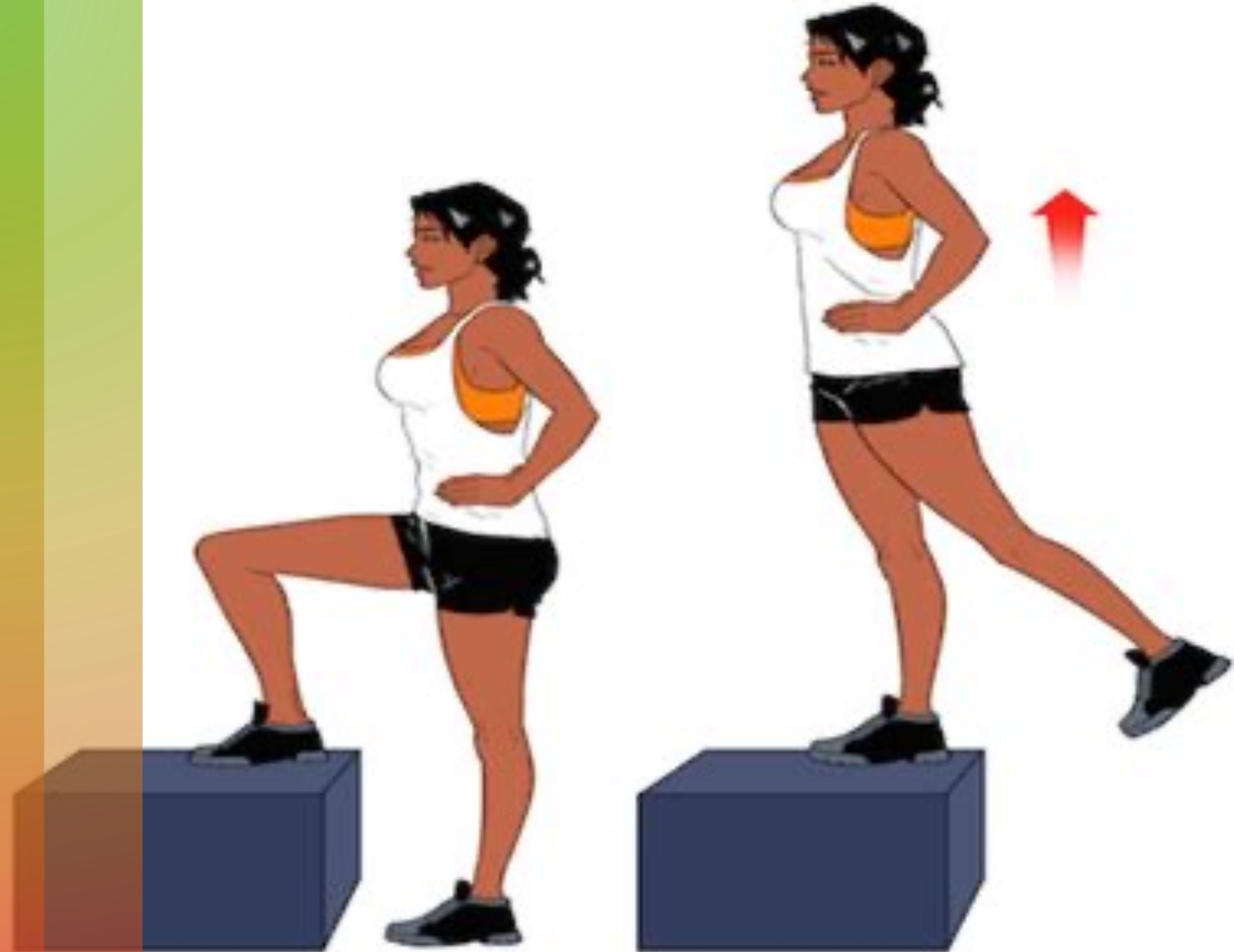


Knee Extension

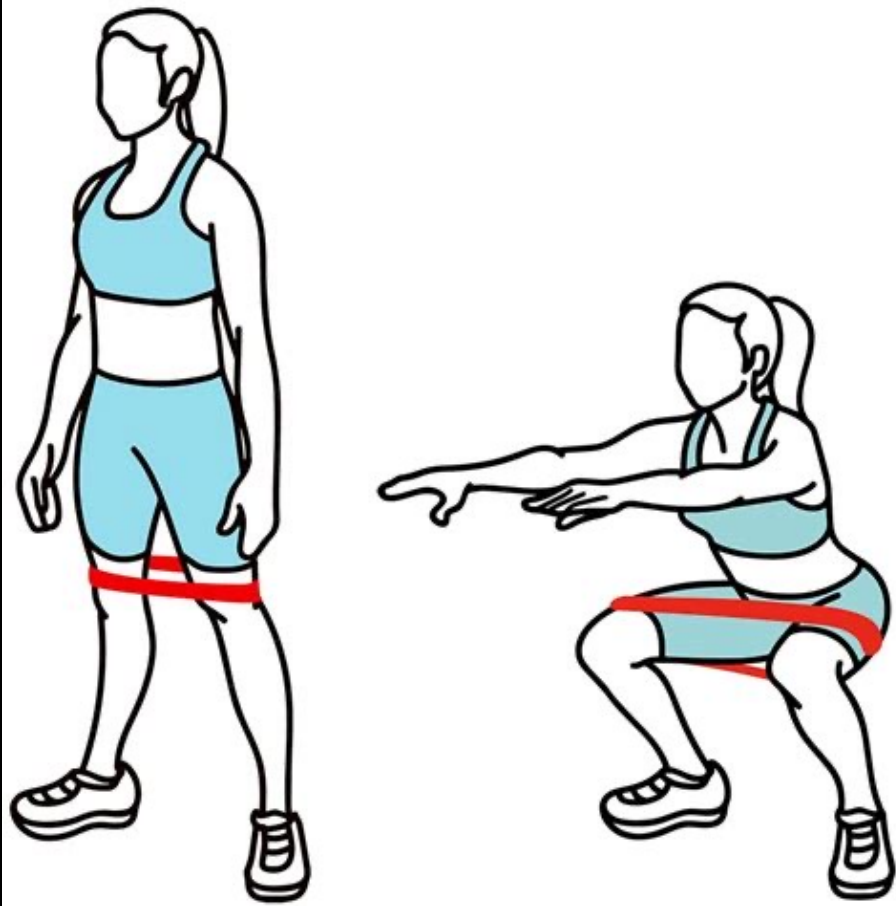
- Sit on bench or chair with both hips and knees at roughly 90 degrees. Slowly extend one knee . Move with control to full knee extension.
- 3-4 Days per week, 3 sets 10-12 reps hold contraction for 1-2 seconds.
- Regression – Short Arc
- Progression – Progressive loading. Bands or Resistance machines.
- For – Muscle Strength, Full ROM.

Step Ups

- Use a stairs, stand onto the first step, straighten leg and balance for 5secs before lowering back down.
- 3-4 Days per week, 3 sets 10-12 reps hold contraction for 1-2 seconds.
- Regression – use handrail
- Progression – step up to second step.
- Functional movement, proprioception.



Banded Squat



- Place a resistance loop above your knees, feet roughly shoulder width apart. Turn feet out slightly if needed to allow deeper squat. Reach hips back and sit straight down. As you lower down drive your knees into the band, keeping spine in neutral and knees aligned over toes.
- 3-4 Days per week, 3 sets 10-12 reps.
- Regression – Remove resistance band / less depth
- Progression – Banded lateral walks.
- For – Variable resistance, engagement of stabilizer muscles (VMO, hamstrings)

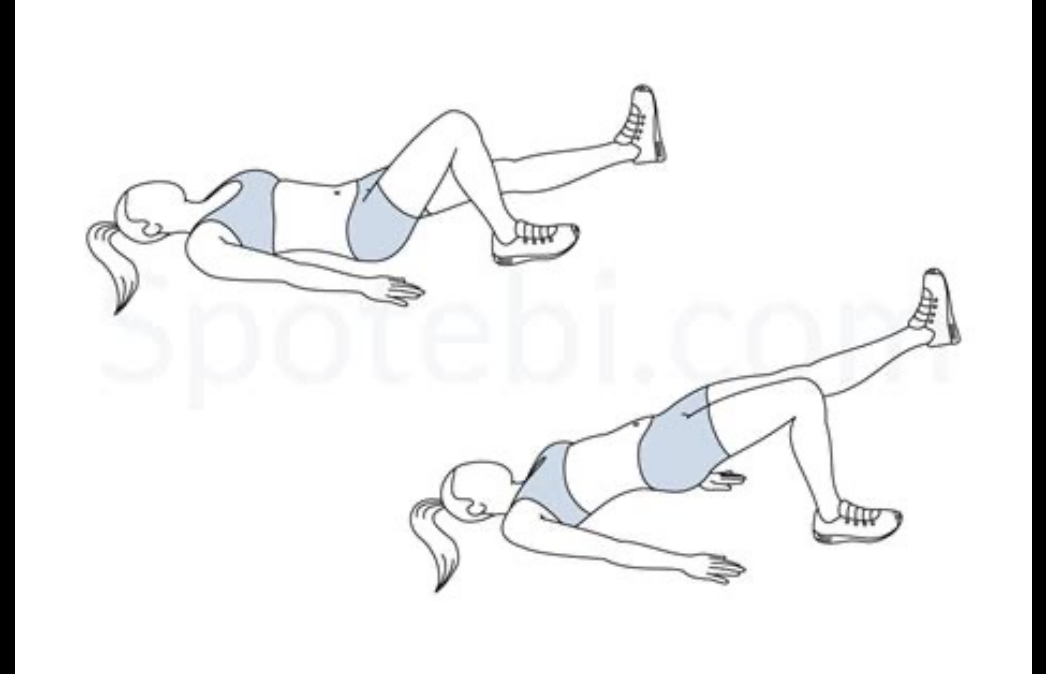
Split Squat



- Split squat stance, torso upright, slight bend in leading leg. Drop hips straight down lowering rear knee to the floor. Extend knees and raise back up.
- 3-4 Days per week, 3 sets 10-15 reps.
- Regression - Use support
- Progression – Add dumbbells.
- For – Functionality, strengthening and proprioception.

Single Leg Bridge

- Progression from SLR whilst extending hips so supporting knee is at 90.
- 3-4 Days per week, 3 sets 10-15 reps hold contraction for 1-2 seconds.
- Regression – SLR
- Progression – straighten supporting leg or place foot on uneven surface.
- For – Isolates and strengthens hip, core and posterior chain muscles, promotes functional stability and enhances balance and proprioception.



Hops

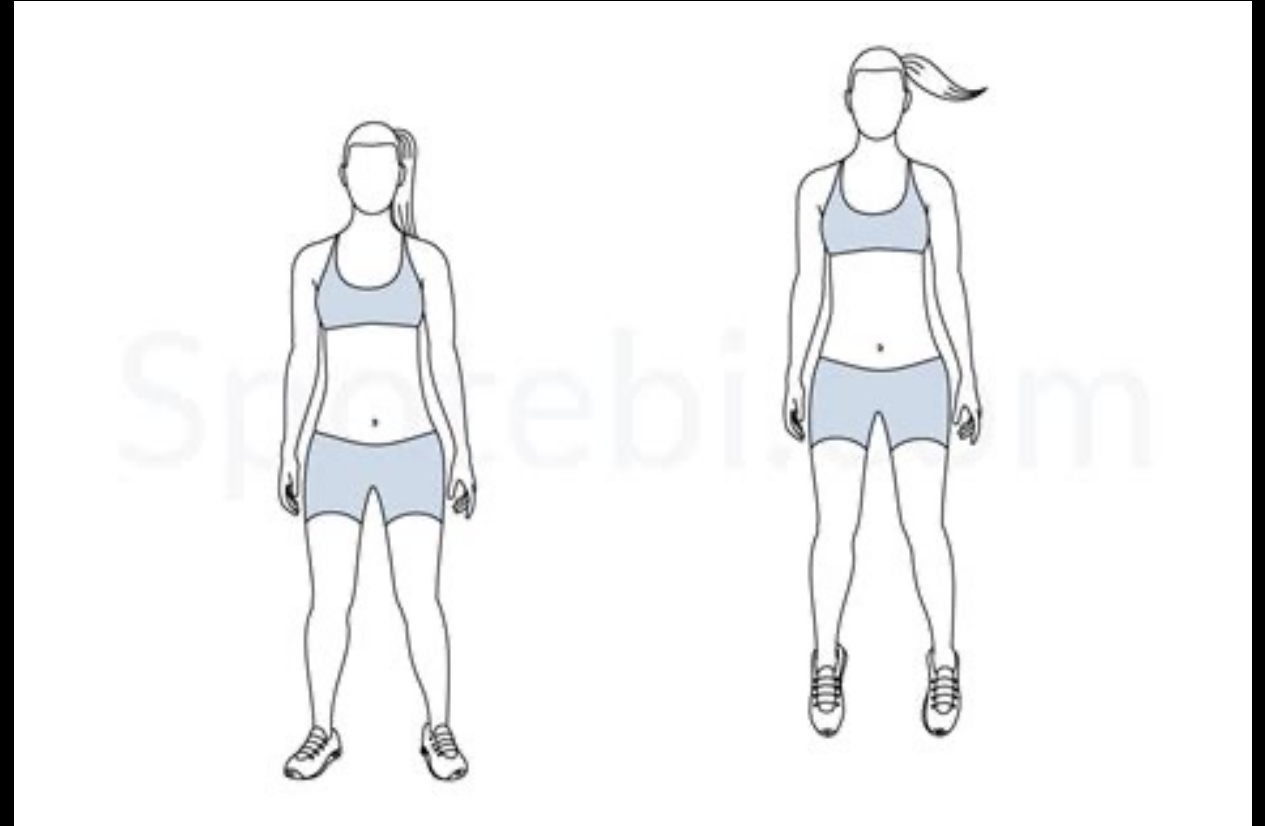
Feet shoulder width apart, bend your knees slightly. Engage core and maintain an upright posture and perform a controlled double leg hop.

3-4 Days per week, 3 sets 10-15 reps.

Regression – Reduce height of hops, softer surface.

Progression – increase intensity or include variations such as forward hops.

For – Neuromuscular Control,
Dynamic stability, muscle activation,
CV.





Any Questions?

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