



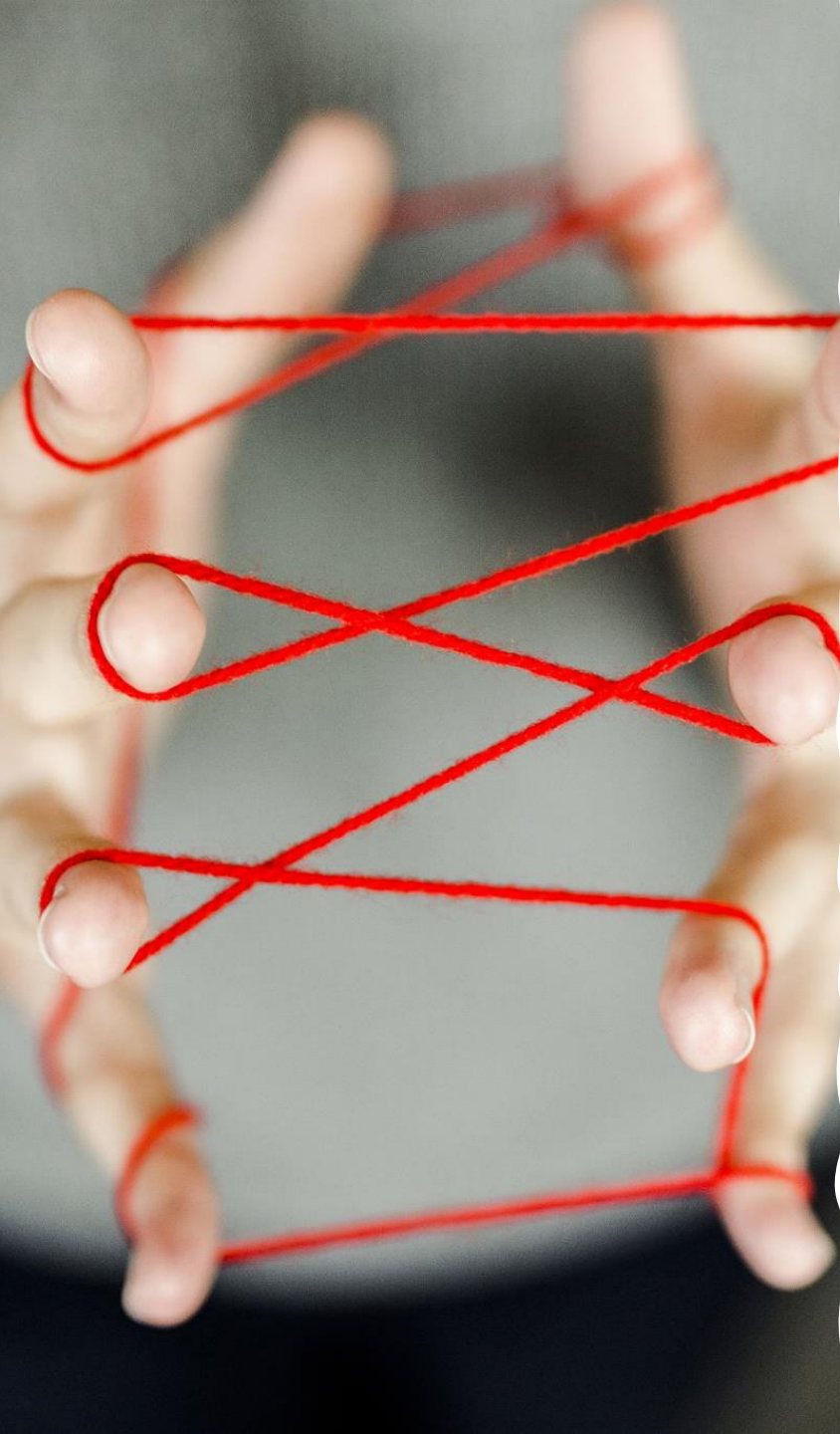
Early to intermediate rehabilitation





Ligaments

- Ligaments are made up of connective tissue with strong closely packed, parallel collagen fibres.
- Connect bones together.
- Provides stability in the joints.
- Allow for a joint's anatomical movement.
- Prevent bone separation.



How they work

- Ligaments straighten then create resistance to stretch.
- In extension at a joint anterior fibres stretch.
- In flexion anterior fibres relax.

Forces on the tissue



WITHIN SPORTS (ACUTE)



WEIGHT BEARING FORCE
(CHRONIC)

These tissues are frequently injured due to repetition and overuse as well as quick cutting motions that involve acceleration and deceleration.

Jung, Ho-Joong, et al.(2009)



Forces on the tissue (knee specific ligaments)

- Chronic force.
- 'The cause of a chronic injury is typically due to repeating the same motion over and over again.' NIAMS 2018
- Overuse injuries occur an activity is repeated so often that the body doesn't have enough time to heal between occurrences.
- During walking, the leg structure is subjected to external forces.
- Joint stiffness is needed to prevent dislocation.
- Cruciate ligaments are affected the most.
- ACL is constantly loaded.
- The MCL and LCL have a mild contribution.
- The PCL is lightly loaded.
- Ligaments adapt to these repetitive movements such as walking.



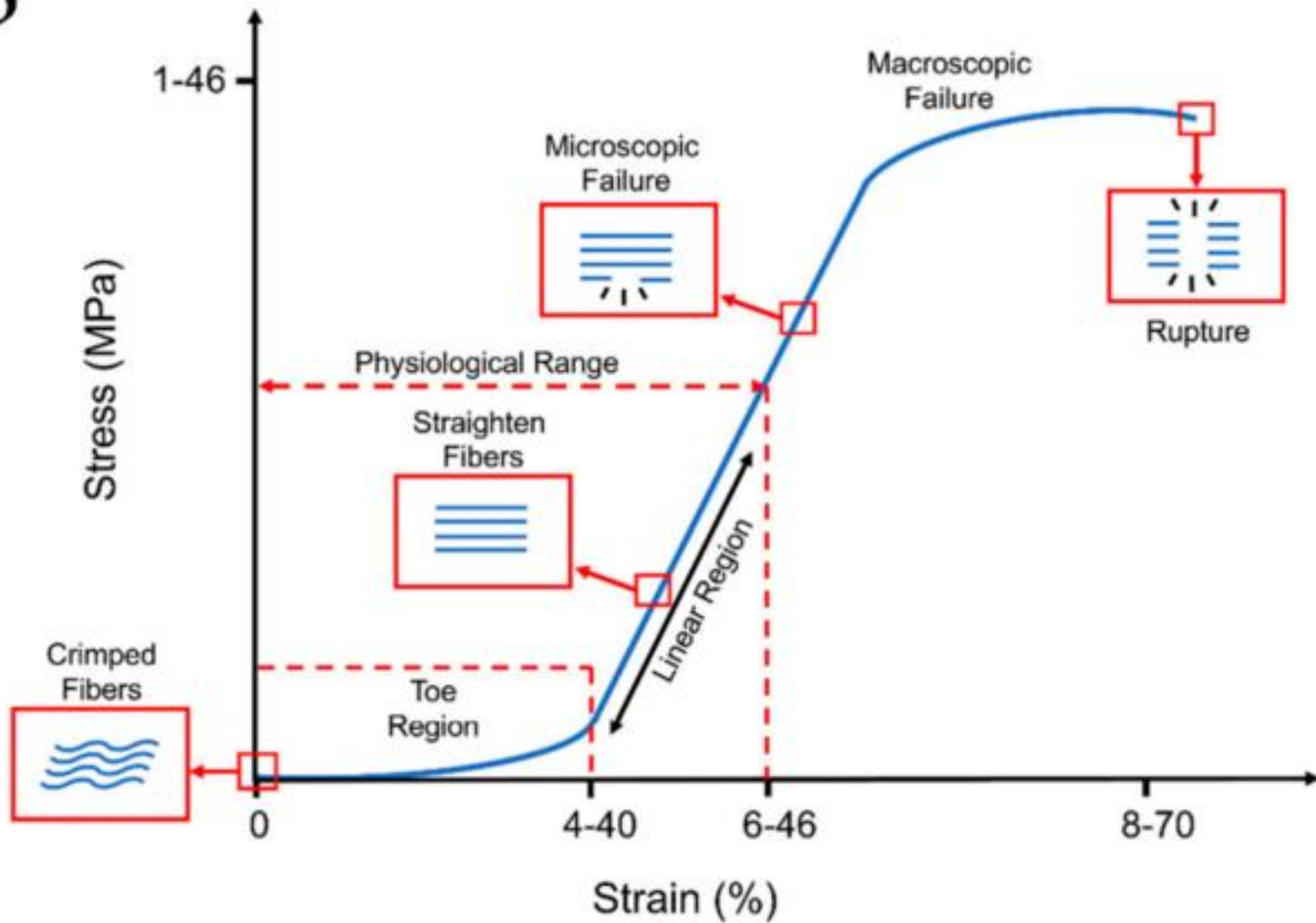
Forces on the tissue (knee specific ligaments)

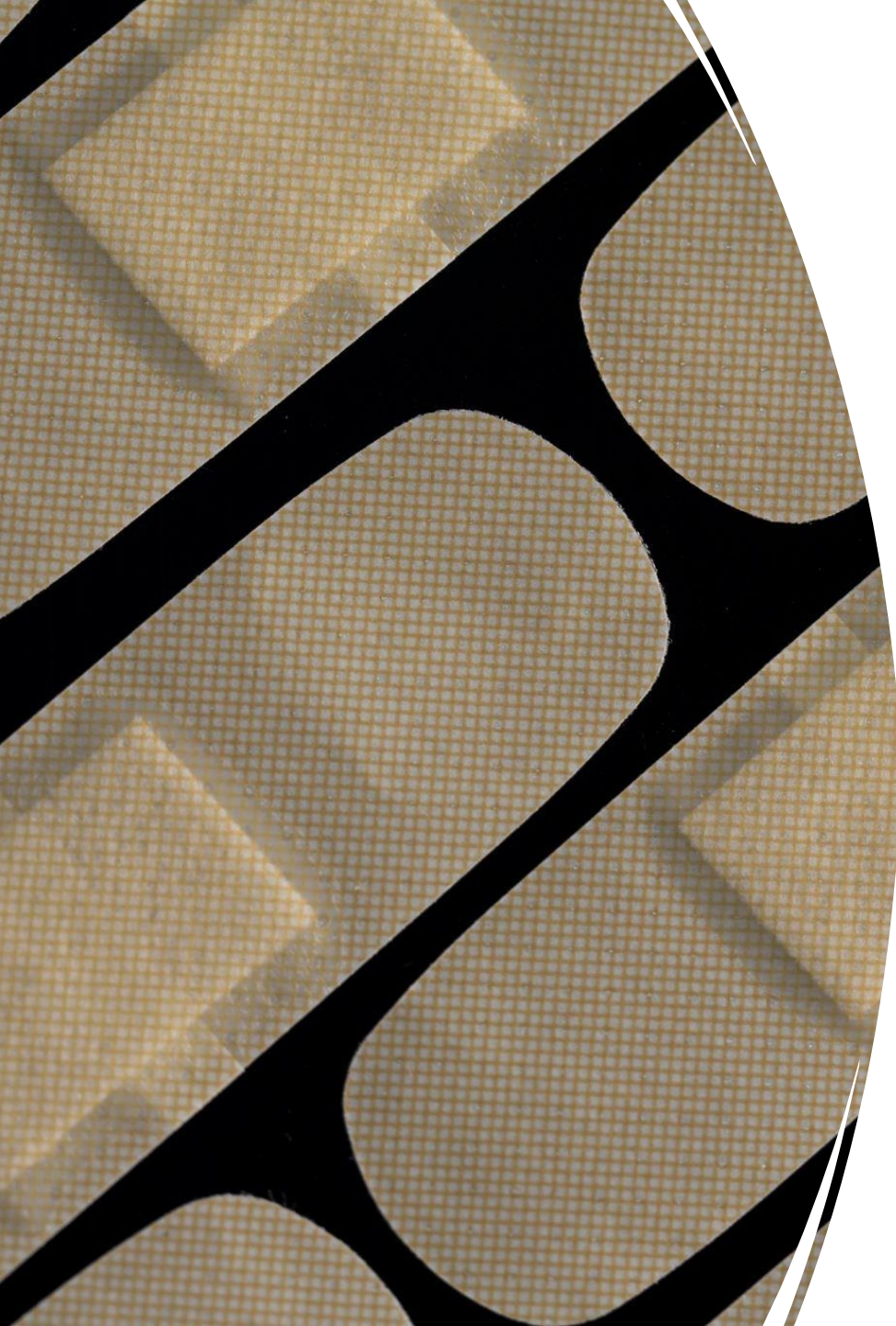
- Acute forces
- 'The cause of an acute sports injury is a force of impact that is greater than the body part can withstand' NIAMS 2018
- Acute injuries are caused by a sudden trauma, such as a fall, twist, or blow to the body.
- Overextended or twisting movement. (when the knee is over-extended or twisted, the ligaments within it can tear due to the force of this acting on the ligament.)
- Happens with a sudden change of direction or landing in a jump. (this often happen when the person changes direction suddenly or landing awkwardly in a jump.)
- Other causes include, (other causes of an acute injury to the knee ligaments include)
- Pivoting with your foot firmly planted
- Stopping suddenly
- having a collision or blow to the knee (in a tackle)



Stress strain curve

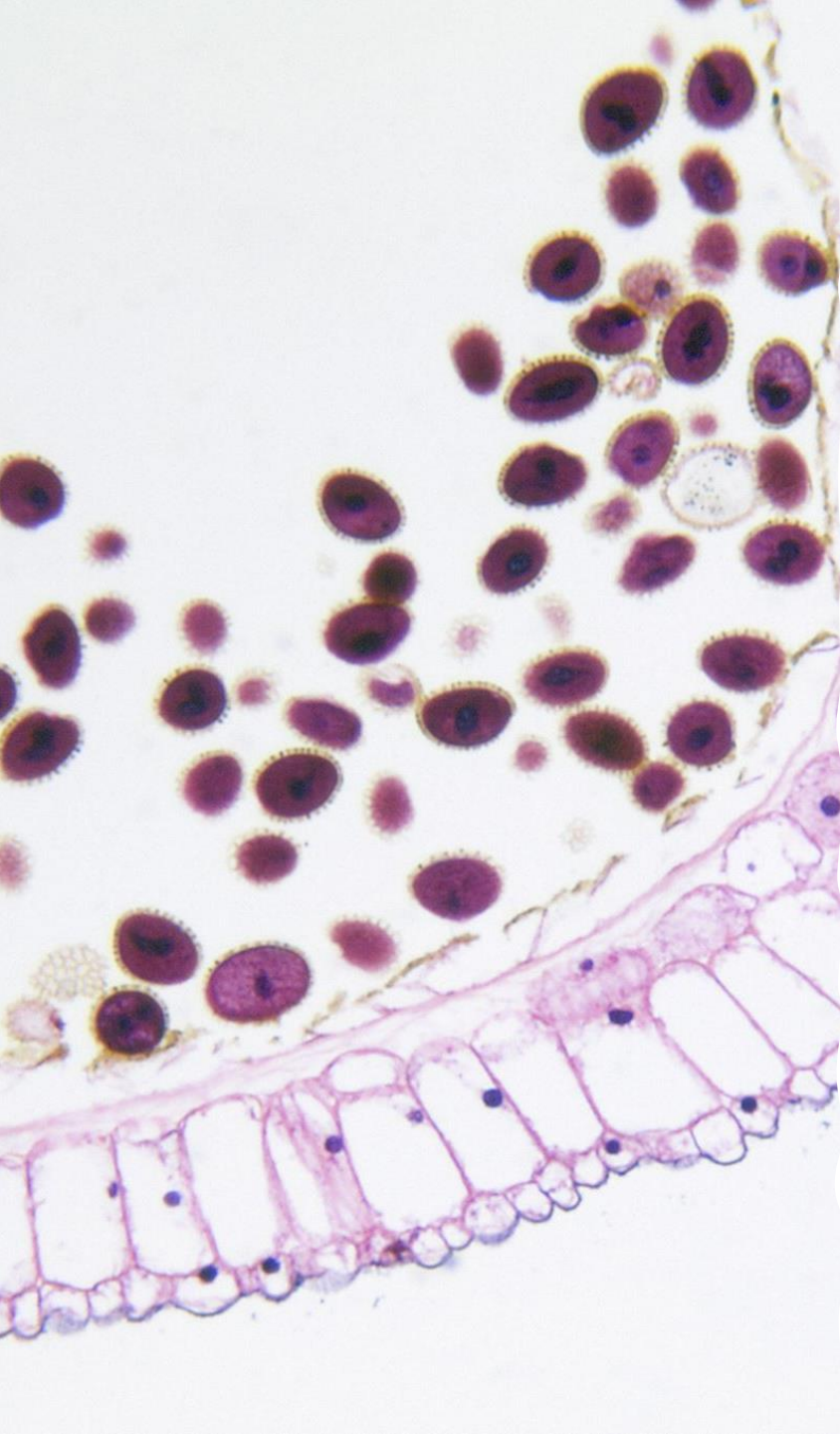
- Stress strain curve – graphical representation of a materials behaviour under increasing loads.
- Shows - elastic region, plastic region, yield point, and ultimate tensile strength.
- For ligaments - slope is constant in pre-failure stage.
- Failure mode varies with different types of ligaments.

b



Types of injuries

- Grades of injury (ligament sprain)
- Grade I – microscopic damage, slight tenderness, without joint instability.
- Grade II – partial tear, visible swelling and tenderness, without joint instability (or mild)
- Grade III – severe sprain, complete rupture, significant swelling, with instability.



Types of injuries

- Repetitive loading over periods of time result in creep.
- Creep – micro-damage in the structure of the tissue.
- Inflammatory - swelling, redness, elevated temperature and pain.



Healing

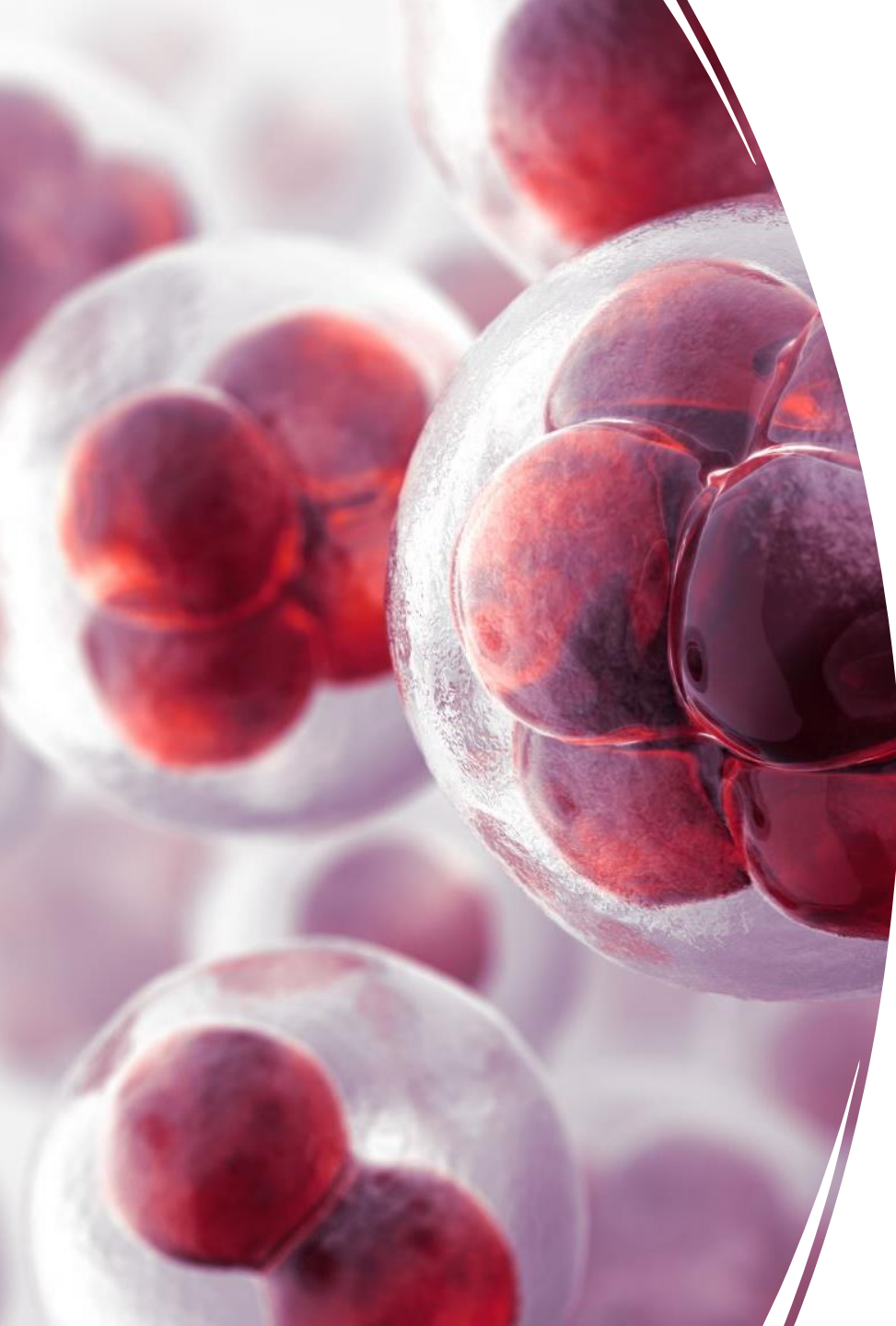
- Acute inflammation shows healing or upgrading of the ligament's properties.
- If left undisturbed will allow recovery and upgrading of the ligament.
- Inflammation manages breakdown and removal of damaged protein and importation of new protein.
- 70% of the original characteristics are attained post-injury.



Healing stages

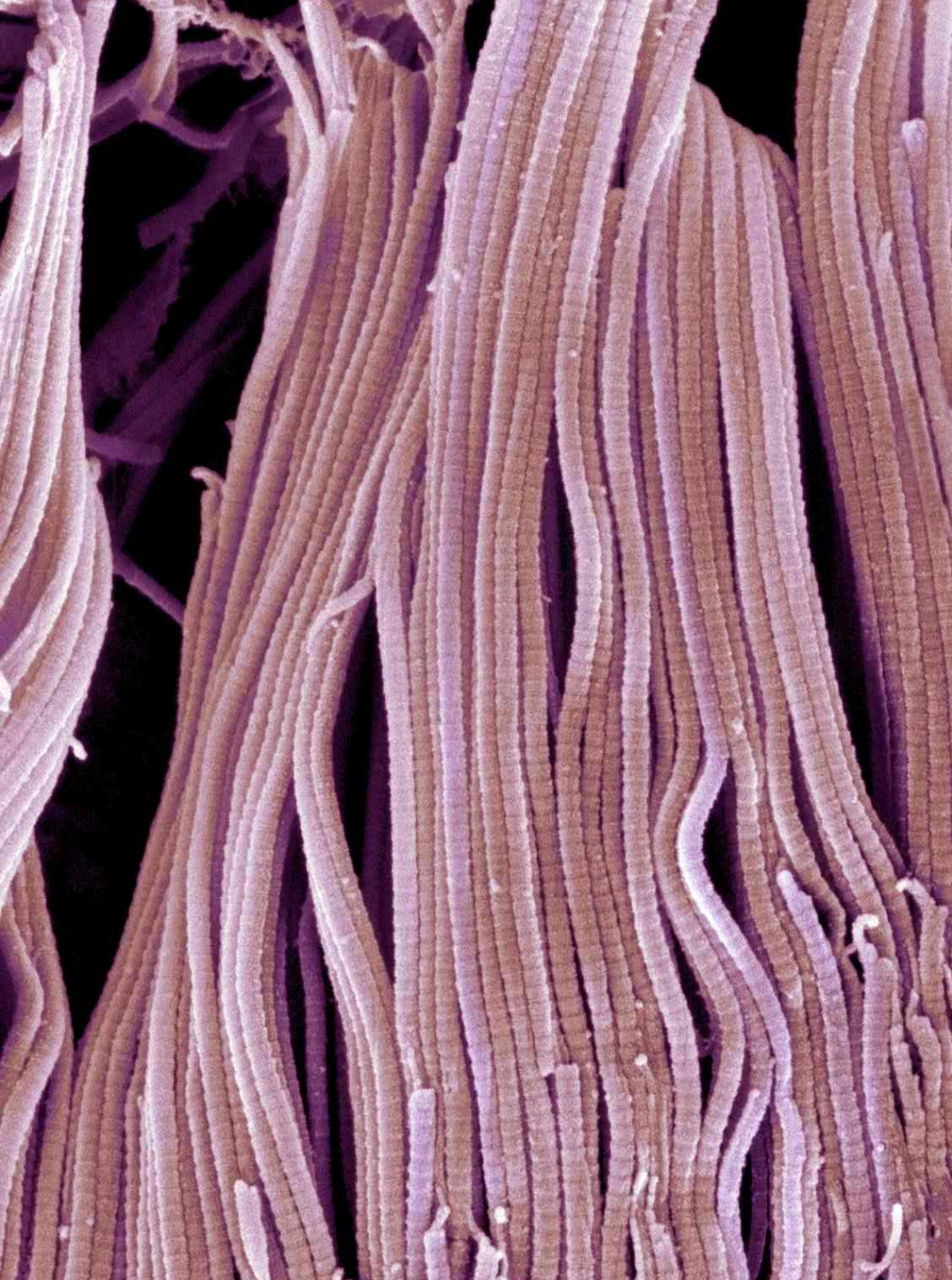
The inflammatory stage –

- Happens immediately after injury
- clot is formed
- inflammatory cells are activated
- fibroblasts are recruited to continue the healing process
- Platelets release TGF β , IGF-I, and PDGF

A circular inset on the left side of the slide shows a microscopic view of several red blood cells. The cells are spherical and have a reddish-pink color, with some showing a darker, more concentrated center. They are set against a lighter, slightly blurred background.

Healing stages

- The proliferative phase -
- Fibroblasts come in and proliferate.
- Fibroblasts continue to come in increasing extracellular matrix production.
- Scar tissue is removed.



Healing stages

- The remodeling stage -
- New collagen is deposited and reorganised.
- Collagen fibres become aligned.
- Type 1 collagen is replaced.
- This continues for months and years following the injury.



Aims of rehabilitation

- Prevention of abnormal scar tissue formation.
- Prevention of joint stiffness.
- Prevention of muscle weakness.
- Strengthening injured area.
- Improving performance (later stages).
- Restore proprioceptive.

Rehabilitation range of movement

- The first stage of rehab after reducing pain
- Loss of ROM is common after injuries.
- decreased knee flexion or extension ROM after ACL reconstruction.
- Regaining ROM is crucial.
- Loss of ROM (in flexion and extension) can cause -
- difficulty running and jumping
- altered gait pattern
- limited functional squatting



Rehabilitation range of movement (ACL)

- Passive quad extension
(with towel/foam block)
- Done by -
- Placing towel or foam block underneath recovering knee
- Slowly contracting quads (straightening knee)
- Then relaxing



Rehabilitation range of movement (ACL)

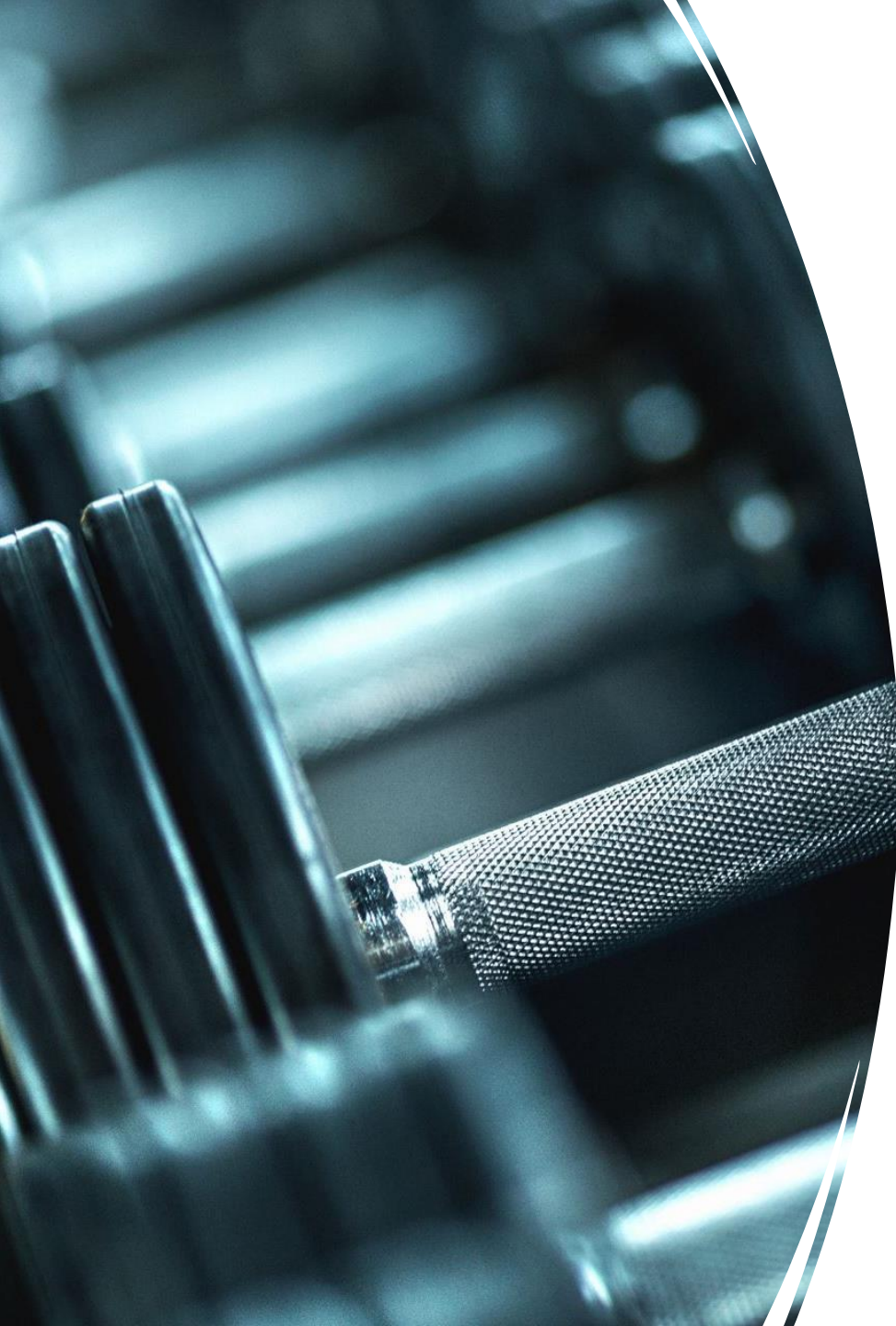
- Regression -
(no towel/foam block)
- If the client is having difficulty
- They can regress to removing the towel
- Or moving it to underneath the ankle for support



Rehabilitation range of movement (ACL)

- Progression -
(with foam roller)
- To progress the client slightly and making the exercise more challenging
- Replace the towel or foam pad with a foam roller.
- Allows for a greater range





Rehabilitation isometric contraction (ACL)

The first step in restoring strength in rehabilitation.

- Involve no joint movement.
- Increased tension in muscle without changing length.
- Increases strength 10 degrees on either side of the joint angle.

Rehabilitation isometric contraction (ACL)

- Hamstring heel drive with band
- Have band tied to an external structure
- Wrap band around ankle
- While seated pull in leg towards chair
- Hold exercise for 10-30 seconds for 3-5 sets



Rehabilitation isometric contraction (ACL)

- Regression - Heel drive into box
- Provides more stability for client
- Can be done lying with feet elevated
- Or sitting on the box
- Push heels into the box
- Hold exercise for 10-30 seconds for 3-5 sets



Rehabilitation isometric contraction (ACL)

- Progression – hamstring curl hold
- Less stability
- Weight can be added to progress further
- Pull inwards with help of the non-injured limb
- Let go with non-injured and hold with injured
- Hold exercise for 10-30 seconds for 3-5 sets





Rehabilitation concentric contraction

- The muscle shortens as the tension increases.
- Muscle produces force.
- Lifting phase of an action – for example a bicep curl.
- Can lead to wear and tear on joints.

Rehabilitation concentric contraction

- Quad extension machine
- Set machine to a relatively light weight
- Push up and contract with injured limb
- Release and lower with guidance of non-injured limb
- Do this between 8-12 times for 3 sets



Rehabilitation concentric contraction

- Regression – remove band
- If the client is struggling removal of the band can help.
- Removes the resistance to lessen the stress on the joint and muscles.
- Have them seated on a box
- Lift injured limb to straighten and contract quads
- Lower with help from non-injured limb
- Do this between 8-12 times for 3 sets



Rehabilitation concentric contraction

- Progression - Knee extension with band
- Reduces stability without the machine
- Sitting on either a bed, chair or block
- Have a band tied behind and looped around foot of injured limb
- Lift injured limb and contract quads
- Lower leg with support of non-injured leg
- Do this between 8-12 times for 3 sets





Rehabilitation eccentric contraction

- When the muscle lengthens as the force is applied.
- Example – lowering phase of a pull up.
- Most damaging movements to muscles.
- Higher demand on muscles and nervous systems.

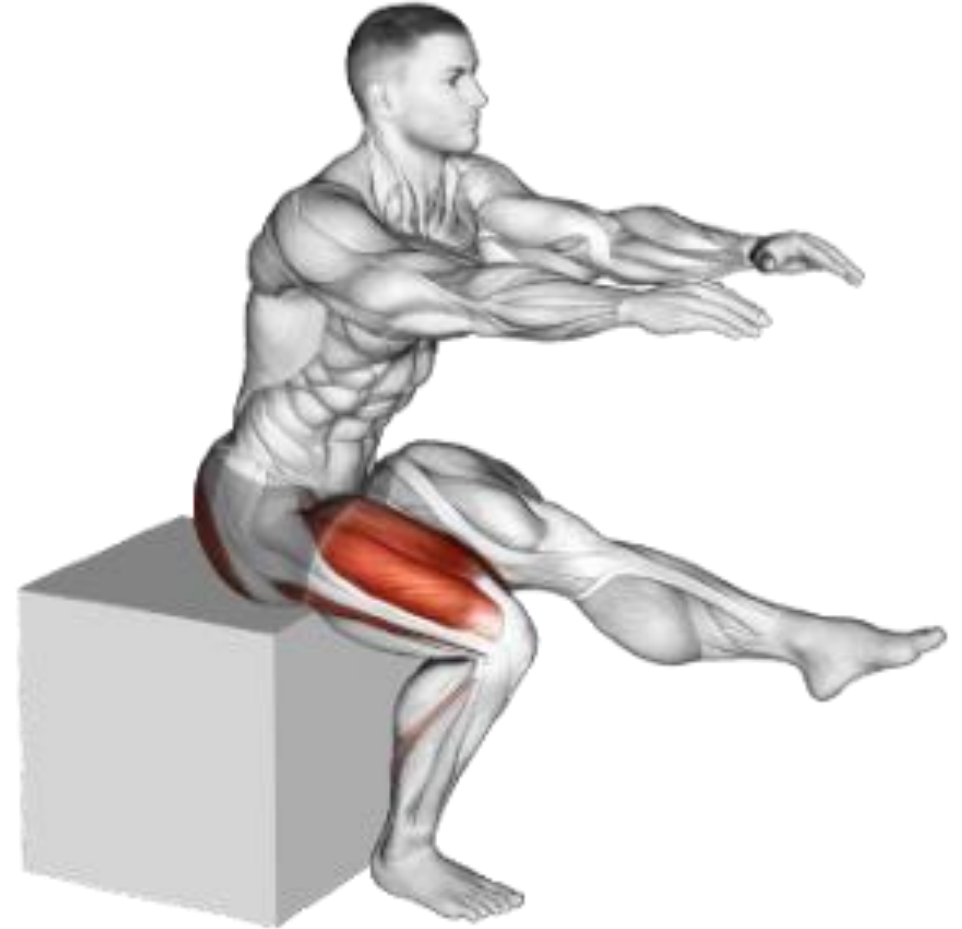
Rehabilitation eccentric contraction

- Eccentric wall sit
- Start from a standing position
- Leaning with back against the wall
- Slowly bend knees and lower down
- End at around 90 degrees (if able to) in a squat position
- Then stand back up to original positioning
- Do this between 8-12 times for 3 sets



Rehabilitation eccentric contraction

- Regression – box sit
- Provides more stability
- Lower slowly down onto a box or chair
- Can be done on both legs or single leg (with injured)
- End in a seated position on the object
- Then stand again to initial position
- Do this between 8-12 times for 3 sets



Rehabilitation eccentric contraction

- Progression – wall sit with ball behind back
- Requires more stability due to movement of the ball
- Place a yoga/stability ball behind back
- Execute a normal wall sit with the added movement of the ball
- Do this between 8-12 times for 3 sets



Rehabilitation concentric and eccentric contraction

- Heel slide with resistance band
- Wrap a band around foot and hold it
- This can be done concentrically as well as eccentrically
- Sliding outwards (straightening leg)
- Works the hamstrings concentrically and the quads eccentrically
- Sliding inwards (bending leg)
- Works the hamstrings eccentrically and the quads concentrically
- Do this between 8-12 times for 3 sets



Rehabilitation concentric and eccentric contraction

- Regression - Heel slides without band
- Takes away resistance
- Can use sliders to help with movement
- Or socks can be worn help slide
- Works the same concentrically and eccentrically as with band
- Carry out the same movement as with the band
- Do this between 8-12 times for 3 sets



Rehabilitation concentric and eccentric contraction

- Progression – heel slides with a ball
- Any kind or size of ball can be used
- Adds an unstable element
- Works the same concentrically and eccentrically as with the other variations
- Movement is also carried out the same but with foot resting and moving on the ball
- Do this between 8-12 times for 3 sets



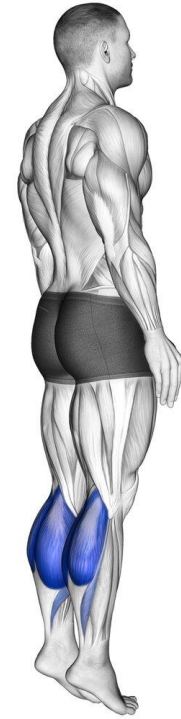
Rehabilitation concentric and eccentric contraction

- Calf raise on foam pad
- This can be used to work the calf concentrically and eccentrically
- Concentrically – upwards phase flexing the calf (Going up onto toes)
- Eccentrically – lowering phase relaxing the calf (Foot going back to flat)
- having a foam pad under your feet
- Concentric - Contract up with injured limb and relax down with both
- Eccentric – contract up with both limbs and relax down with injured
- Do this between 8-12 times for 3 sets



Rehabilitation concentric and eccentric contraction

- Regression – without foam pad
- Allows for more stability on solid surface
- Works the same concentrically and eccentrically as with foam pad
- Carry out the same movement and principles as original exercise
- Do this between 8-12 times for 3 sets

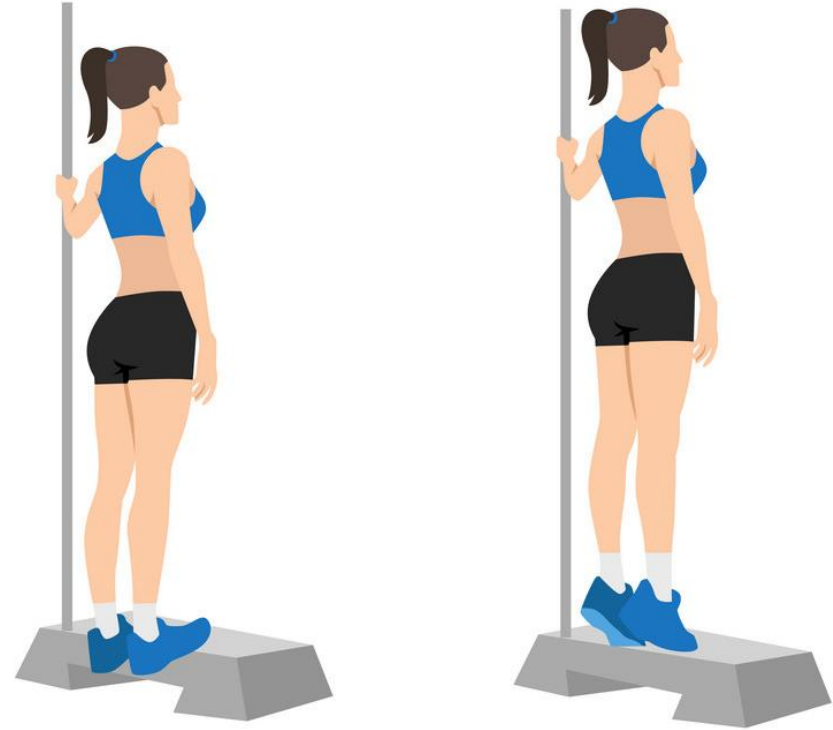


STRENGTH
LEVEL



Rehabilitation concentric and eccentric contraction

- Progression – on raised platform
- Adds a larger stretch on eccentric (downwards)
- Requires more stability
- Standing on the edge of a raised platform
- Works the same concentrically and eccentrically as previous variations
- Same movement as original exercise with a larger eccentric movement
- Do this between 8-12 times for 3 sets



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