ÖSSUR ACADEMY

Optimising Outcomes with RHEO KNEE

Training Considerations for Improving Performance with RHEO KNEE 3 and RHEO KNEE XC

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Benefits of RHEO KNEE:

- Weight Activated Stability.
- Accommodates changes in walking velocity.
- Smooth transitions between phases of gait.
- Potential with Pro-Flex and training to decrease stresses on the remaining limb.

Gait is Optimised By: Reaching full Toe Off and End of Range Hip Extension.

1. The full length toe lever results in a longer stance phase which initiates an extension moment in the knee, resulting in a smooth **transition from stance to swing.**

2. Combined with a Flex-Foot there is a smoother transition onto the intact leg, **decreasing the stresses on the remaining limb**.

3. Resulting in a **more symmetrical gait.**

Stability on RHEO KNEE is Optimised By:

- Effective Weight bearing.
- Lateral Pelvic Shift.
- Controlling the location of weight bearing along the length of the foot.

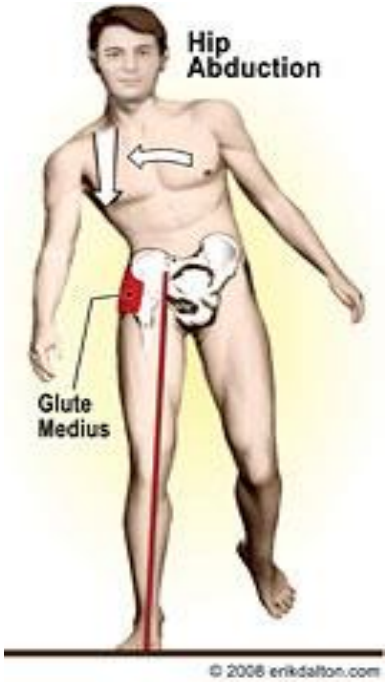
Training Considerations to Optimise Performance with the RHEO 3 and RHEO XC.

- Achieving Toe Off.
- Achieving Effective Weight Bearing.
- Improving Lateral Pelvic Shift.
- Triggering the Rheo XC Additional Functionality Modes- cycling
  - stair ascent
  - running

The most important element of weight bearing on a prosthesis.

- Please Stand up.
- Place your hands on your iliac crests.
- Stand on your Left leg BUT DON’T ALLOW YOUR PELVIS TO MOVE LEFT.
- How can you achieve it?

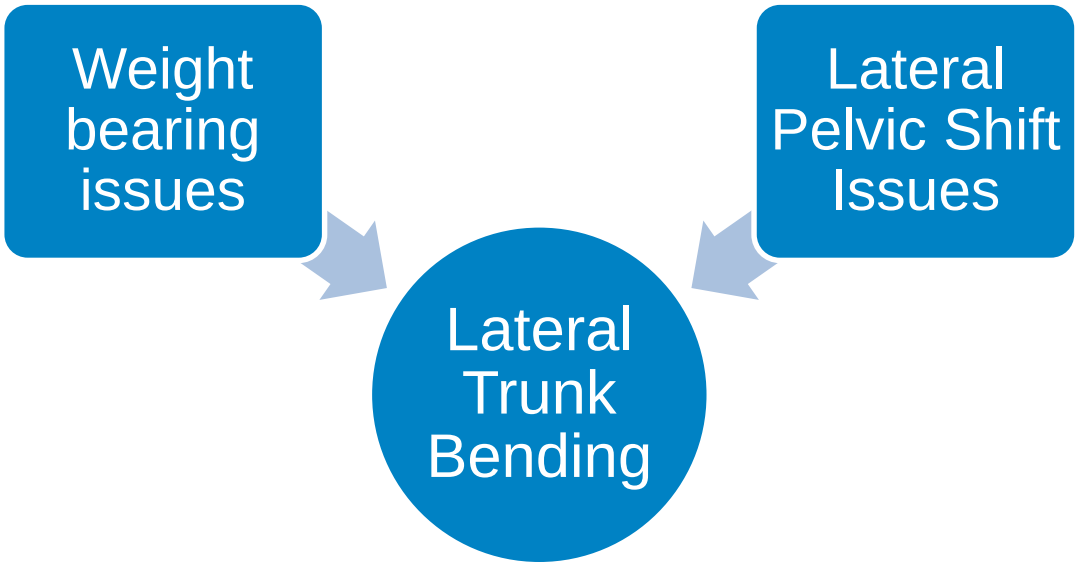
Lateral Trunk Bending occurs resulting in **less than optimal weight bearing.**



One of the Most Common Amputee Gait Deviations.

Lateral Trunk Bending

Causes of Lateral Trunk Bending



Weight Bearing Problems

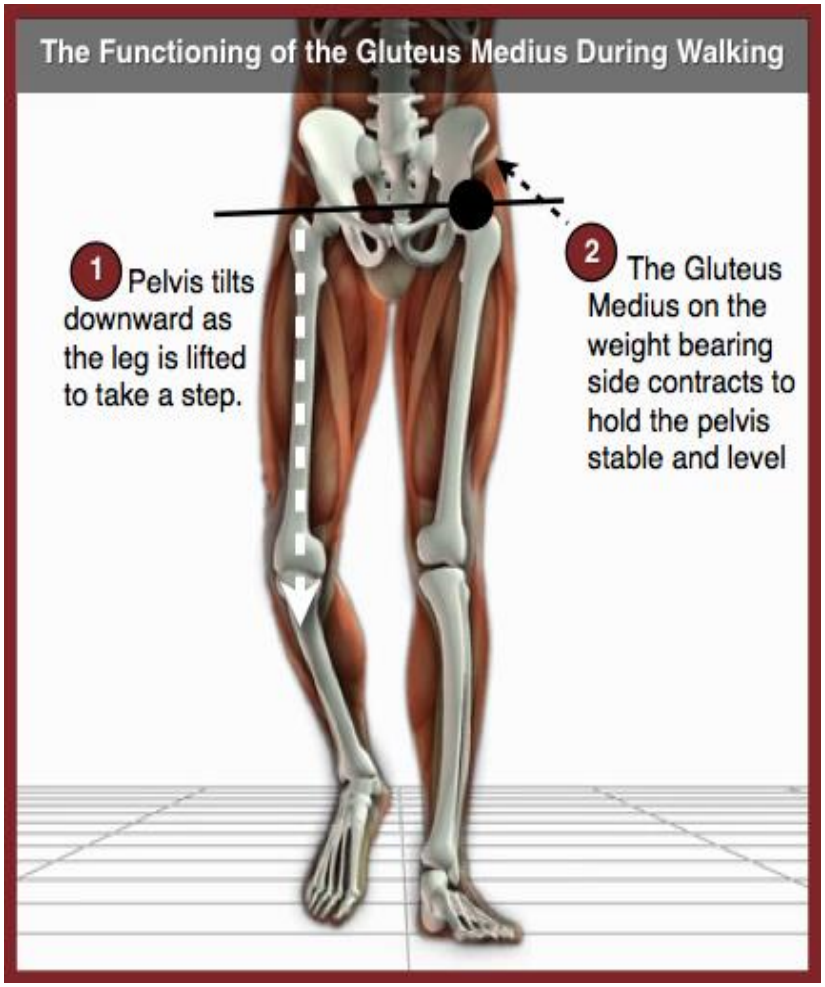
- Primary user
- Prosthetic length
- High medial wall
- Pain from socket
- Distal Lateral Stump Pain

- Denotes amputee related causes.

Problems with Lateral Pelvic Shift

- Short stump
- Flabby stump
- Poor balance
- Weak abductors
- Poor Core Stability
- Lack of upper body rotation
- Abduction Contracture
- Poorly stabilised femoral remnant
- Pain
- Wide M-L diameter

Normal Gait: Control of Lateral Pelvic Shift



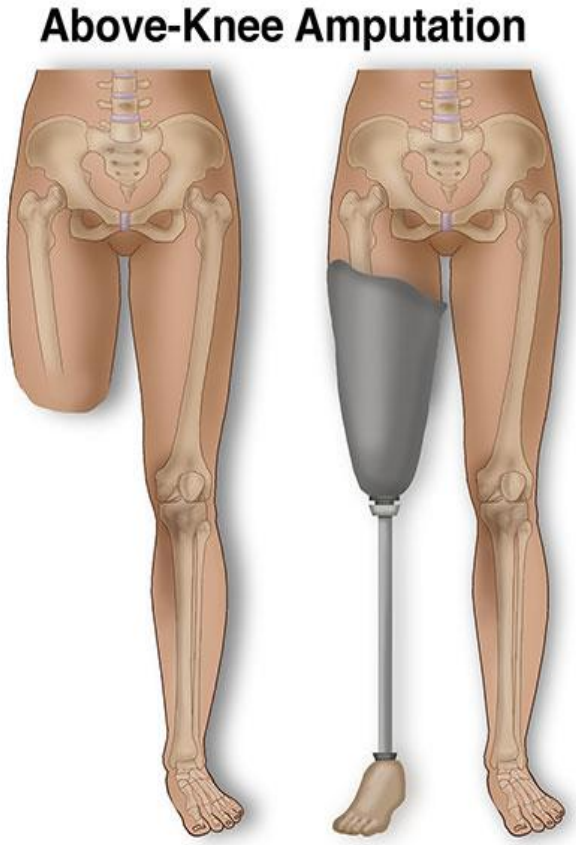
- Gluteus Medius strength and control.
- Rotation of the upper body in opposition to the pelvis.
- Core stability.

Normal Gait:

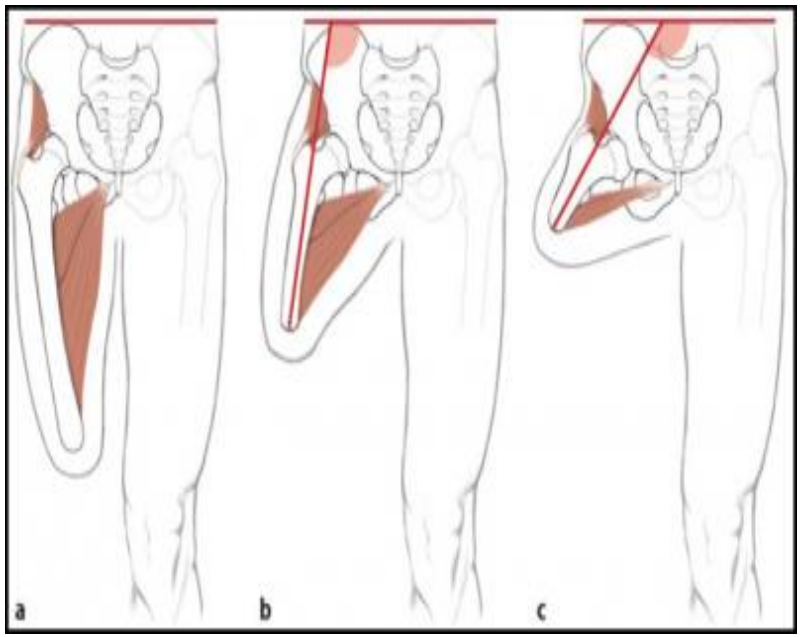
- Pelvis tracks laterally toward the weight bearing side.
- Lateral Pelvic Shift reaches its maximum just after midstance.

Effectiveness of the Gluteus Medius after Amputation.

- Destabilisation of the lever's contact with the ground.
- Motion of the femoral remnant in the socket.
- Weakness of Glute med.
- Decreased core abdominal strength and control on affected side due to decrease in weight of limb.



Effectiveness of the Glut med after Amputation:



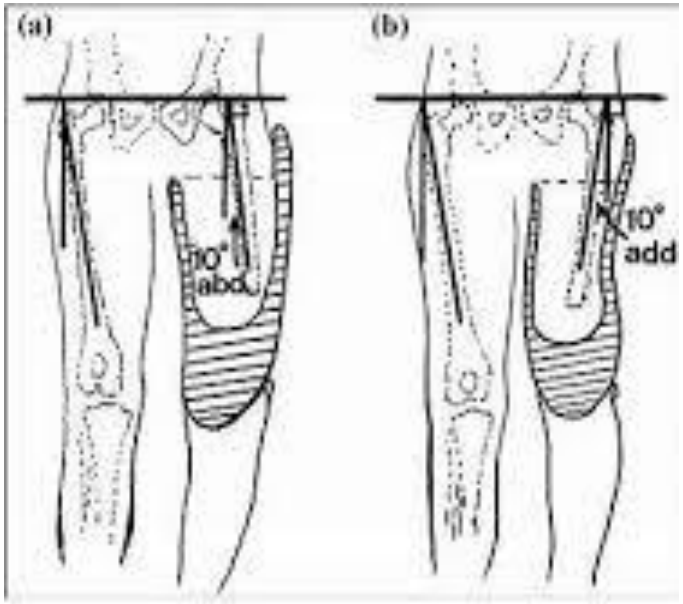
- Sectioning of the adductors
- Abductors remain intact- may become shortened & overactive.
- Difficulty in achieving lengthened position of Abductors to achieve socket adduction.

Factors contributing to shortening of the abductors….

Positioning….

Habit…

Action of the Abductors in Stance Phase.



For maximal effectiveness the abductors need to be:

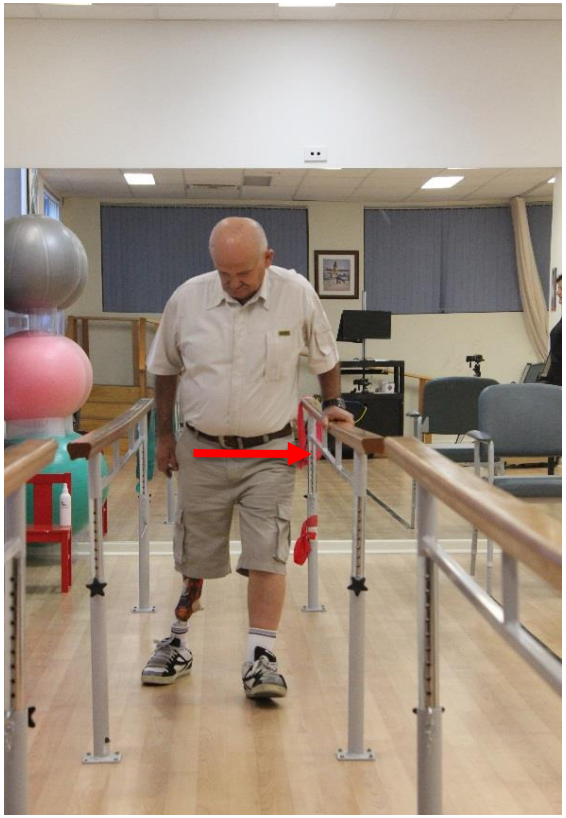
- Lengthened by adduction of the femoral remnant.
- Working ECCENTRICALLY on a well stabilised femoral remnant.
- Uninhibited by pain.

Considerations for Initial Gait Training:

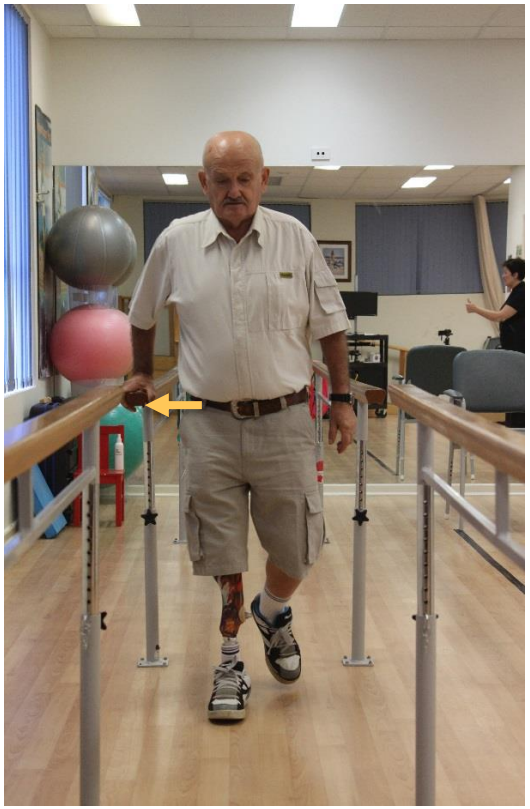
Weight Transference → **Depends on lateral pelvic shift.**

Effective Training to Avoid Lateral Trunk Bending…

A bar in the opposite hand will excessively relieve the hip abductors.



Hand on the same side will require greater muscle force to stabilise the hip.



How the use of Aids influences Gait:

Stick in the opposite hand discourages weight bearing and lateral pelvic shift to the prosthetic side.

Stick in the ipsilateral hand encourages WB and LPS to the prosthetic side.

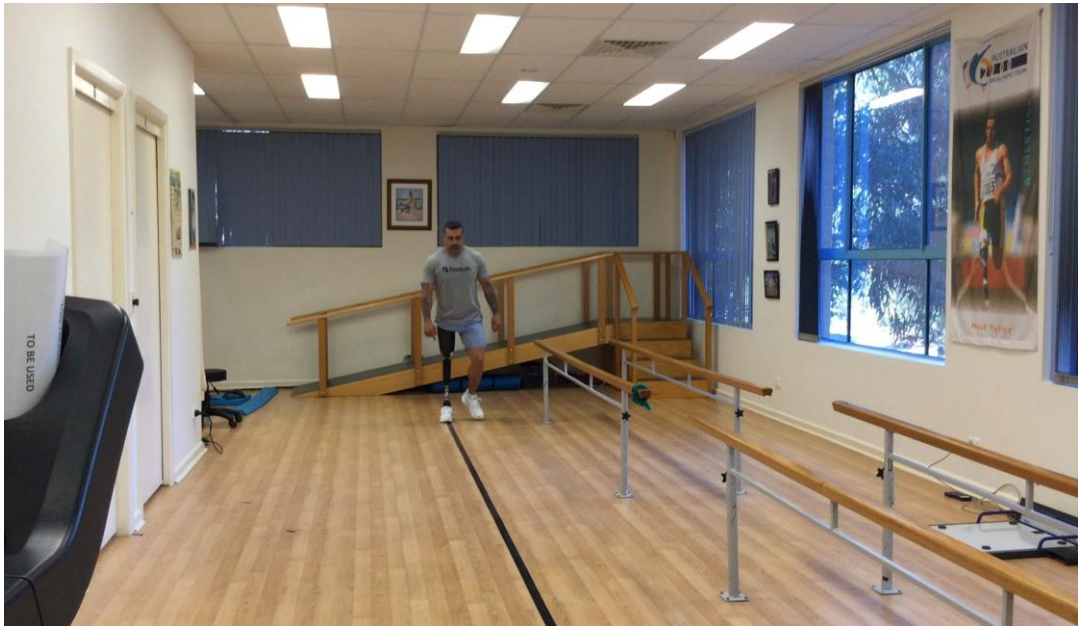
Avoiding a Flexed Gait Pattern in Early Training:

Stick placement too anterior- difficulty extending the hip and reaching the prosthetic toe.

Aid should be at the level of 1st MTP joint- extension of the hip is encouraged and prosthetic toe off can be achieved.

Consequences of too much hip flexion and/or **not achieving proper Toe-Off.**

- Shortened stride with sound limb.
- Shortened toe lever.
- Difficulty initiating prosthetic swing.
- Catching prosthetic foot and falling.



- *See Pro-Flex webinar for more information on causes, assessing and preventing excessive flexion.*

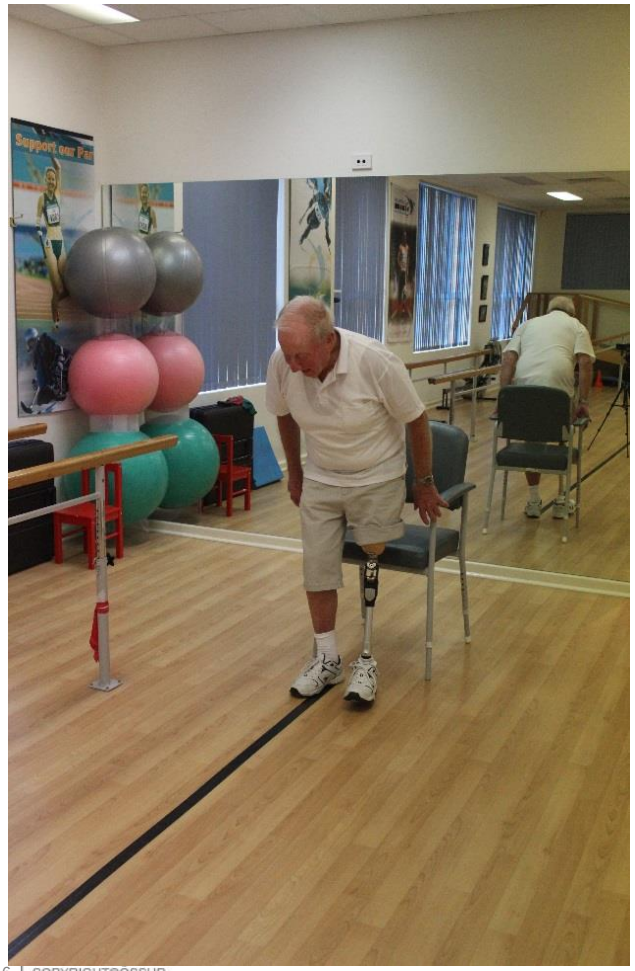
Falls and Lack of Confidence in the Knee Joint occur when:

The Prosthesis is used as a “strut” and not a “leg”.

- Prosthesis is placed in a position where alignment is not safe.
- Prosthesis is unloaded.
- Knee joints will be forced into flexion.
- Excessive rotation forces around the stump.

Preventing Falls when turning:

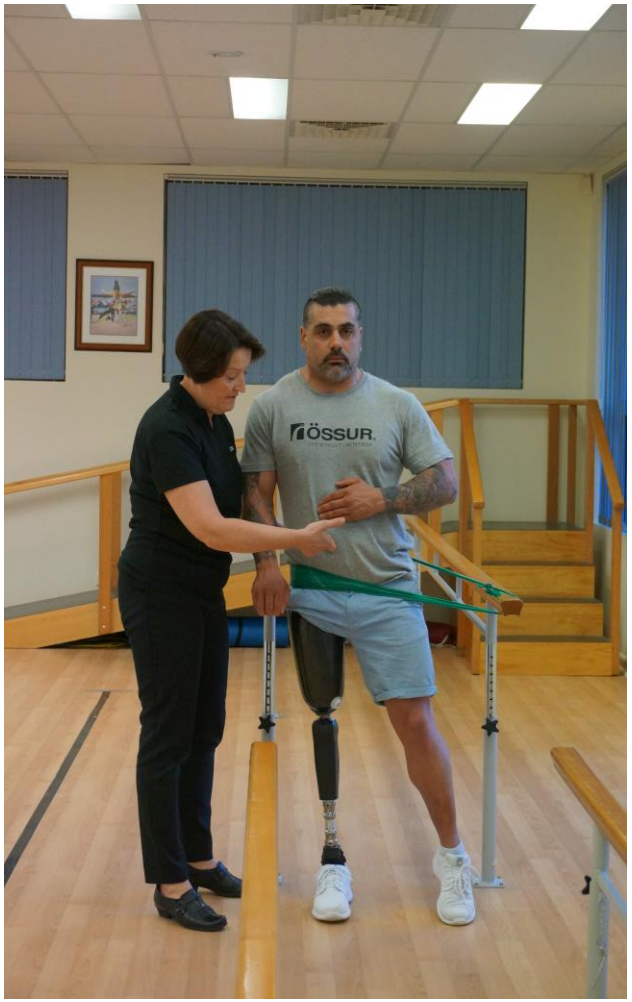
Prosthesis is used as a "leg":



- Inherent alignment stability of the prosthesis is maximised.
- Constant reminders are needed initially to reinforce safe technique.
- Step around – never spin on the prosthesis.
- Prosthetic foot is kept under the hip.
- Prosthesis is loaded correctly.

Strategies for increasing weight bearing on the prosthesis.

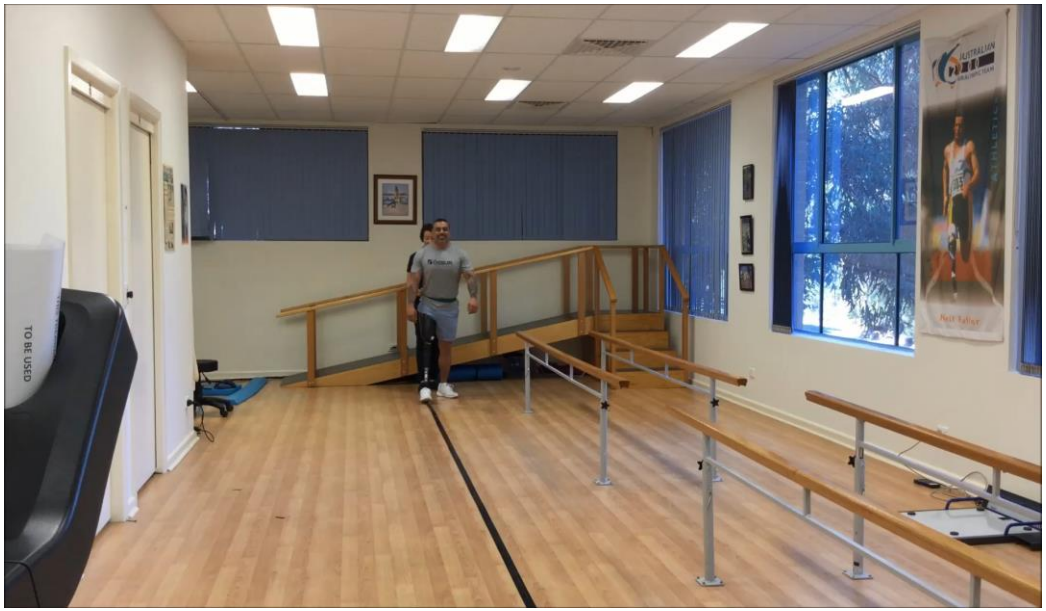
- Use scales.
- Biofeedback.
- Weight transference exercises & mirror feedback.
- Decrease contralateral hand support.
- Add resistance to the activity.



Weight transference can be improved by:

Abductor Strengthening

Adding resistance to the activity



Gaining Confidence in Weight Activated Resistance

“Testing” the knee in initial training.

Strengthening the core and hip muscles on the loaded RHEO.

Safety provided with RHEO: Training use of Stance Resistance.

- Sitting and Squatting Drills.
- Emphasis on weight bearing through the heel of the prosthesis.
- Core Stability and gluteal activation important to maintain extended lumbar spine and pelvic position and ensures that the prosthetic knee does not translate forward in space.

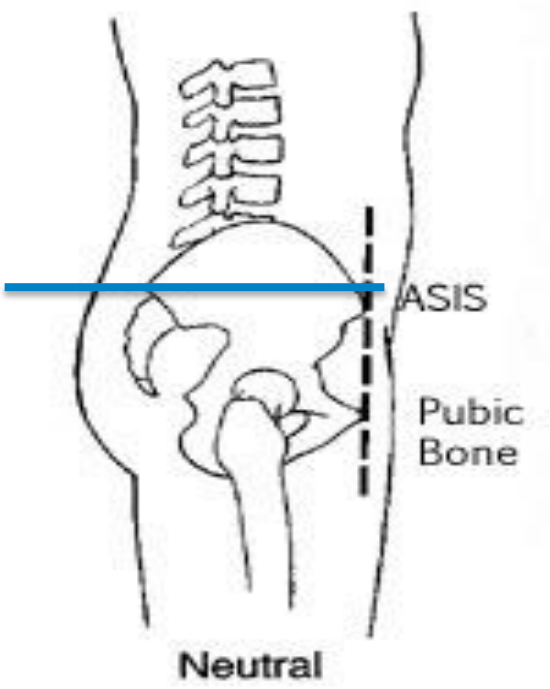
Training the use of Stance Phase Resistance.

Step over an object.

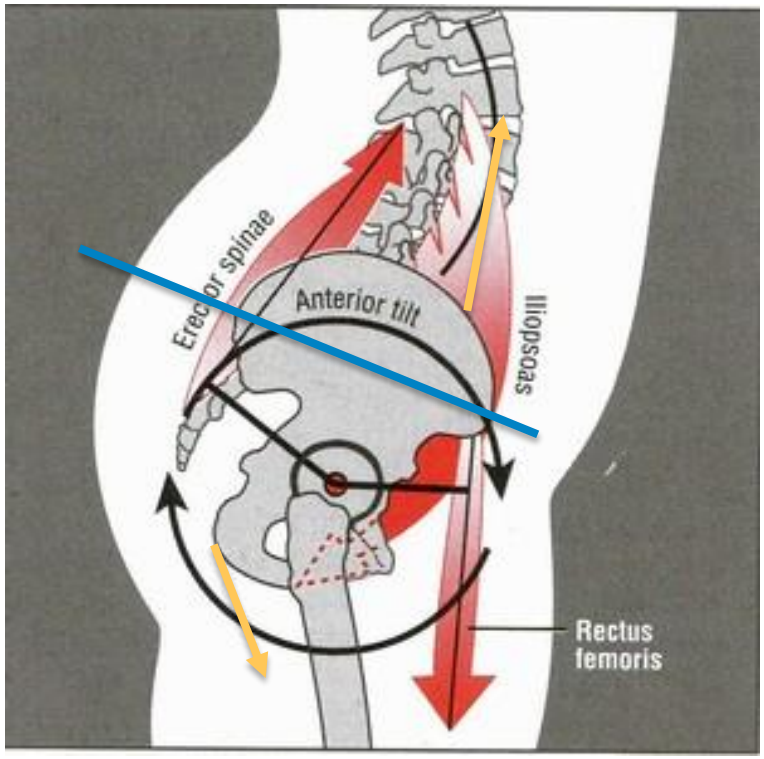
Training to assist on slopes, uneven terrain and confidence.

Amputation affects core stability of the T/F amputee by **decreasing the ability to stabilise the pelvis** in prosthetic stance phase in the AP plane.

Pre Amputation



After T/F amputation



The Effect of Poor Core Stability on T/F Gait and use of RHEO.

Predisposition to Anterior pelvic tilt (sagittal plane) and hip flexion.

- T/F ↓ stabilisation of pelvis by hamstrings.
- Tight/overactive psoas.
- Weakened/lengthened abdominals.
- Imbalance in strength between sides of abdominal musculature.
- Weakened/lengthened gluteals.

Consequences for T/F Gait

- ↓ Push off by the Hip extensors.
- Shortened intact leg step length.
- Difficulty initiating and clearing prosthesis during swing phase.
- May lead to shortening of the prosthesis. Predisposes to other Gait deviations/problems.
- Impaired momentum and loss of power.

Anterior Pelvic Tilt in T/F Amputees (Gaunaurd I, Gailey R 2011)

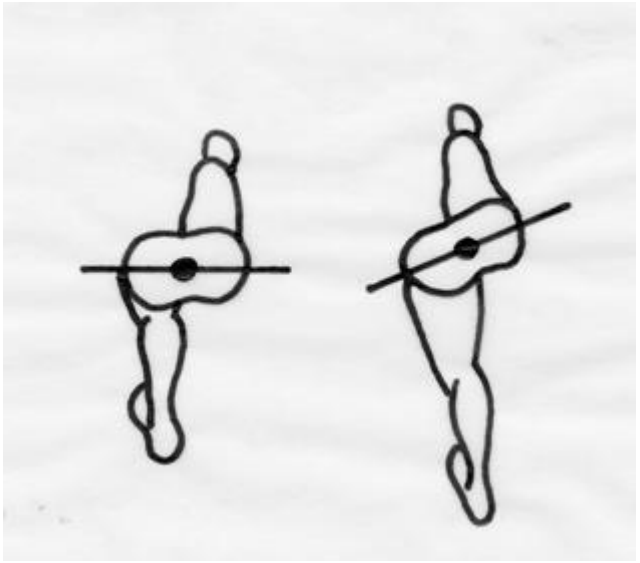
Equal Limb Length **vs** **Shortened Prosthetic Limb**

- N=16
- All had some degree of hip F tightness on prosthetic side.

- N=27
- Greater degree of hip F tightness on prosthetic side

Pelvic movements during Gait that may reflect a decrease in Core Stability.

Pelvic Rotation in Transverse Plane.

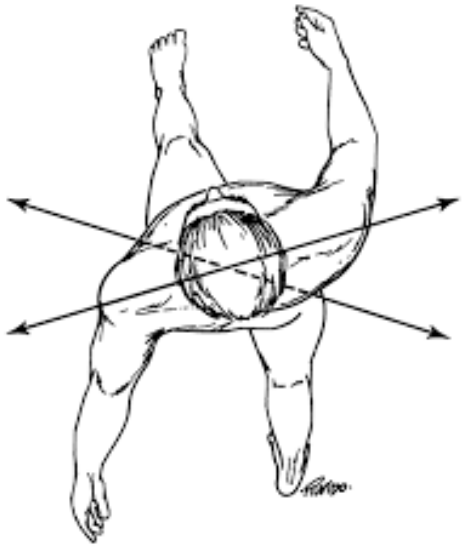


Excessive Posterior Rotation at End of Prosthetic Stance:

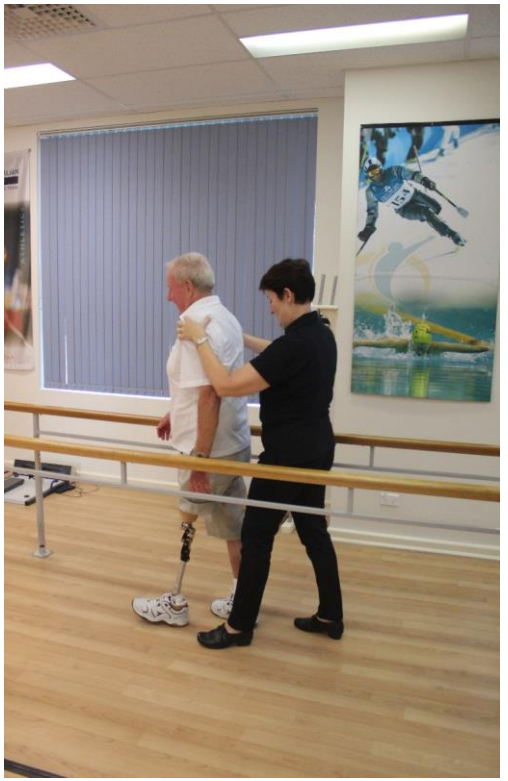
- Weakened End of Prosthetic Stance.
- Decreased push off from prosthetic toe.
- May also be associated with External Rotation of the foot.
- Avoidance of the provided toe lever = impaired momentum.

Lateral Trunk Bending results in loss of upper body rotation in opposition to the lower body.

In normal gait the shoulder girdle and pelvis rotate in opposition- this helps to **balance the body over the stance limb.**



Facilitated Walking- rotating the shoulders in opposition to the pelvis to balance the body over the prosthesis during stance.



Reinforcing Upper Body Rotation:

Core Strengthening with RHEO:

Using the Extension Lock:

For Planking or Pushups.

Resisted Walking Drills:

Resisting lateral pelvic shift.

Resisted backwards walking emphasises pushing into Rheo's stance resistance.

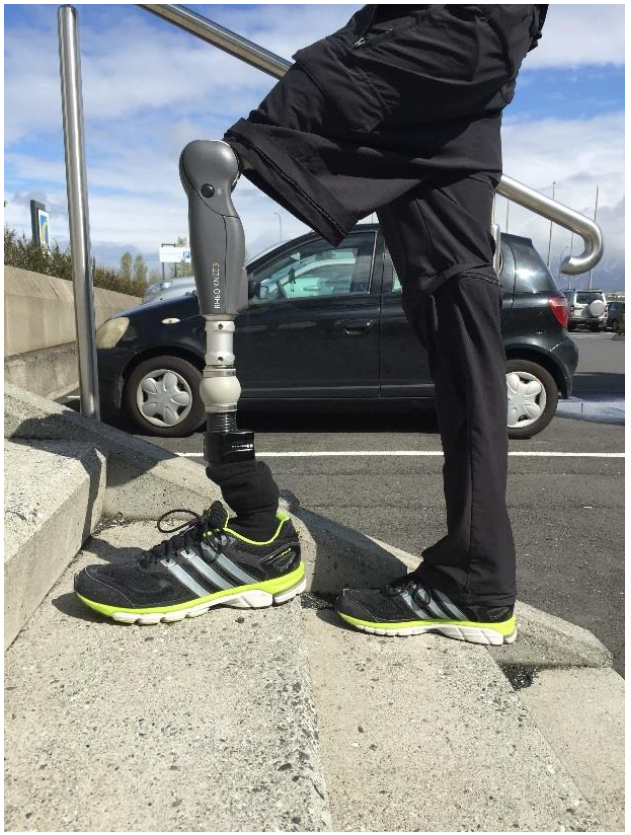
Training RHEO on Stairs:

Down:

- Load the prosthesis optimally. Use the rail on the prosthetic side when learning.
- Don’t extend the stump on heelstrike.
- Foot placement needs practice.
- More of the foot can be left on the step if combined with Pro-flex.

Initiating Stairs.

- Slightly Extend then Flex the hip more rapidly than usual.(ie swipe the foot back slightly on the floor, then flex the hip.)
- RHEO KNEE XC is in Stair mode: the RHEO KNEE XC stays in flexion during swing phase
- Position prosthetic foot flat into the stair above.
- Tip: Beginning with the sound limb on the step above will make triggering the knee easier.



Progressing Up Stairs.

- Do not allow the knee joint to translate forwards.
- Push down and back with the stump.
- It can be easier to initate prosthetic step up with the sound foot on the first step.

At the top of the Stairs:

- Continue, it is easier to stay in a rhythm
- Last step to level ground:
  - Prosthetic foot first
    - Extend residual limb
    - Roll over over the prosthetic foot
    - Small step with the sound side
    - Continue walking
  - Sound side foot first
    - Initiate hip flexion with the residual limb: the RHEO KNEE XC keeps the knee flexion longer in position.
    - Wait a split of a second so the RHEO KNEE XC will exit the stair mode
    - Continue walking

Stair Ascent step-over-step:

Training on Slopes

- Avoid overstepping.
- Load the prosthesis and “ride” it down. Avoid extending the stump.
- Maintain an erect trunk.

Training on Slopes

Down:

- Load the prosthesis.
- Ride it down – there is no extension force by the stump.

Automatic Cycling Recognition

- Correct Seat Height: the RHEO XC should not fully extend at the bottom of the revolution.

- To enter the cycling mode:
  - 2 rotations with minimum load on the knee. (little as possible)
  - One long beep confirmation: your are in cycling mode
  - During cycling mode there is no resistance to knee
  - motion.

- Exit the cycling mode:
  - Extending the knee to 15 degrees of flexion or less
  - One short beep confirmation: you are out of the cycling mode

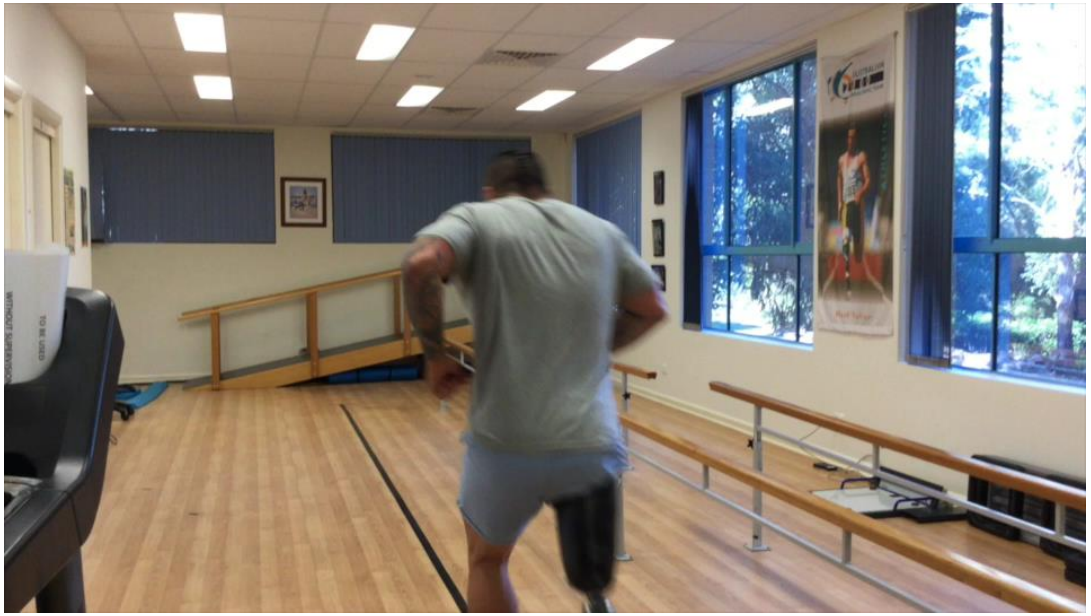
Hop-Skip Running

RHEO XC Running:

- Users >110 kg
- Running mode is triggered when a stance phase of <0.3 sec is detected.
- During running: the stair ascent step-over-step is blocked.
- Tested at speeds up to 12.6 km/h

Running with RHEO XC

- Preparation is key to avoid injury.
- Begin with sideways flight drills to get use to increased impact of running.



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