



Optimising Outcomes using Flex-Foot.

Indications for Training Based on Flex-Foot Prescription.

Cathy Howells OAM

BAppSc(Phty) APAM

Consultant Amputee Physiotherapist

Optimising Outcomes throughout the Flex-Foot Range.



Training Considerations for Properties Common to all Flex-Feet:

Properties:

- Assist in Shock Absorption
- Provide Energy Return



Training Considerations:

- Reliant on Loading
- Achieving Toe-Off

Training Considerations for Properties Specific to **Pro-Flex:**



- Increased Range of Ankle Movement.
- “Free feeling” in Midstance.
- Enhanced Protection of the Sound Side.
- Stair and Slope Training.
- “Relaxed” Balance Training.
- Training to achieve toe-off to allow optimal transfer of weight to sound limb.

Training Considerations for Properties Specific to **Cheetah Xplore and Flex-Run:**



- Higher Impact Activities.
- Training activities to maximise shock absorption.
- Achieving toe off.
- Advanced balance and joint stability towards the prosthetic toe.
- Preparation of the body to avoid Injury.
- Increased importance of Energy Return.
- Increased strength for prosthetic control and harnessing energy return.

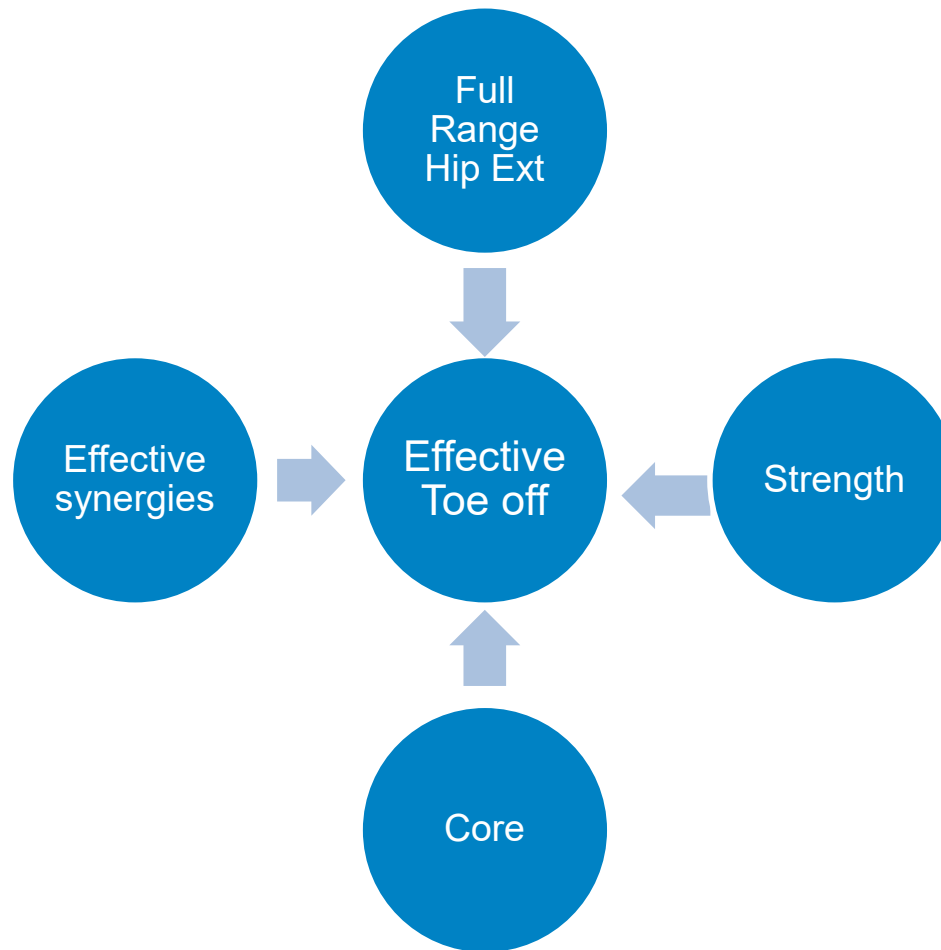
Level ground walking with Pro-Flex.



Looking Above the Prosthesis is Essential- What has to happen to achieve toe-off?



Elements to achieve Prosthetic Toe Off



How Amputation Causes Challenges for Reaching Toe-Off:

- Some muscles are inhibited and become weak.

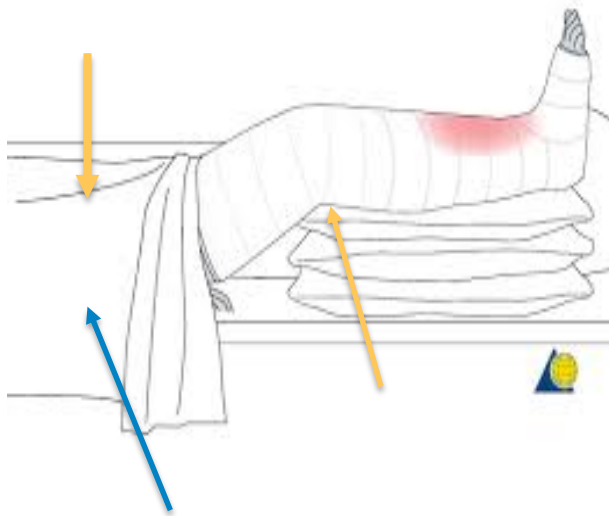
- Pain
- Surgery
- Positioning

- Some muscles are overactive and become tight.

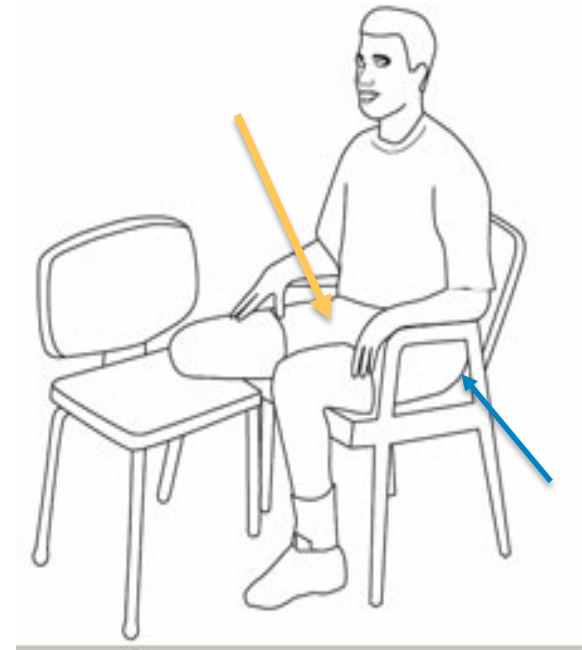
- Pain
- Positioning
- Adopted movement patterns

Prolonged positioning.

- **Positioning pre op**

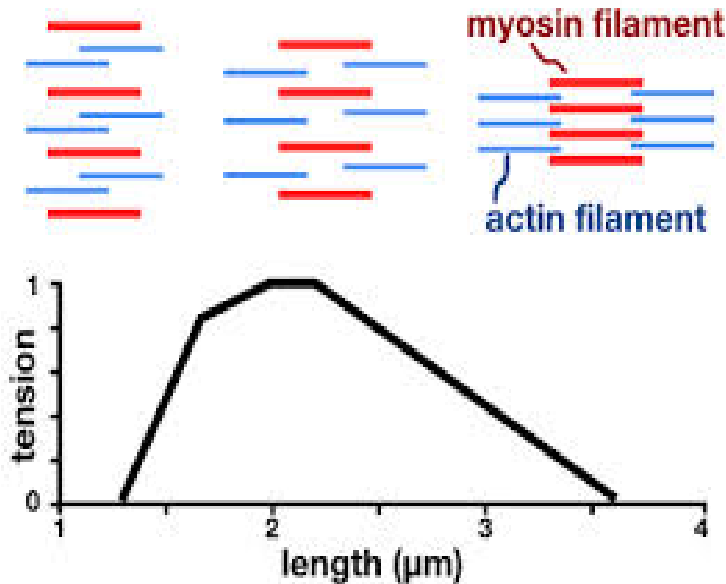


- **Positioning post op**



Prolonged positioning:

Greater difficulty generating tension in lengthened hip extensors:



Tight hip flexors are recruited first:

- Less range available, less slack and earlier shortening.
- Greater afferent input via stretch receptors to spinal cord.
- Neuromuscular “strengthening” of the flexor pattern (neuroplasticity).

Amputation may affect muscle activation:




- **Learned motor patterns**



Movement = flexion



Muscle imbalances are created:

- Length related with associated joint restriction.  • Contractures
- Related to “**preferred activation**” patterns.  • Learned from movement experiences.
- Muscle imbalances will then be reflected in the gait pattern.  • Gait deviations

Drop Off- When **flexion overrides extension** in transtibial prosthetic stance phase.



Drop off occurs when:

- Prosthetic stance finishes at the mid/fore foot instead of the toe.
- There is no active extension of the hip and knee joints.
- Note the impact at Sound Limb Heelstrike.

Optimising Functional Outcome With Pro-Flex:

Achieving Toe-off:

Functional Outcome: Avoiding Drop Off.



- Equal Step Length
- More Natural Gait
- Reduced walking effort on level ground, ramp ascent, and ramp descent
- Gaining energy return.
- Smoother progression onto the sound limb.

Inner range quads, concentric/eccentric training.



For:

- “wobbly” knee during stance.
- Assistance with shock absorption at heel strike.
- Inability to control an energy returning foot.
- Controlling the knee during slope/stair descent .
- Progressing onto a foot with a stronger toe lever.

“I can’t feel my toe!”

**Training heel to full toe usage
(advanced):**

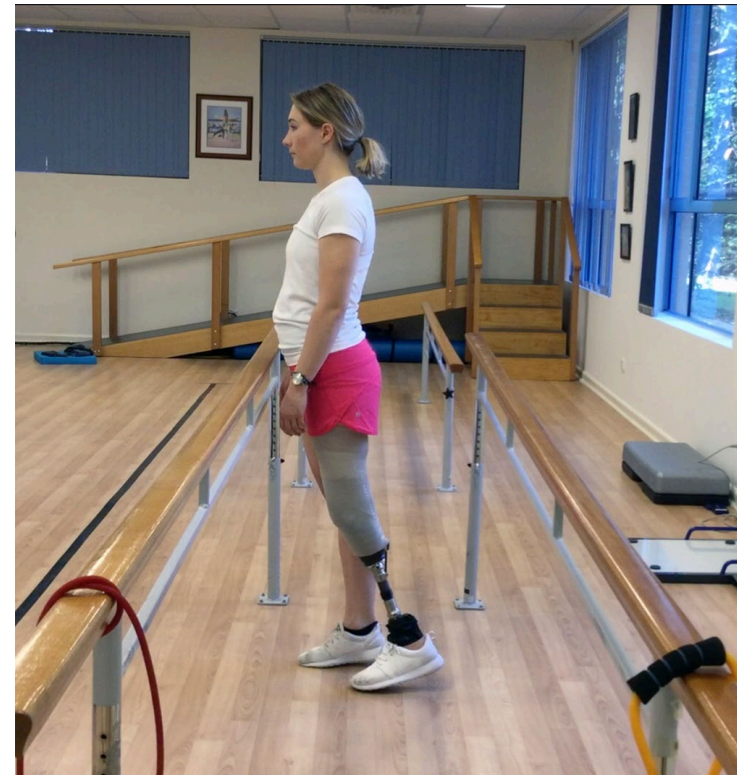
**Also emphasises the quad glute
extension synergy.**



Training “Relaxed Balance” and Heel Toe Proprioception.

Becoming accustomed to the floaty feel around midstance.

Exploring the movement of COG around the base of support.



Enhanced “Relaxed” balance- Learning to move the COG around the Base of Support.

Agility Drills



Balance Training



Passive



Active



Where is the excess flexion coming from?

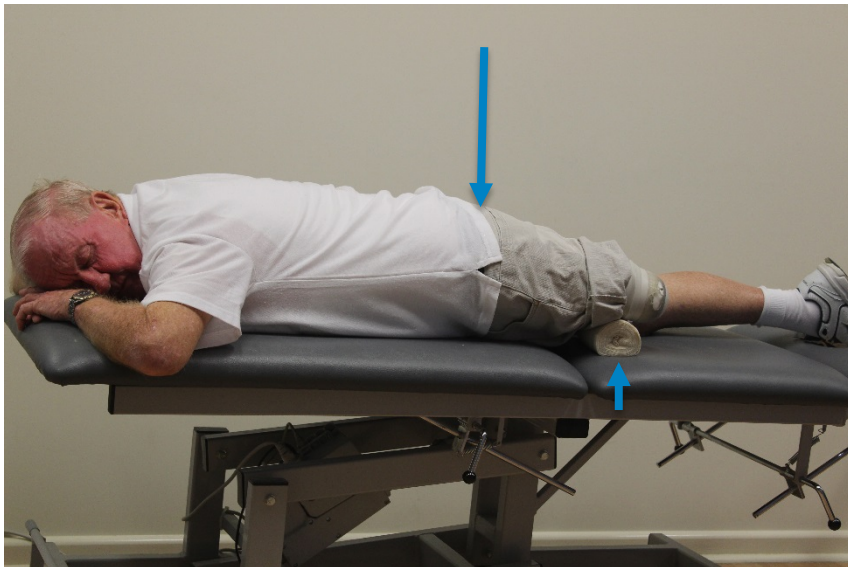
Anatomically Based



Performance Based



Hip Flexor Stretches: Beginner



- **Daily for 20 mins.**
- **Add extension exercises whilst pushing the ASIS into the bed.**
- **Do not allow the pelvis to come off the bed.**

Hip Flexor Stretches: Advanced.

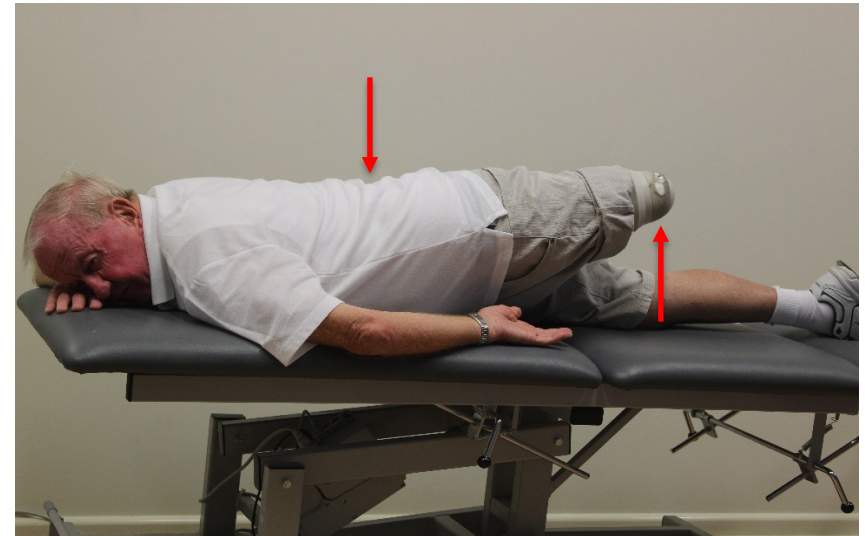
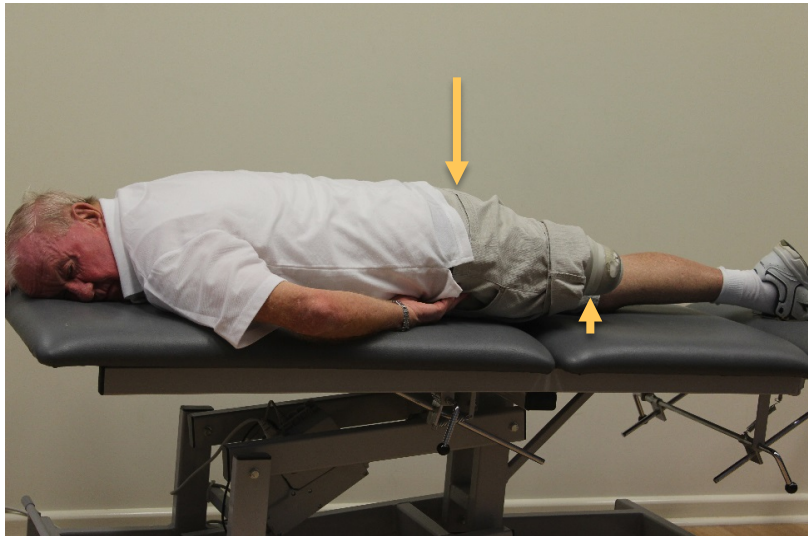


- Kneel on the chair.
- With the abdominals activated to prevent excessive L/S extension- push the hip into extension.
- Always stretch after activity when the muscles are warm.
- 5 good stretches at least x3 per week.

Active Hip Extension:

Use the hip joint and control pelvis

Not Lumbar Spine



23

Progressive Hip Extensor Strengthening: 15 reps x3 sets x3 times per week.

This position allows more feedback in controlling unwanted lumbar spine and pelvic compensations.



More advanced: resistance is added, abdominals control pelvic tilt and rotation.



Correct Aid Placement to compliment progression of body weight towards the toe.

Stick placement too anterior.



Aid should be at the level of 1st MTP joint.



Strengthening for the Hip and Knee Extensors:

Strength through functional range:

Strengthening the Quad/Glute Complex in conjunction with the core.



Enhancing weight bearing and hip and knee stability on the prosthesis.

Stability on Prosthesis



Adding in upper body rotation.



Strategies for Increasing Weight Bearing on the Prosthesis.

- Use scales.
- Biofeedback.
- Weight transference exercises & mirrors
- Decrease contralateral hand support.
- Ask patient to meet your hand resistance.



Improving Loading of the Prosthesis:

Improved loading = improved response.

NB. Moving the toe posteriorly and effective weight bearing increases the ease of rising from a chair.



Stair Ascent- increased dorsiflexion of the **Proflex** assists in stair ascent.



Note the position of the hip and loaded toe.



Stair Descent.

- More of the foot can be placed on the stairs.



Ramp Ascent and Descent



Ramp Ascent



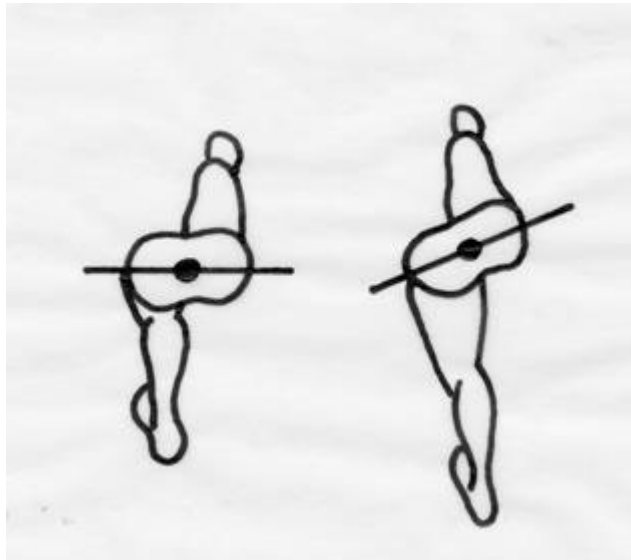
Ramp Descent

Eccentric Knee exercises assist with a smooth and controlled descent of Stairs.



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.

Abdominal exercises are essential for all Amputees to improve performance and prevent injury especially prior to running.

Crunches: include rectus and obliques.



Push ups: Form is essential.



Core Work

Eccentric abdominals: essential for controlling excessive anterior pelvic tilt in running.

The Plank



Cheetah Xplore

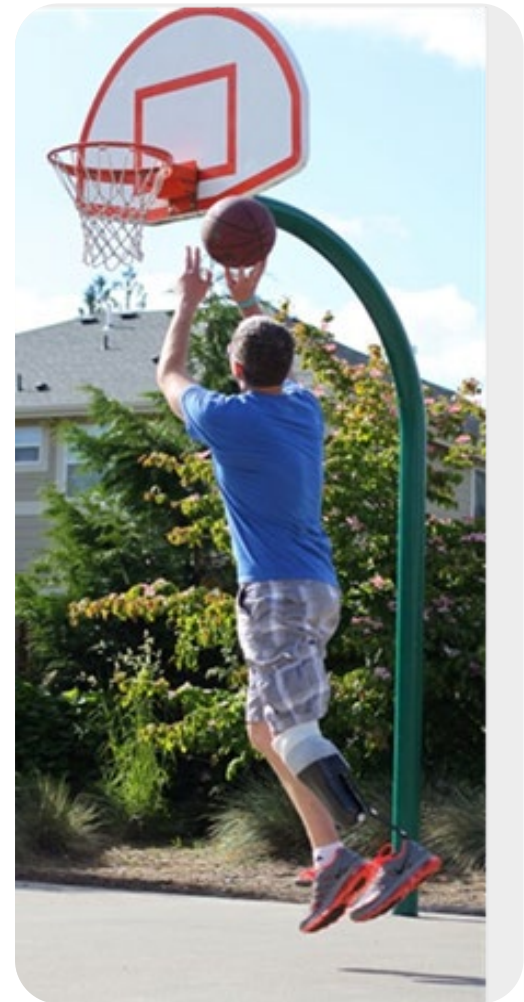
Fast accurate feet and gaining a flight phase.

Load it!



Cheetah Xplore: Get more bounce to the ounce:

- Get to the toe.
- Load it- push down and back into the socket.
- Push off with extensor power.



Cheetah Xplore

Loading and controlling to....



Lift Off!



Flex-Run

Preparing to run: Avoiding injury

- Adequate ROM
- Adequate Strength
- Adequate Joint Stability
- Adequate Core Stability

Good form minimises injury risk.



Flex-Run

It's all about the toe.



Achieving a flight phase.



Importance of the Core

- Excessive movement of the pelvis or upper body= loss of power and speed.
- Predisposes to injury.
- Good Core Stability enables effective transfer of power through the body to the ground= more speed/efficiency.



Amputee Running Technique (or Moving Quickly)

Prof Robert Gailey PT
Dept Physical Therapy, University of Miami



- 1: Prosthetic Trust
 - Repeated single hops onto the prosthetic side



- 2: Backward Thrust
 - Push down and pull back with limb at the same time inside the socket
 - Propel over the prosthetic foot
 - Use Gluteus and Hamstring muscle groups

Amputee Running Technique



- 3: Sound Limb Stride
 - Novice athlete has short sound stride
 - Reaching further out with sound side
 - Increase time to load prosthetic foot
 - Squeeze the glutes and pull down and back with your stump



- 4: Stride Symmetry
 - Strive for equal stride length and stride frequency between each limb
 - Relaxed strides
 - Don't overstride with your prosthesis

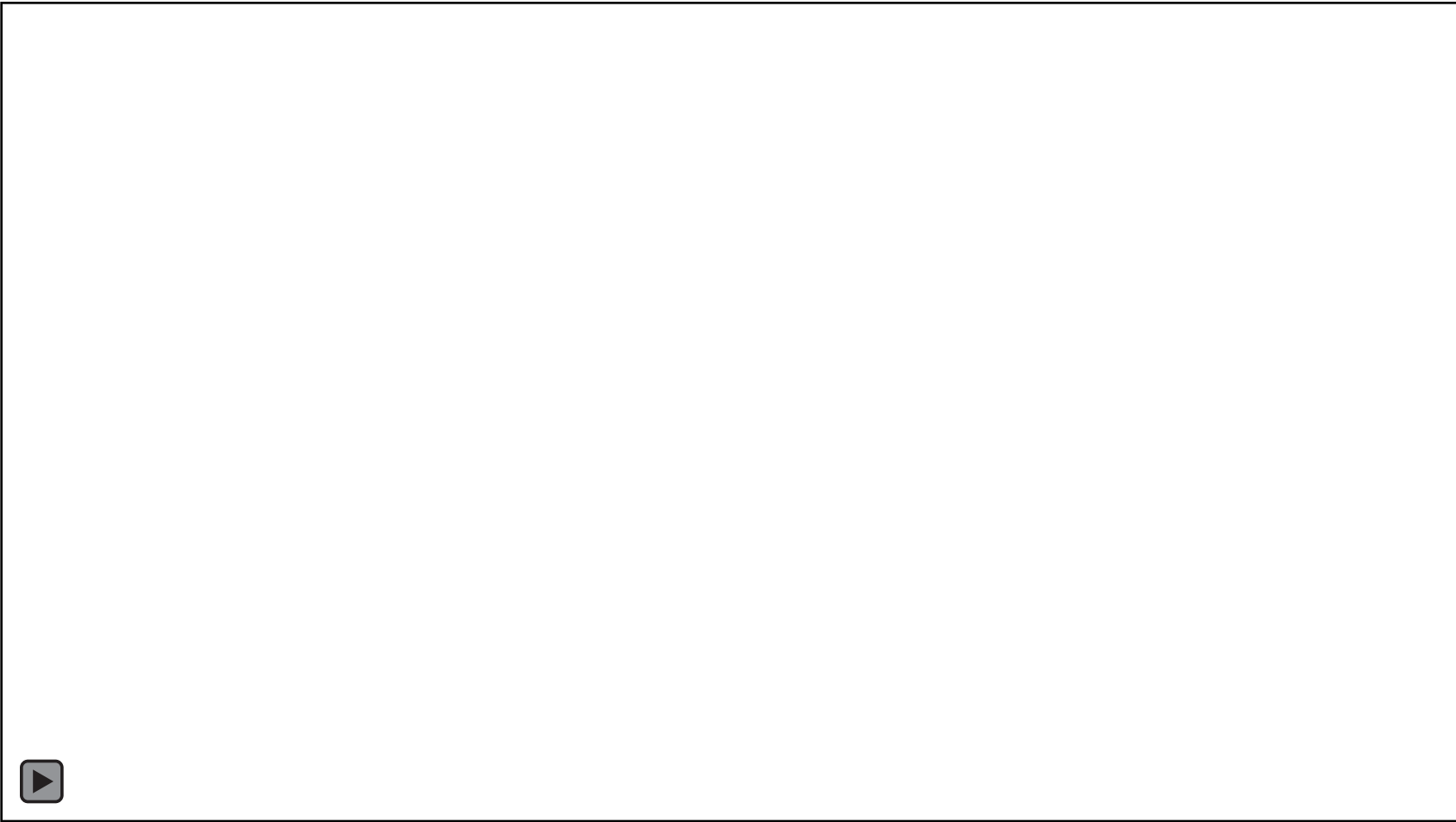
Amputee Running Technique



- 5: Arm Swing
 - Relax the upper body while running
 - Novice runners often keep arms close to their bodies
 - Arm swing encourage stride length and timing
 - With forward movement, hand should reach shoulder level
 - With reversing backward movement, hand should point just behind hip

- NOTE- If you have undergone *osseointegration* we recommended that you **DO NOT RUN.**

Progress Running from Pro-Flex XC to Flex-Run



Feet: Function, Fitness, Fun.



WE IMPROVE PEOPLE'S MOBILITY

