ÖSSUR ACADEMY

Össur Running Solutions and Training Techniques for all Ability Levels

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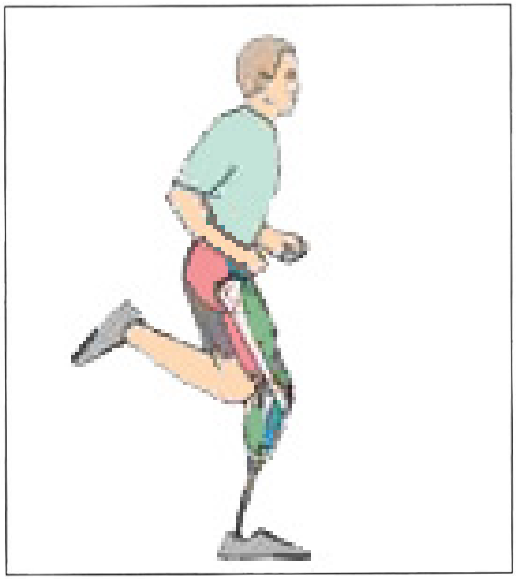
Sports - Amputee

- Not being able to run is perceived as the most limiting factor when amputees compare with able bodied
- Running is a prerequisit for most sport activities
- Most of the amputees are able to run

Gailey R.:Recreational Pursuits for elders with amputation Rehabil. 1992;8;39-58



- Running forms the basis of many recreational activities and running related issues should be addressed and incorporated in the rehabilitation programs for active amputees.

Czerniecki and Gitter, 1992.

Sport – All ages

- For a child with limb deficiency, involvement in sport and recreational activities provides an important mechanism for development of motor coordination, integration with peer groups, and adjustment to physical limitations.

Anderson et al, 1991

- Even for the less active amputee, the ability to run could be useful in an emergency.

Thomas, 1998

Disadvantages of high activity

- Asked the effect of recreation on their residual limb:
  - 46 amputees said it became soaked with perspiration
  - 26 complained of pain
  - 26 reported sores
  - 20 experienced fatigue
  - 17 had swelling
  - 8 suffered cramping

Kegal et al, 1980

- The intact limb of the transfemoral amputee experiences higher impact loads and higher work demands compared to the prosthetic and normal limbs

Czerniecki J.M. Rehabilitation in limb deficiency. 1. Gait and motion analysis. Arch Phys Med Rehabil 1996; 77: S3-8

Requirements for higher activity / sports

- Quality of Residual Limb
- Liner / Interface
- Socket
- Prosthetic Knee (TF/KD)
- (Sport) prosthetic foot
- Training

Interface

The single most critical aspect of any prosthesis is the quality of the interface between the residual limb and the prosthesis.

Marks & Michael (2001)

Liner materials such as silicone, often are recommended for patients who are entering athletic activity or who have skin conditions, such as grafting and adherences, that reduce the ability to accept shear.

Fergason et al, 1999

Suspension

- Prosthetic socket suspension may need to accommodate a greater increase and decrease in volume of the residual limb.
- The user ideally should have the ability to adjust the suspension properties of the socket.
- Auxiliary suspension methods may be required.

Socket

For persons with TF amputations who desire to run, most will utilize a narrow ML socket design.

They may also benefit from the use of a flexible inner liner to accommodate the changing shape of the thigh during muscular contraction and relaxation.

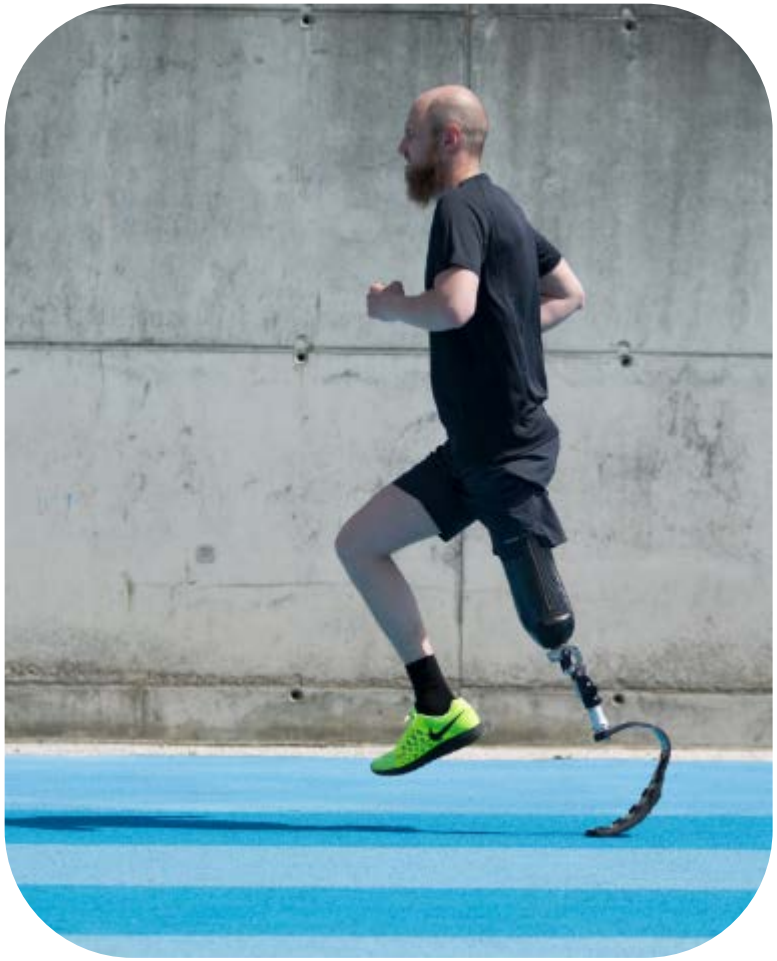
Webster et al, 2001

Prosthetic Knees

Swing and stance control hydraulic knee units, which allow variable cadence, are preferred for most amputee runners

Knee Options:

- Cheetah Knee
- Total Knee
- OH7 Knee
- PASO Knee
- RHEO KNEE XC

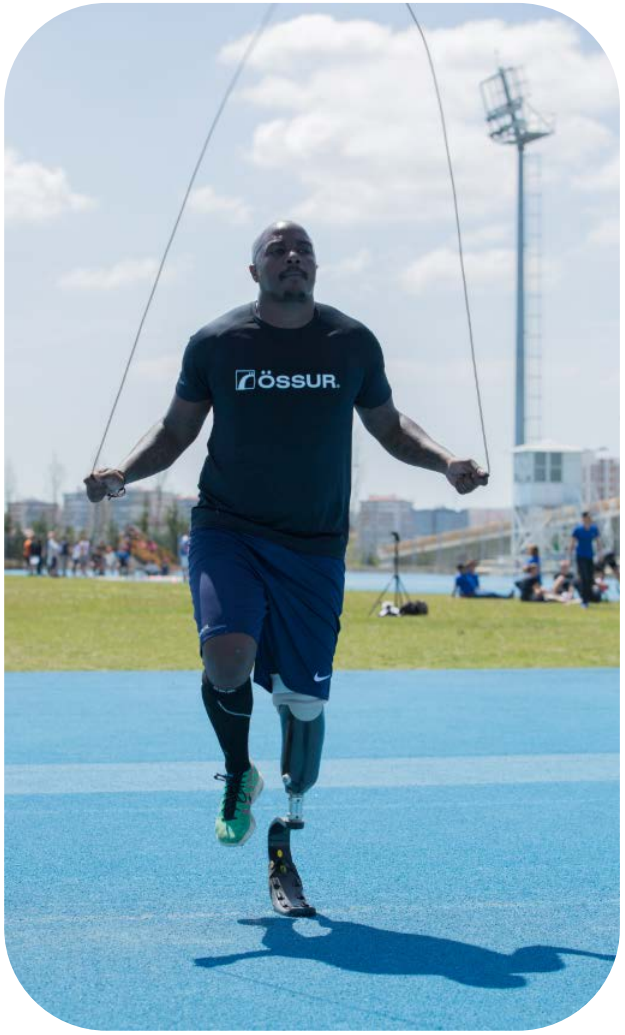


Webster J.B. et al. *Sports and recreation for persons with limb deficiency.* Arch Phys Med Rehabil. 2001;82;S38-44

Prosthetic feet

Survey lower limb amputees – what functions they missed most and what areas of prosthetic improvement should be addressed to improve the quality of their life. The survey indicated overwhelmingly that the most needed function was the ability to move quickly and to run.

They felt their prostheses were not responsive, and in particular blamed the foot.

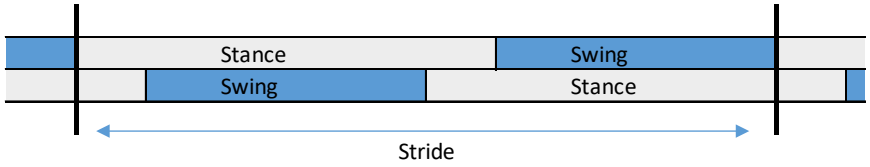


Kegal 1985

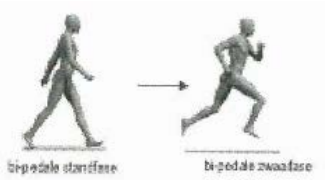
Walking – Running – Sprint

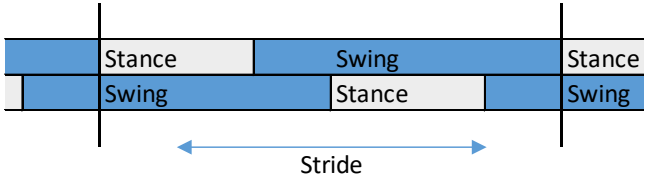
Stance Phase – Swing Phase

- Walking:
  - Stance phase 60 %
  - Swing phase 40 %
  - Double Support phase

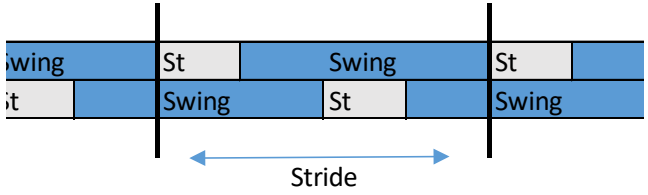


- Running:
  - Stance phase shorter than swing phase
  - Flight phase



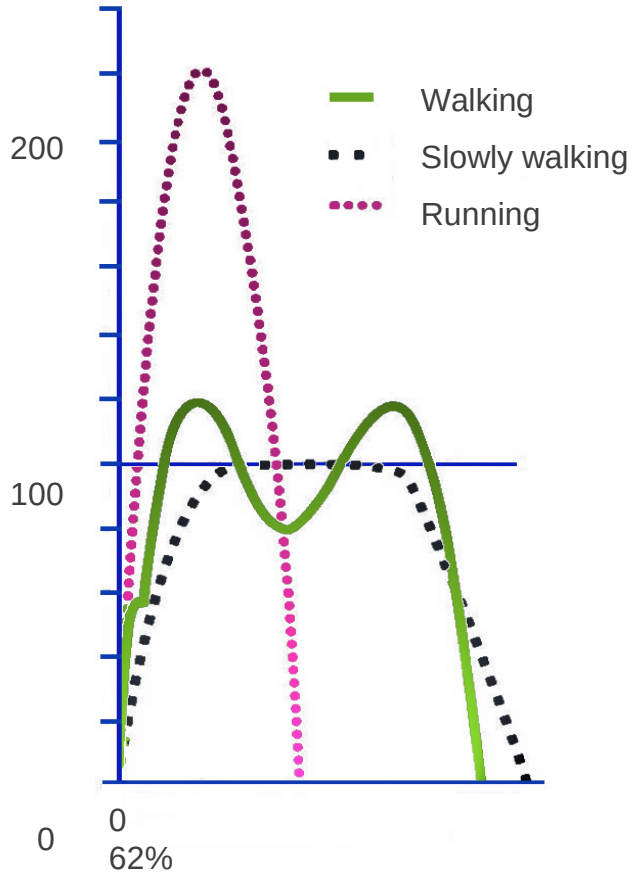


- Sprint:
  - Stance phase time↓
  - Swing phase ↑



Walking – Running - Sprint

- Ground Reaction Forces ↑
- Stance phase ↓ 50 %
- No heel contact
- No double support phase

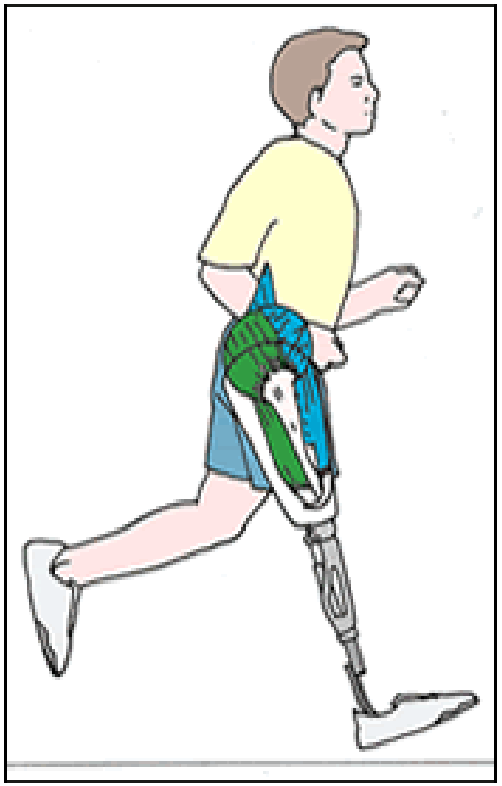


GRF in % body weight – Stance phase in % Gait Cycle
Jaqueline Perry, Gait Analysis, ISBN 1-55642-192-3

Amputee Running Technique: Robert Gailey, PHD, PT

Step 1: Prosthetic Trust

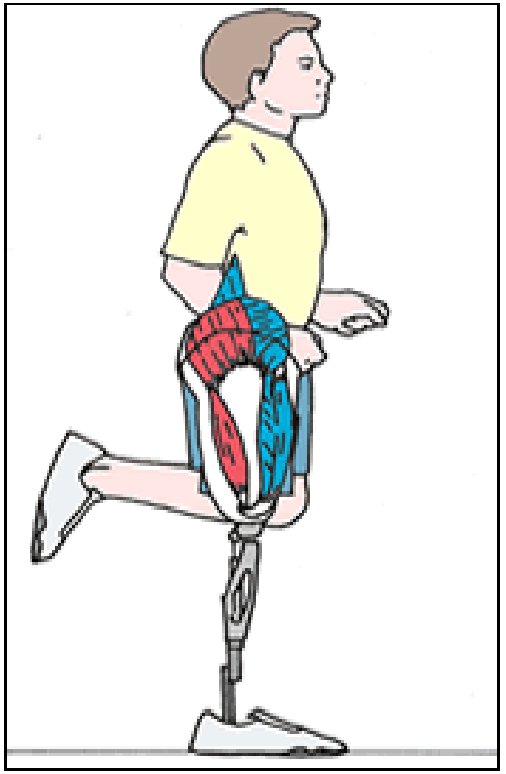
- Gaining trust and confidence in prosthesis
- Reaching out with the prosthetic limb and landing squarely on foot



- TTA: body weight support of prosthetic side
- TFA: keep prosthetic knee in extension

Step 2: Backward Extension

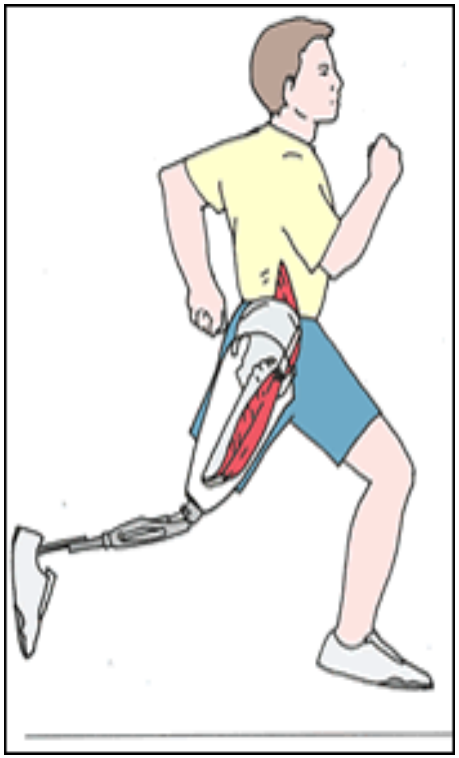
- Prosthetic side pulls back forcefully = more power to get over prosthesis, more load prosthetic foot
- Body acceleration forward = increase of speed



- TTA: control of knee flexion
- TFA: promote extension of prosthetic knee, not collapse

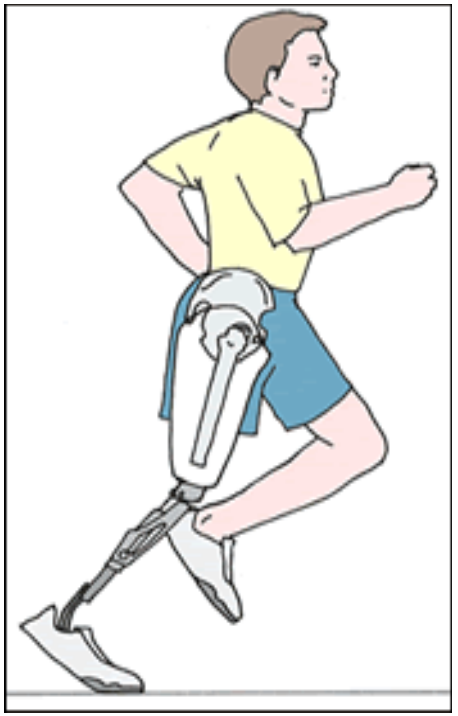
Step 3: Sound Limb Stride

- Longer stride with sound limb
- By continuing to pull down and back through the prosthetic limb
- Generate more power and a stronger push off with the prosthetic limb
- TTA: hip and knee extension simultaneously, stability
- TFA: The hip musculature in combination with the core provides the stability



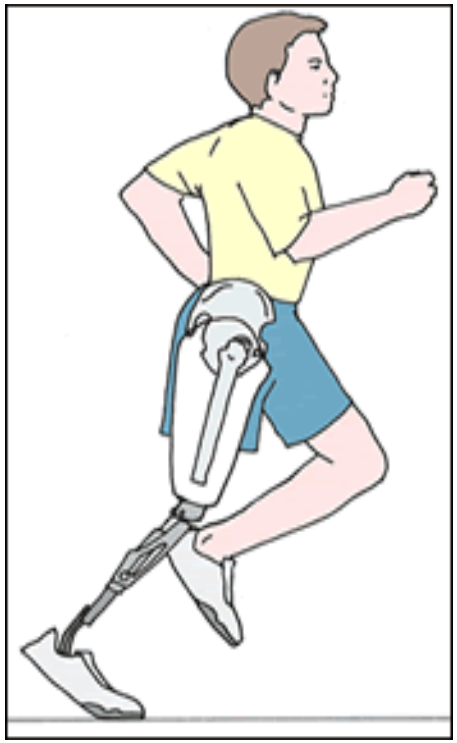
Step 4: Stride Symmetry

- Comfortable jogging pace for equal stride lengths both limbs
- Maintain stability over prosthetic limb by using hip muscles



Step 5: Arm Carriage

- Arm swing is the result of trunk rotation.
- The arms should be relaxed and help create momentum and rhythm.
- Elbows 90°, hands loosely closed and rise to chin level.
- Attention should be focused on the down swing of the arms.



- TTA: can be limited both sides
- TFA: limited arm swing prosthetic side

Key Running Preparation Exercises: Creating a New **POWERHOUSE**

Transtibial: The Gluteal/Quad Complex

Key Running Preparation Exercises: Creating a New POWERHOUSE

Transfemoral: Strengthening glutes and core together

Better push off from the prosthetic side. Incorporating upper body rotation

Combining Core and Hip Control/Strength

Core Strengthening:

Essential for good technique and prevention of injury due to increased forces applied to the body during running.

Learning to Coordinate Arm Swing

Facilitated Walking

Improving weight transference has many benefits for amputee gait

Yitiger, K. 2002 Resistive Gait Training results in:

- Increased weight bearing
- Increased stride length
- Decreased step length with prosthesis
- Increased step length with the sound side
- Increased self selected cadence

Resistance training…

More Resistance Training

- Resistance training for upper body rotation and stability on the prosthesis
- Resistance training for LPS and weight bearing on the prosthesis

Early Days…

Transtibial Interfaces

- Silicone liners recommended to provide:
  - Cushioning
  - Protection against shear forces
  - Suspension
- Liner options:
  - Seal-in X
  - Seal-in V
  - Dermo/Comfort/Synergy Cushion liners with Knee Sleeve
  - Iceross Sport Locking
  - Iceross Dermo Locking

Socket Suspension

- Preferred method for running is suction
- Cushion liner with flexible insert option
- Expulsion Valve
- Suspension sleeve

Iceross® Activa

Iceross® Sleeve

Icelock® Expulsion Valve 551

Suspension Sleeve Considerations

- Comfort
- ROM
- Durability

Socket Suspension – Symes and Congenital

- Socks/gel socks
- PE-lite insert and socks
- Flexible inners/windows/BOA systems

Suspension Alternatives

- Locking liner systems
- Suspension belt
- Cuff strap – short limb
- Flexible insert and socks

Transtibial Socket Fit

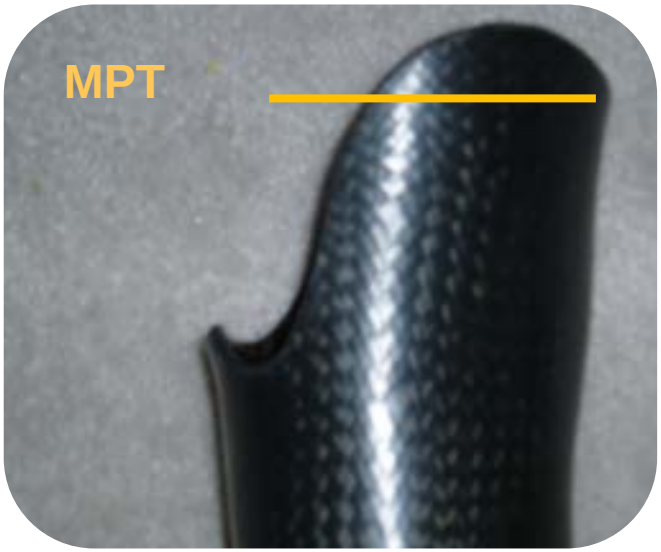
- Increased peak pressures and shear forces are created in the socket from walking to running gait
- Load can increase up to 3 times body weight
- Socket fit is vital to optimise proprioception and control
- Critical in avoiding breakdown of tissue and maintaining comfort

Transtibial Socket Design

- Residual Limb assessment determines the most appropriate options:
  - Scar tissue
  - Skin grafts
  - Prominent fibula head/distal end of tibia
  - Sensitive areas
- Socket design considerations:
  - Total surface bearing
  - Expulsion valve
  - Suspension Sleeve
  - Lower posterior trim lines for ROM
  - Where possible avoid supracondylar suspension

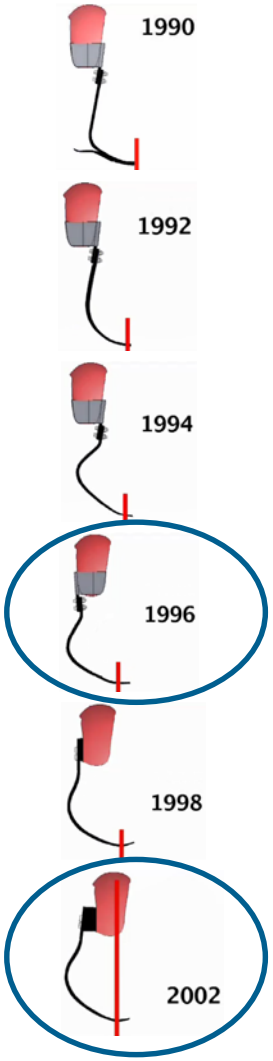
Transtibial socket considerations

- Knee stability determines ML trim lines
- Low posterior wall to accommodate hamstring tendon
- Can make use of flexible inner socket and frame to maximise ROM and comfort
- Carbon/laminated socket (strong and lightweight)



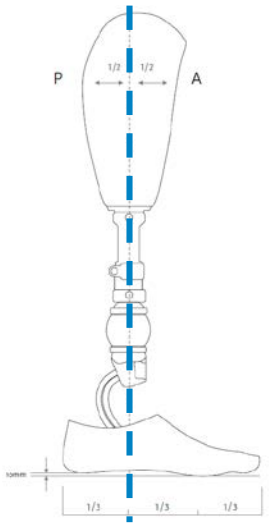
History of Running Blade Alignment

1988	FF +15º plantar flexion
1990	Flex-Sprint I
1996	Flex-Sprint III a-mould
1998	Flex-Sprint III b-mould
2003	Cheetah
2006	Flex-Run
2014	Cheetah Xtreme, Xtend
2014	Cheetah Xplore



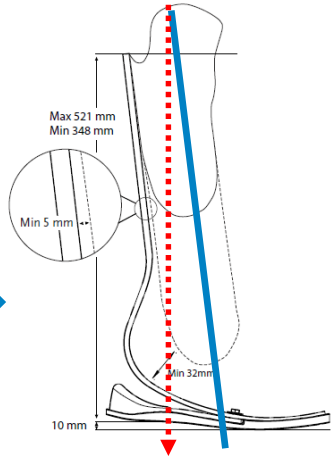
Össur running solutions

Flex-Foot



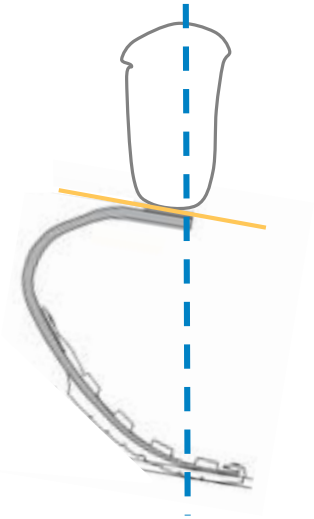
1. Category selection (Weight/Impact level)
2. Socket bisection- weight line through posterior 1/3 of foot
3. Use Wedges if necessary
4. External Rotation 3-5°

Cheetah Xplore



1. Category selection (Weight/Impact level)
2. **Length:** Match to sound side measurement
3. **Extension:** +5-7° compared to client's normal alignment
4. **Adduction:** +3-5° compared to client's normal alignment
5. **Transverse:** +5° external rotation

Flex-Run

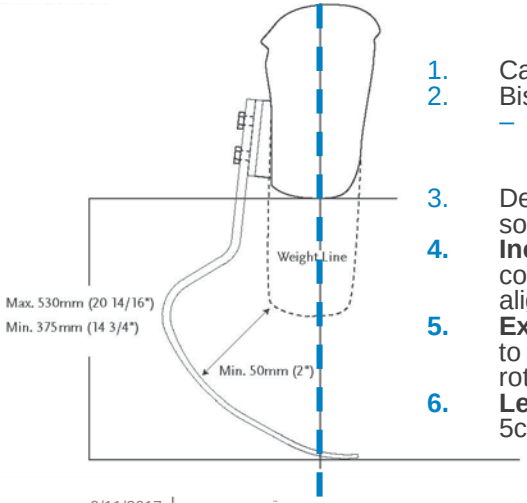


1. Category selection (Weight)
2. Bisect socket at MPT level
   - 2.5-4cm posterior to ground contact point

Look for 5°anterior lean on top plate

3. Determine the appropriate socket flexion
4. **Increase Adduction** +3-5° compared to clients normal alignment
5. **Externally rotate foot** 3-5° to accommodate internal rotation of hip and knee
6. **Lengthen prosthesis** + 3.5-5cm

Cheetah Xtreme



1. Category selection
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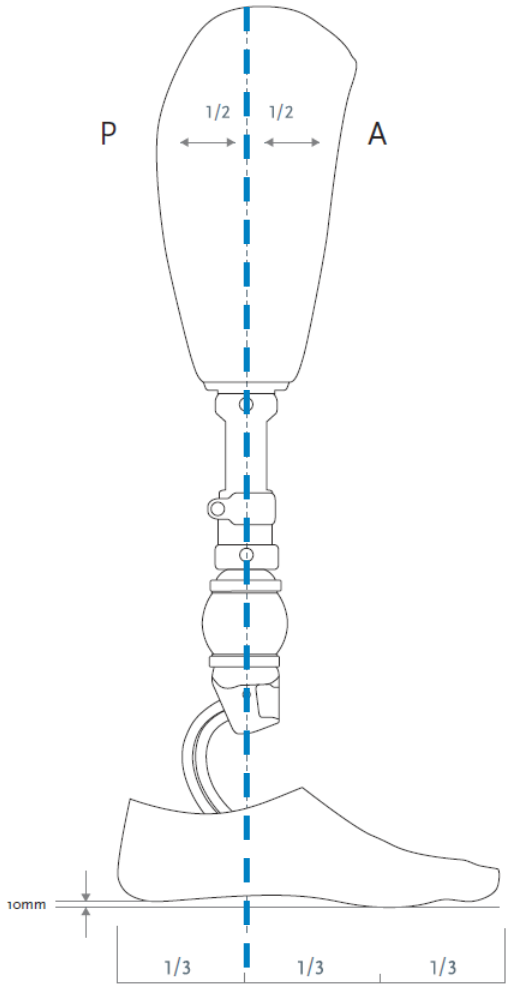
5. **Externally rotate foot** 5-7° to accommodate internal rotation of hip and knee
6. **Lengthen prosthesis** + 3.5-5cm

Flex-Foot Running Options



Flex-Foot Set-up Options

1. Category selection (Weight/Impact level)
2. Socket bisection- weight line through posterior 1/3 of foot
3. Use Wedges if necessary
4. External Rotation 3-5°

Running foot options

- Pro-Flex XC Torsion
- Pro-Flex LP Torsion
- Pro-Flex XC
- Re-Flex Shock
- Re-Flex Rotate
- Vari-Flex Modular

Prosthetic component options: Cheetah Xplore

- Composed of a Cheetah toe blade and a heel plate
- Designed for walking/running and everyday use
- High impact activities- sport/running
- Attached directly to the posterior wall of the socket. (or use of lamination adapter)
- Match height with sound side

- Maximum patient weight: 147kg
- Minimum patient weight: 45kg

Cheetah® Xplore - Evidence

Self-assessed balance confidence in patients with transtibial amputations using the Modified Cheetah prosthesis. AAOP, 41st Academy Annual Meeting & Scientific Symposium , February 18 - 21, 2015

Link to poster presentation: http://www.oandp.org/publications/jop/2015/2015-81.pdf

- **Objective**: The purpose of this survey was to evaluate the change in balance confidence as experienced by patients with transtibial amputations who wear the Modified Cheetah prosthesis.
- **Method**: 36 subjects were given the opportunity to fill out the Activities Specific Balance Confidence Scale via internet survey or by paper copy in the clinic. Subjects were asked to reflect upon their balance confidence while wearing their conventional prosthesis and then while wearing their Modified Cheetah prosthesis.
- **Results**: 22 subjects returned the survey. Results supported the hypothesis that balance confidence would increase while wearing the Modified Cheetah as compared to a conventional prosthesis. Primary outcomes that showed the greatest improvement in confidence were running, playing sports, and walking faster than the subjects' regular pace.
- **Conclusions**: Results suggest subjects have greater balance confidence while using the Modified Cheetah prosthesis compared to a conventional prosthesis.
- **Clinical Relevance:** Patients with balance confidence issues who also require a light weight, strong device may benefit from wearing the Modified Cheetah.

Cheetah® Xplore - Evidence

Self-assessed balance confidence in patients with transtibial amputations using the Modified Cheetah prosthesis. AAOP, 41st Academy Annual Meeting & Scientific Symposium , February 18 - 21, 2015

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Data analysed per question on scale of 0-4 (‘no confidence’-’complete confidence’):

Greatest increases in balance confidence with Modified Cheetah:

“Are walking faster than your normal pace”	+1.41
“Are playing sports”	+1.32
“Are running”	+1.50

Average of +1.36 points higher with respect to ‘high activity’ questions

With respect to energy:

Conventional prosthesis **27.3%**
Modified Cheetah **86.4%**

“Somewhat energetic – Very energetic”

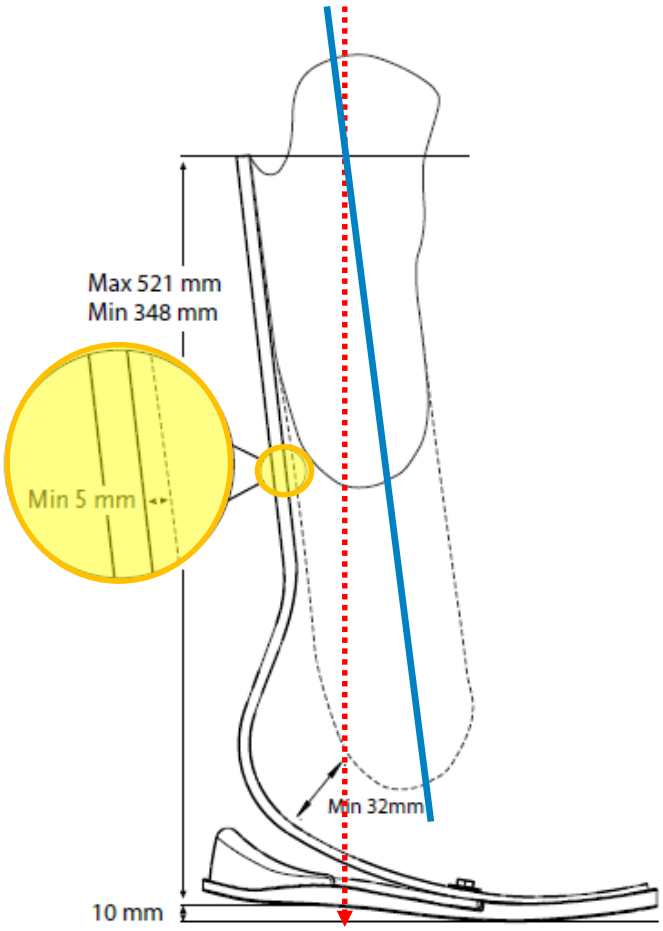
With respect to weight of prosthesis:

90% of responses – Weight of prosthesis either “More important” or “Very important”

Cheetah® Xplore – Clearance & Alignment

- **Min-Max posterior wall length:** 348-521mm
- **Minimum clearance** from the socket to the foot: 32 mm
- **Length:** Match to sound side measurement
- **Extension:** +5-7° compared to client's normal alignment (follow line of blade)
- **Adduction:** +3-5° compared to client's normal alignment (Accounts for narrower base during running activities)
- **Transverse:** +5° external rotation of blade relative to socket

5-7 degrees additional socket extension



Weight-line posterior 1/3 foot + socket bisection @ MPT level

Cheetah Xplore - walk/run/sprint

Updated Cheetah Xplore Fabrication Techniques

- Davidson recommends using the Cheetah Xplore without footshell for optimal alignment
- Cut the toe to length and create asymmetrical toe shape
- Lightly sand plantar surface of the foot toe prepare for gluing
- Place a drill bit in between the springs to separate them (this helps later when splitting the sole material)
- Roughen and split rubber heel component
- Superglue rubber heel component

Greg Davidson CPO: Davidson Prosthetics

Updated Cheetah Xplore Fabrication Techniques

- Use HD EVA/ Soleflex to build up the plantar surface of the foot
- Heat EVA to mould and glue easier
- Start by gluing EVA to toe section
- Remove drill bit
- Glue EVA to the posterior 2/3 of the foot
- Shape the EVA to foot shape and then split material with a blade or saw

Greg Davidson CPO: Davidson Prosthetics

Updated Cheetah Xplore Fabrication Techniques

- Match the shape of the foot to ensure that the shoe doesn't get distorted on the lateral side
- Shape the plantar surface leaving a thickness of 15mm under the heel, 15mm to flat under the metatarsal point and create a slightly rocker toe
- This thickness will give you room to play with when fine tuning plantarflexion/dorsiflexion
- Create a medial arch
- Round the entire plantar surface edges of the foot

Greg Davidson CPO: Davidson Prosthetics

Updated Cheetah Xplore Fabrication Techniques

- Build up dorsal surface of the foot to fit into the shoe
- Use a lightweight foam such as plastozote
- Cover using thin lightweight material e.g. cloud crepe

Greg Davidson CPO: Davidson Prosthetics

Updated Cheetah Xplore Fabrication Techniques

- Identify height (match sound side) Can trace existing prosthesis to establish
- Mark trimming point on Cheetah Xplore
- Hold socket against blade and view laterally
- Extend socket 5-7 degrees following the line of the blade
- Use a jig if prefer
- Cut blade and round off-will make it easier to apply knee sleeve

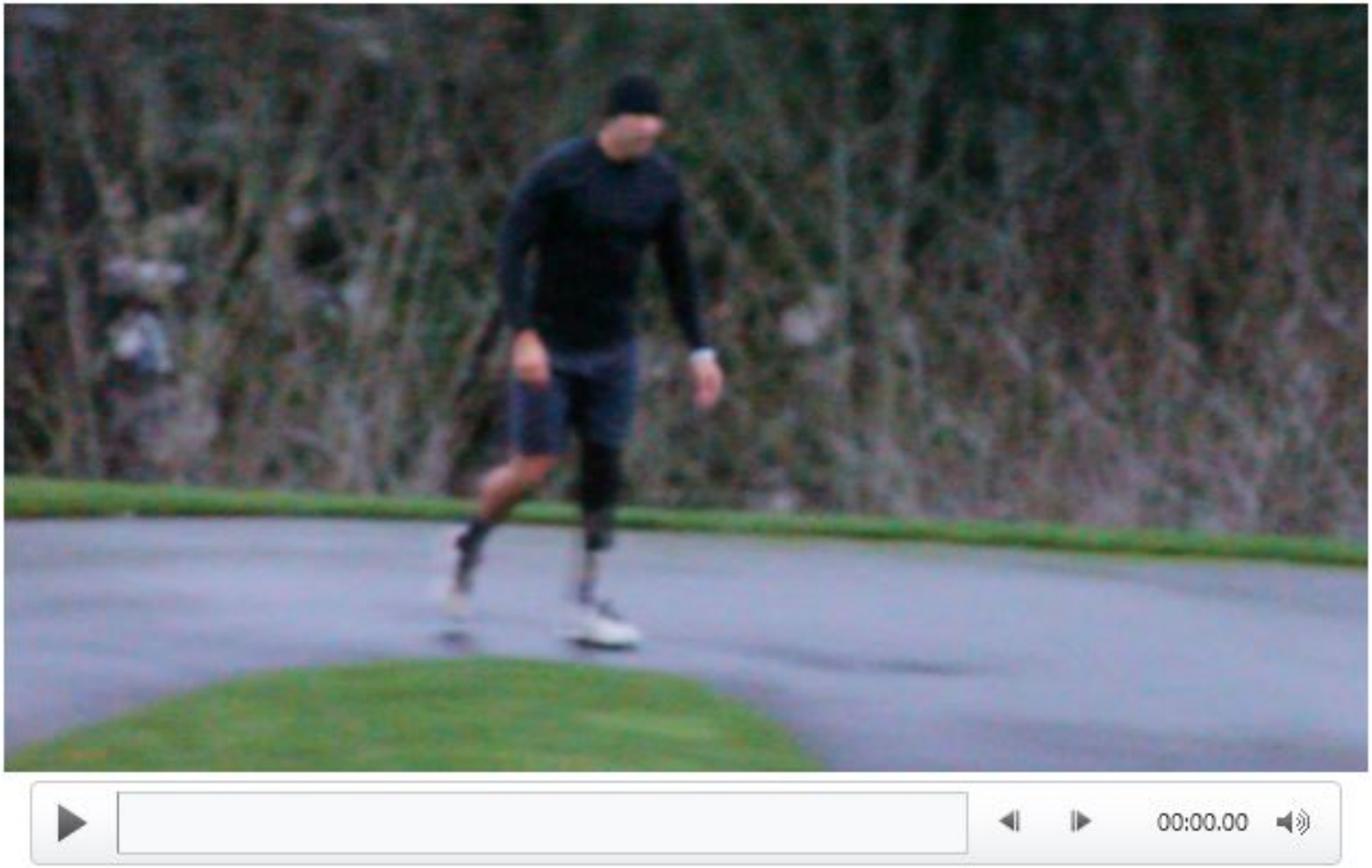
Greg Davidson CPO: Davidson Prosthetics

Updated Cheetah Xplore Fabrication Techniques

- Once the position of the blade has been established, add a piece of EVA to the distal end of attachment on the blade.
- This will help define a distal edge for the attachment
- The thickness of the EVA will be determined by your socket flexion/extension alignment
- Glue blade using 1 minute adhesive
- If using a knee Sleeve then wrap around in electrical tape to create a smooth surface
- Apply additional reinforcement layers of carbon strips and resin (4 carbon layers distally, 2 layers proximally)
- A heat gun will speed up the process

Greg Davidson CPO: Davidson Prosthetics

Cheetah Xplore- walk/run/sprint



Greg Davidson CPO: Davidson Prosthetics

Prosthetic Component Options for Running

- **Feet for Distance Running 5km- Marathon:**

- **Flex-Run with Nike Sole**
  - Sustained running
  - Provides shock absorption
  - Reduced peak load on residual limb
  - Residual limb comfort
  - Energy Return-less effort to run
- **Flex-Run Junior**
- **Cheetah Xplore**

Flex-Run with Nike Sole

Flex-Run with Nike Sole Alignment

- Alignment reference line follows:
  - Bisection of socket at MPT level
  - 2.5-4cm posterior to ground contact point

Look for 5°anterior lean on top plate

- Determine the appropriate socket flexion
- **Increase Adduction** +3-5° compared to clients normal alignment (Accounts for narrower base during running activies)
- **Externally rotate foot** 3-5° to accommodate internal rotation of hip and knee
- **Lengthen prosthesis** + 3.5-5cm (compared to sound limb WITH shoe)

Flex-Run™ Alignment

- Prosthesis always longer than sound side:
  - 3.5-5cm
- Depends on various factors:
  - Knee strength
  - Core stability
- Check pelvis (50mm higher)
- Check toe-out 3-5°
- Check add/abduction

Flex-Run™ Static Alignment - Short

- Level pelvis
- Toe-out 1°

Flex-Run™ Track Video – Short

- Internal foot rotation
- Uneven foot placement
- Unstable knee moment
- Uneven stride length
- Uneven pelvis and shoulders

Flex-Run™ Static Alignment - Long

- Prosthesis is too long - over 6cm
- Excessive knee flexion

Flex-Run™ Track - Long

- Circumduction gait
- Toe stubbing
- Un-equal stride length
- Sound side vaulting
- Uneven shoulders

Flex-Run™ Static Alignment - Optimal

- Pelvis 25-50mm higher on prosthetic side
- Slight knee flexion
- Toe-out 3-5°

Flex-Run™ Track - Optimal

- Vertical foot placement
- Equal stride length
- Knee ROM
- Flat foot transition
- Pelvis level
- Shoulder level
- Arm swing

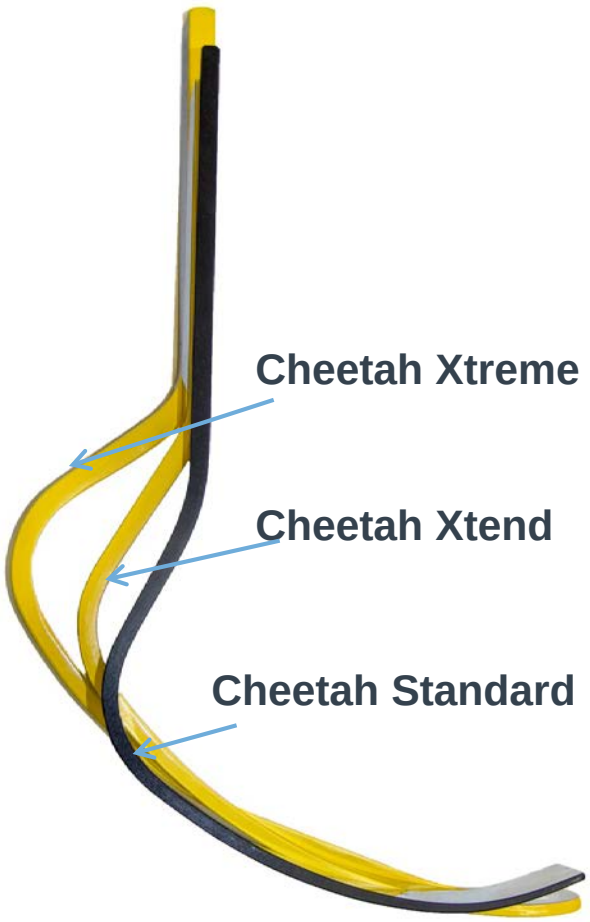
Flex-Run with Nike Sole

Sport Prosthetics Training: TT Bilateral Considerations

- Residual limb length
- Determine dominant side
- Less plantarflexion needed
- Overall height equal
- Same foot Category selection
- Evaluate stride length

Prosthetic Component Options for Running

- **Feet for Sprinting:**
  - Running-specific feet must have a single point of contact
  - Alignment that allows the spring to compress and return the energy in a force vector that propels the runner forward at the desired speed
- **Cheetah**
  - Less experience runners looking for a more compliant feel from a running blade
  - Longer distance running for users who don't have clearance for a Flex Run with Nike Sole
- **Cheetah Xtend**
  - Longer sprints and recreational running
  - 400-5000m sprints
  - Continuous curve allows for smooth roll over
- **Cheetah Xtreme**
  - 100-200m short sprints
  - Aggressive cure provides powerful energy kick



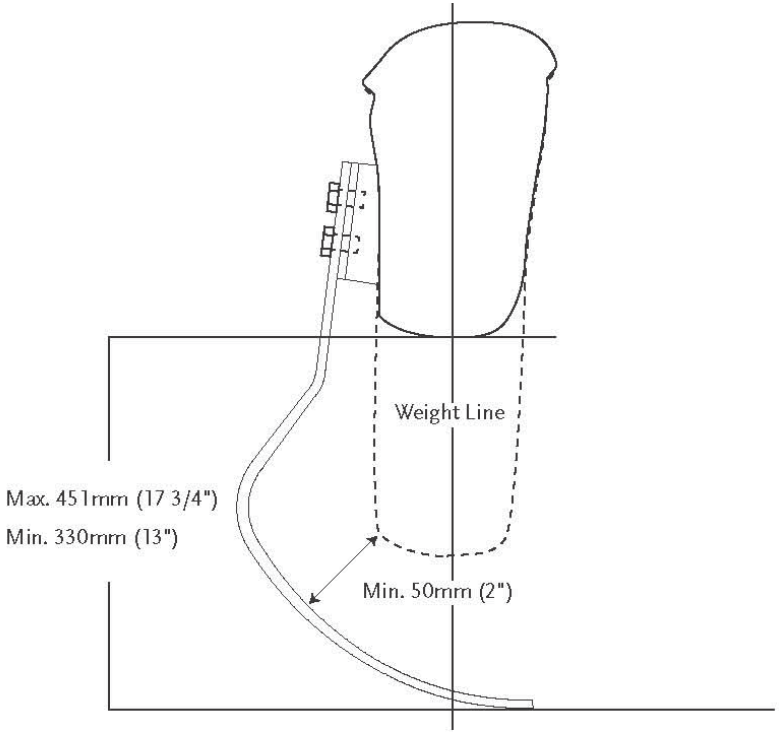
Cheetah Xtreme

- **Cheetah Xtreme**
  - 100-200m short sprints
  - Aggressive cure provides powerful energy kick

1. Category selection
2. Bisect socket at MPT level
   - 2.5-4cm posterior to ground contact point
3. Determine the appropriate socket flexion
4. **Increase Adduction** +3-5° compared to clients normal alignment
5. **Externally rotate foot** 5-7° to accommodate internal rotation of hip and knee
6. **Lengthen prosthesis** + 3.5-5cm

Cheetah Xtend

Cheetah Xtend

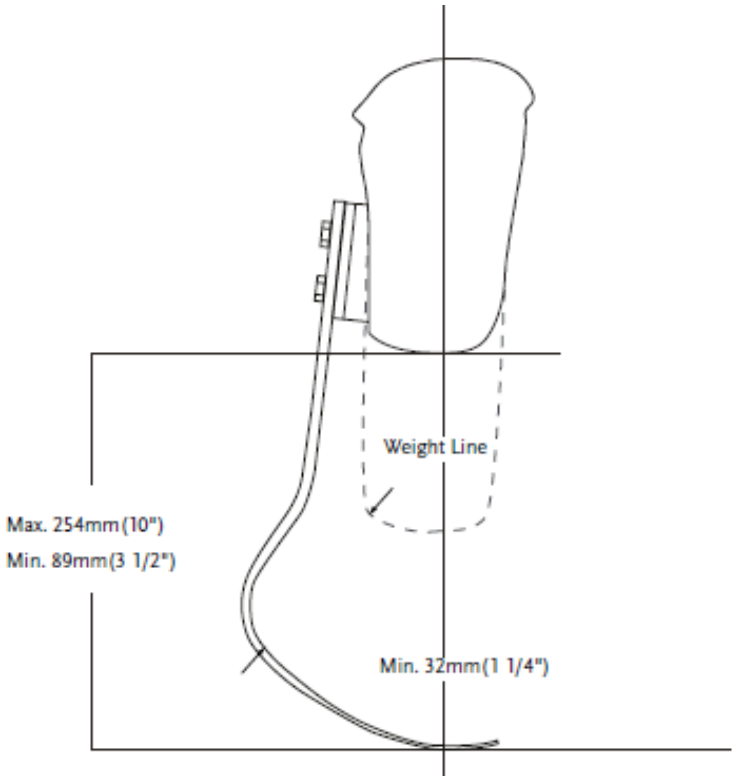


- **Cheetah Xtend**
  - Longer sprints and recreational running
  - 400-5000m sprints
  - Continuous curve allows for smooth roll over

1. Category selection
2. Bisect socket at MPT level
   - 2.5-4cm posterior to ground contact point
3. Determine the appropriate socket flexion
4. **Increase Adduction** +3-5° compared to clients normal alignment
5. **Externally rotate foot** 5-7° to accommodate internal rotation of hip and knee
6. **Lengthen prosthesis** + 3.5-5cm

Flex-Foot Cheetah

Cheetah



- **Cheetah**
  - Less experience runners looking for a more compliant feel from a running blade
  - Longer distance running for users who don't have clearance for a Flex Run with Nike Sole

1. Category selection
2. Bisect socket at MPT level
   - 2.5-4cm posterior to ground contact point
3. Determine the appropriate socket flexion
4. **Increase Adduction** +3-5° compared to clients normal alignment
5. **Externally rotate foot** 5-7° to accommodate internal rotation of hip and knee
6. **Lengthen prosthesis** + 3.5-5cm

JUNIOR Running Solutions from Össur

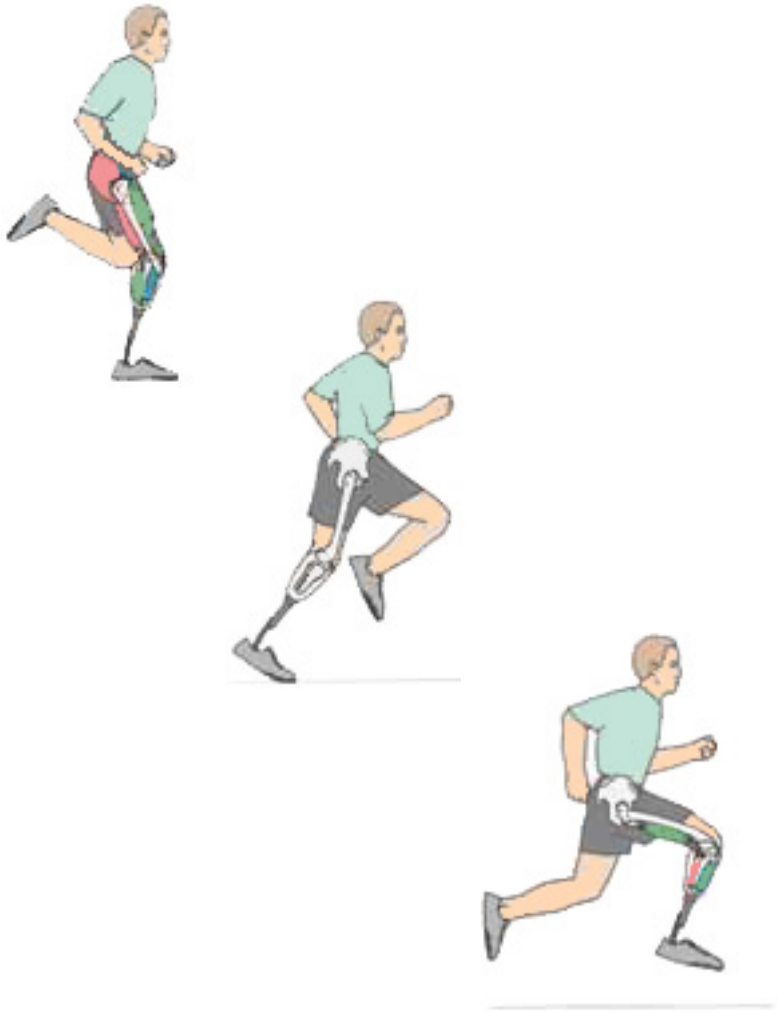
- **Cheetah Xplore Jr.**
  - 55kg weight limit
  - Foot plate size 16-24cm
  - Minimum foot shell size 19cm
  - Foot weight: 312g
  - Direct lamination or ***Adult*** Lamination Connector attachments
- **Flex-Foot Cheetah Jr.**
  - 55kg weight limit
  - Foot weight: 232g
  - Direct lamination or ***Adult*** Lamination Connector attachment
- **Flex-Run Jr.**
  - 84kg weight limit
  - Foot weight: 336g
  - 200mm build height
  - Uses ***Adult*** male and female proximal adapters

The Running Cycle

Absorption Phase
(Stance Phase)

Propulsion Phase
(Stance Phase)

Deceleration Phase
(Swing Phase)



Training Transtibial Knee Control

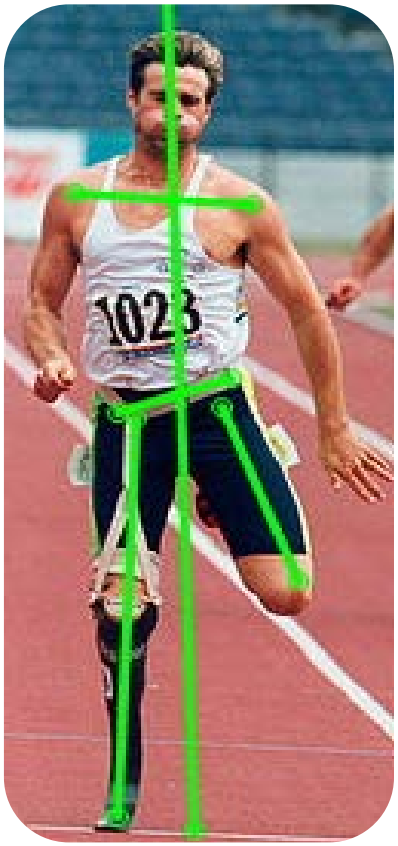
Training for the Absorption and Propulsion Phases of Walking and Running Gait.

Transtibial Sprinting

Keys to Amputee Sprinting:

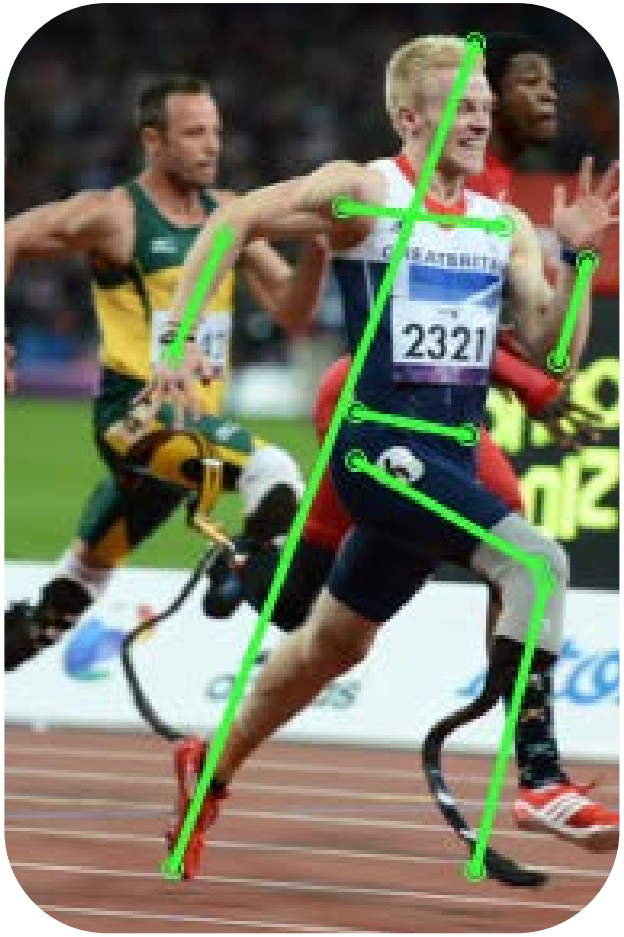
- Solid Core
- ROM in appropriate joints
- Stability of the hip and knee joints
- “Parallel Posture”

Sprinting Posture

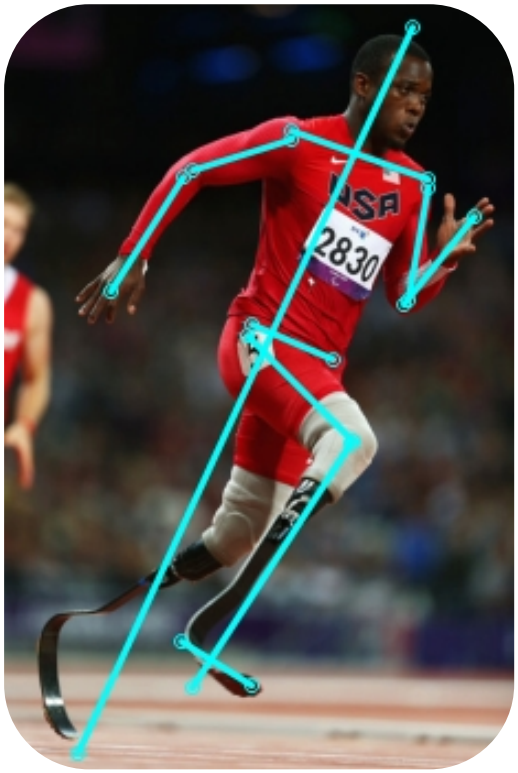


- Hips and shoulders square
- Hip height balanced at full support
- Tight to COM
- Balanced rotation

Sprinting Posture



- Forearms and shins parallel
- Shoulders and hips parallel (square)
- Line of drive(toe knee, hip, shoulder, ear)
- Foot and thigh parallel
- Neutral spine
- Torso Held in Isometric Position whilst limbs rebound around it.



Transfemoral Componentry

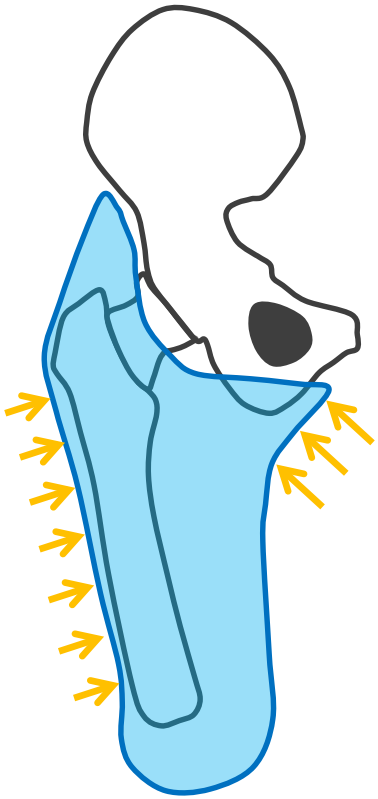
TF running Feet options:

- Pro-Flex XC
- Pro-Flex XC Torsion
- Re-Flex Shock
- Re-Flex Rotate
- Flex Run with Nike sole
- Cheetah/Xtend/Xtreme

Transfemoral Interfaces / Suspension

- Use of silicone liner provides comfort and protection against shear forces
- Negative pressure is ideal for rotational control and eliminating movement/pistoning:
  - Iceross Seal-in X5
  - Iceross Seal-in X TF
  - Consider secondary suspension with Seal-in liner
- Iceross TF locking for shorter residual limbs for security of suspension and confidence:
  - Icecross TF locking
- Belt suspension: Silesian band/ neoprene sleeve

TF Socket Design Considerations



- Preferably Ischial Containment/ Narrow M-L over Quad Socket for increased control of the femur
- Where possible keep trim lines low to maximize ROM
- Utilise a flexible inner socket
- Flexible inner enables addition of windows in the carbon socket to allow for muscle expansion
- Makes it easier to adjust changing volume
- Allow for more comfortable proximal trim lines-keeping the flexible inner high and lowering the carbon outer

Transfemoral Component Considerations

- Polycentric Knees:
  - Stance phase stability
  - Mid swing shortening
- **Cheetah Knee**
- **Total Knee**
- **OH7 Knee**
- **PASO Knee**

- Single Axis Knees
  - RHEO KNEE XC - running capability to 12.6km/hr

Cheetah Knee

Cheetah Knee function:

During stance phase:

- Load line is in front of virtual center of rotation
- Stability throughout entire stance phase
- Knee flexion starts at terminal stance

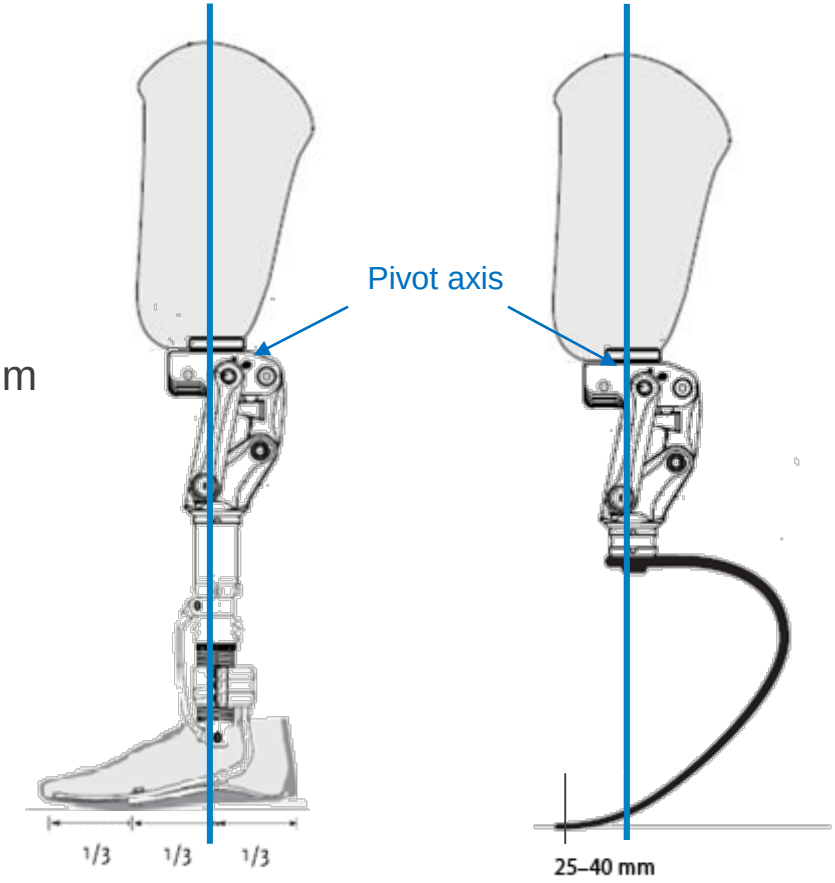
During swing phase:

- After toe load knee flexion can be induced
- Mid-swing shortening
- 3-phase hydraulic swing phase control
- Wider hydraulic valve system than Total Knee 2100 for faster displacement of fluid, providing **faster flexion and extension**
- Soft extension bumper providing a soft terminal impact

Cheetah Knee Alignment

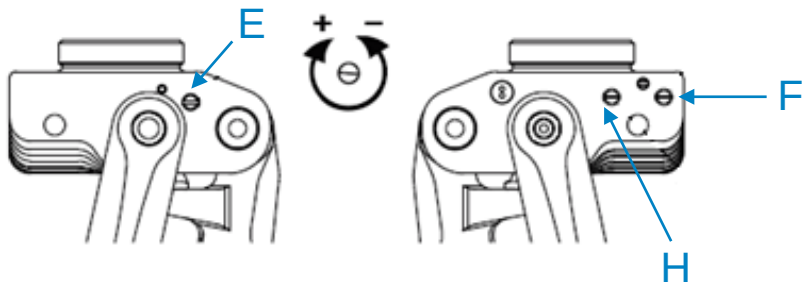
Aligment reference line from bisection of socket on ischial level should pass 0-10 mm in front of the pivot axis of the knee and an alignment reference point of the foot (as specified in the IFU of the selected foot)

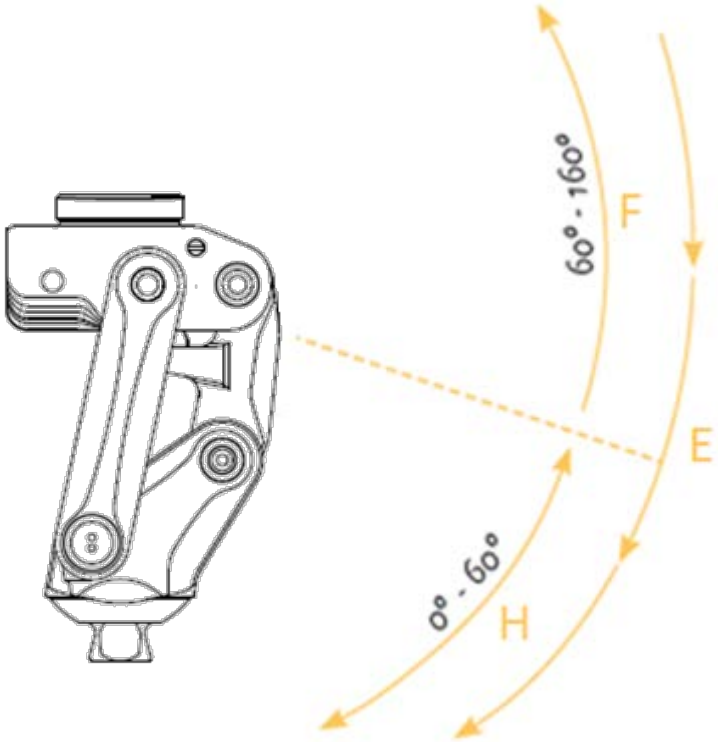
- Re-Flex Shock
  - Posterior 1/3 of foot (see mark in footcover)
- Flex-Run
  - Ground contact point + 25-40 mm
  - Alignment with NIKE Sole



Cheetah Knee Fitting Procedure

- Hydraulic swing control
  - Valve F
    - Affects swing flexion resistance from 60^0-120^0
    - Controls excessive heel rise
  - Valve H
    - Affects swing flexion resistance from 0^0-60^0
    - Controls initial flexion
    - Assists in extension
  - Valve E
    - Affects whole swing extension resistance 120^0-0^0





Tip for running:
Modify F > Min H > Min E

Cheetah Knee and Flex Run

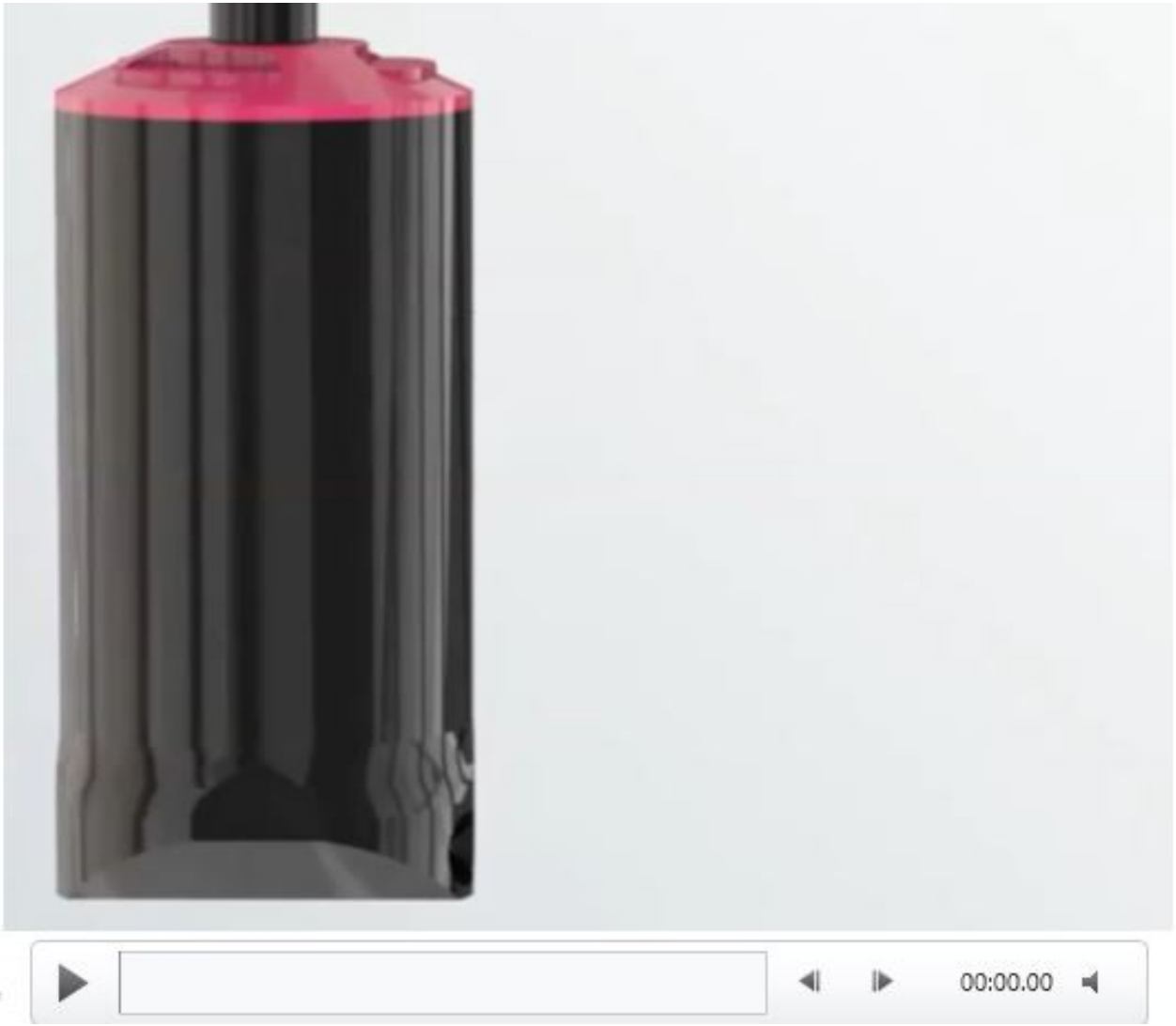
PASO Knee

- Auto-adaptive swing phase control
- No adjustments required
- Adapts to variable walking speeds
- Adapts for smooth and powerful running up to 12Km/hr
- Closing 4 bar geometry for stability in stance
- Mid swing shortening
- Low build height of long TF/KD users

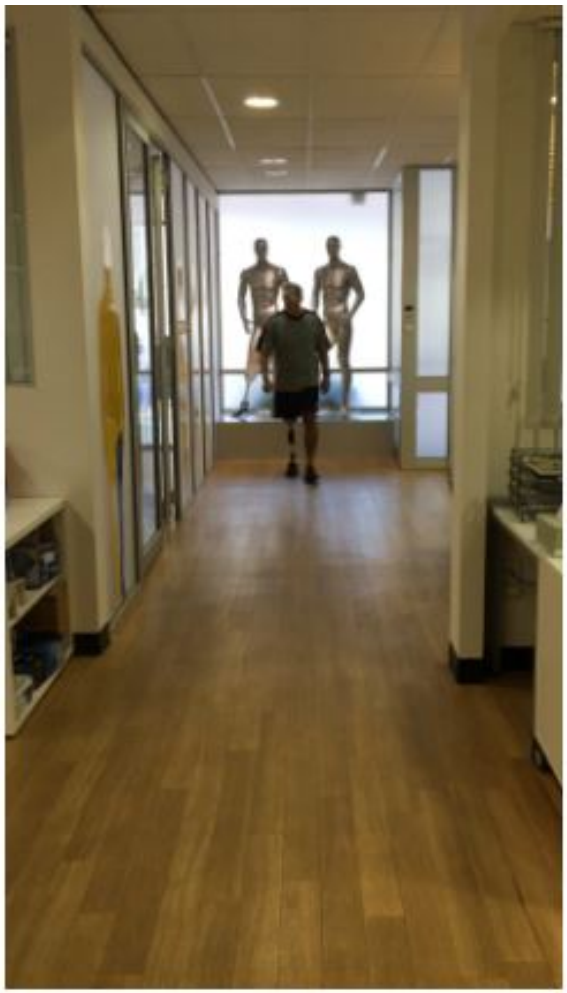
WEDGE

*For running: recommend adding B wedge to disengage closing geometry for an earlier stance release

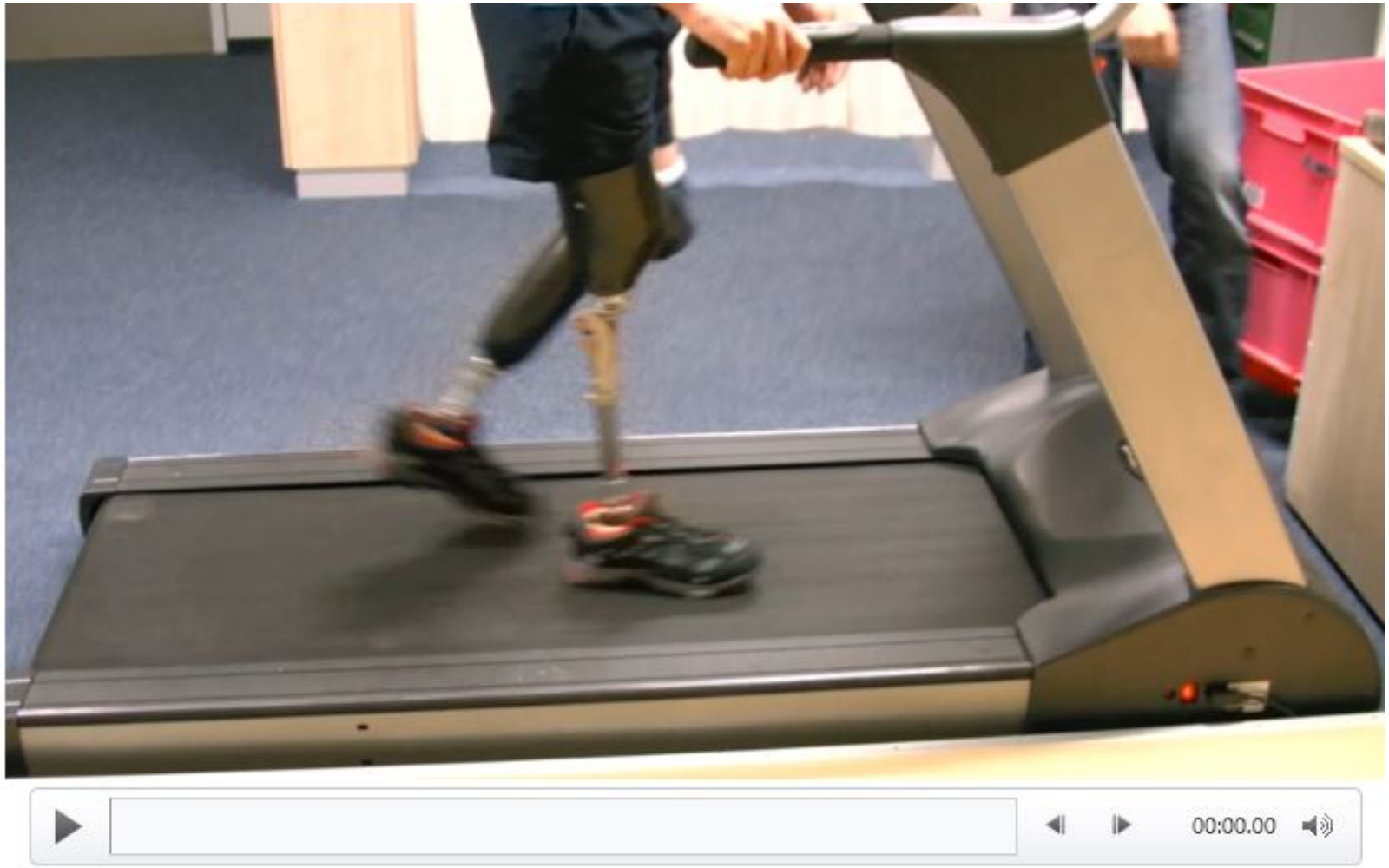
PASO Knee – Auto-adaptive pneumatics



PASO Knee – Walking and Running



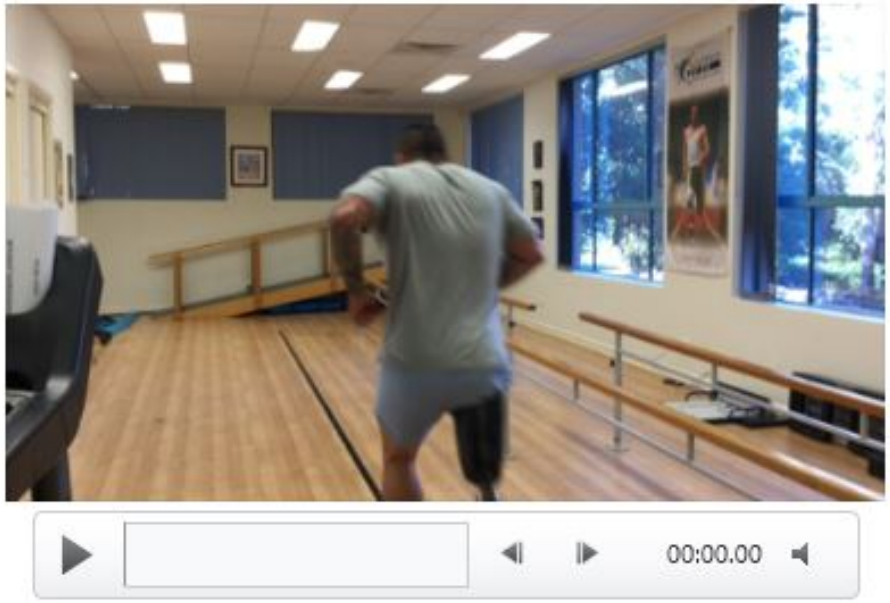
PASO Knee – Running



RHEO KNEE XC- running

The RHEO KNEE XC has been designed and tested for intermittent running, typical in the everyday active life.

- User weight <110 kg
- Activates when stance time is < 0.3s
- Automatic – no mode switching required
- During running: the stair ascent step-over-step is blocked.
- Tested at speeds up to 12.6 km/h



- **Recommended feet solutions:**
  - Re-Flex Shock
  - Re-Flex Rotate
  - Pro-Flex XC

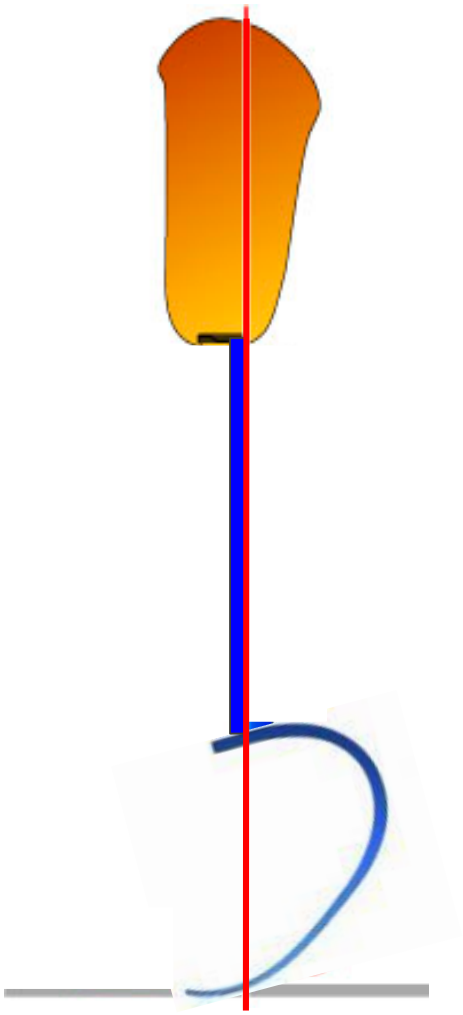
Keys to Success for TF Running

- Maintaining knee stability
  - Voluntary control
  - Limb lever arm
  - Knee design
  - Alignment
- Toe clearance during swing
- Full swing extension prior to initial ground contact
- Take athlete to track for running and video performance
- Achieve symmetry at max speed

Bilateral TF with Flex-Run™

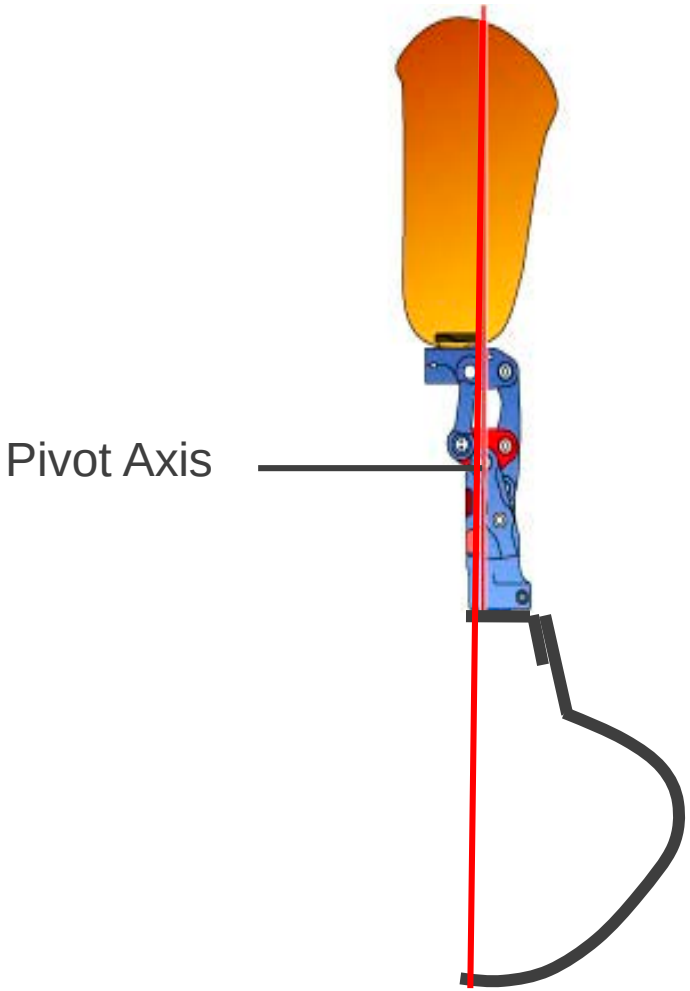
- Good for beginner runner
- Highly stable system
- Requires circumducted gait
- Energy conservation
- Consider for Bi-laterals who are looking to run
  - Highly stable
  - Reduces weight
  - Energy conservation
  - Ensure equal length
- Suitable for long/short distance running

Pylon-only Alignment



- Bisect socket
- Reference line passes 5cm posterior to contact point of foot
- Height is equal to sound side
- Foot is plantar-flexed 10°
- Toe out 3-5

Cheetah™ TF Alignment

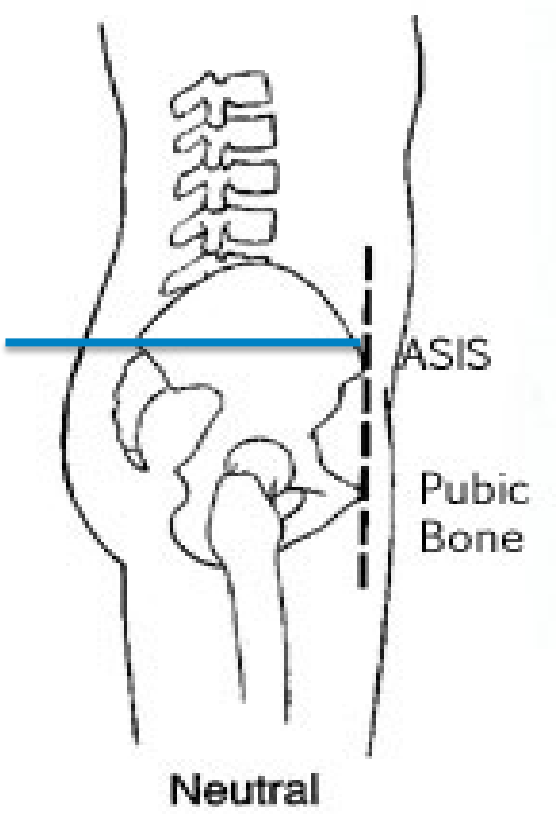


- Position socket so that the alignment reference line bisects the lateral wall of the socket and falls 0-5mm anterior to the **pivot axis/knee center**
- Choose between 5 or 20 degree L- Bracket for attachment
- Weight line falls 2.5-5cm posterior to end of toe

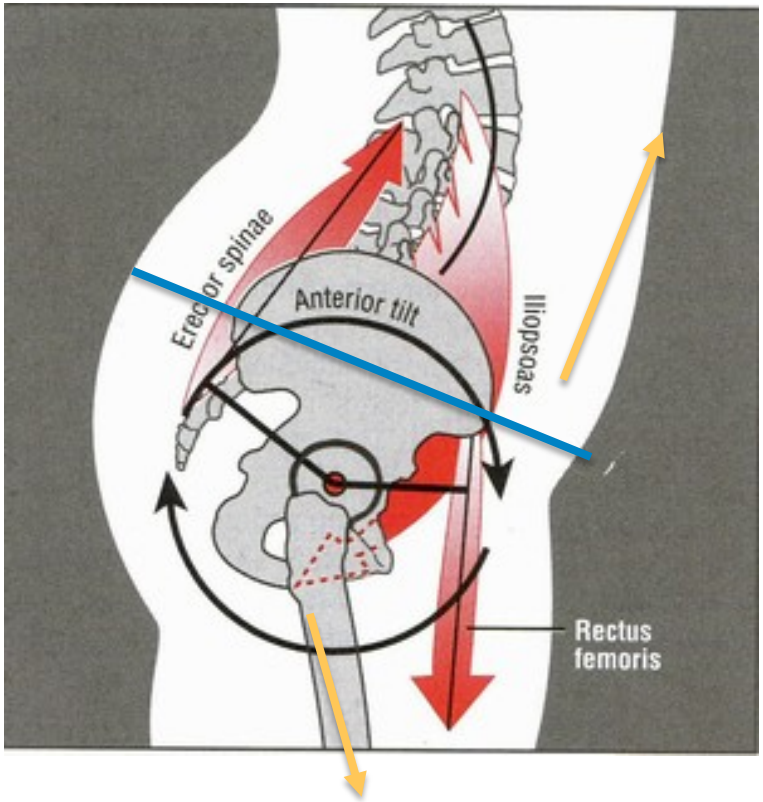
Transfemoral Amputees: Optimising Lateral Pelvic Shift and Hip Control:

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



Controlling Anterior Pelvic Tilt.

- Roll outs: Hips in extension, controlling a neutral spine

- Crunches on the fitball:
  - Strengthening the abdominals with the hips extended

Össur Mobility Clinics Australia and New Zealand