



## Unity<sup>®</sup> Elevated Vacuum Applications for TT, TF and Subischial Socket Design

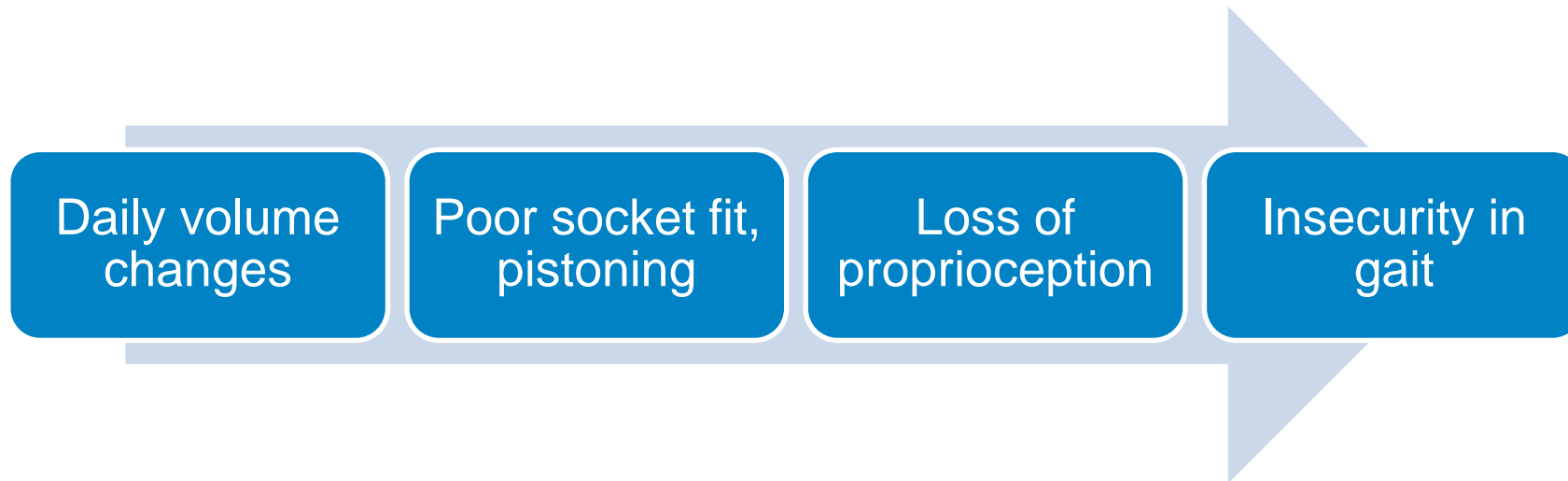
Webinar

Sarah Mulroy (Clinical Specialist Prosthetics)

## Unity® Elevated Vacuum: Advantages of vacuum suspension

- **Very firm suspension** providing excellent security and improved **proprioception**
- Elevated vacuum tends to assist in maintaining more **constant limb volume**, thereby decreasing the need to add additional socks
- Elevated vacuum **assists with wound healing** by improving circulation through the residual limb
- Provides good distal comfort for bony and sensitive distal ends; as long as the socket fits properly with good **volume and length matching**





Conclusion: Control of volume is a necessity<sup>1</sup>

<sup>1</sup>Board et al. (2001) J Int Prosth & Orth.

## Medical Necessity: Active vacuum

### Evidence regarding increased safety:

- Activities-specific Balance Confidence scales (ABC test) were found to be significantly higher in participants using vacuum suspension with 95% confidence, indicating a lower predicted incidence of future falls
- Improved functional outcome<sup>2</sup>: ‘skin problems (breakdown and blistering) seemed to be decreased in vacuum users and walking times increased in some users’

<sup>2</sup>Ferraro, C. Outcomes study of transtibial amputees using elevated vacuum suspension in comparison with pin suspension. *J. Prosthet. Orthot.* 23(2):78–81; 2011.

The Activities-specific Balance Confidence (ABC) Scale\*  
 For each of the following activities, please indicate your level of self-confidence by choosing a corresponding number from the following rating scale:

0% 10 20 30 40 50 60 70 80 90 100%  
 no confidence completely confident

“How confident are you that you will not lose your balance or become unsteady when you...

1. ...walk around the house? \_\_\_\_%
2. ...walk up or down stairs? \_\_\_\_%
3. ...bend over and pick up a slipper from the front of a closet floor \_\_\_\_%
4. ...reach for a small can off a shelf at eye level? \_\_\_\_%
5. ...stand on your tiptoes and reach for something above your head? \_\_\_\_%
6. ...stand on a chair and reach for something? \_\_\_\_%
7. ...sweep the floor? \_\_\_\_%
8. ...walk outside the house to a car parked in the driveway? \_\_\_\_%
9. ...get into or out of a car? \_\_\_\_%
10. ...walk across a parking lot to the mall? \_\_\_\_%
11. ...walk up or down a ramp? \_\_\_\_%
12. ...walk in a crowded mall where people rapidly walk past you? \_\_\_\_%
13. ...are bumped into by people as you walk through the mall? \_\_\_\_%
14. ...step onto or off an escalator while you are holding onto a railing? \_\_\_\_%
15. ...step onto or off an escalator while holding onto parcels such that you cannot hold onto the railing? \_\_\_\_%
16. ...walk outside on icy sidewalks? \_\_\_\_%

\*Powell, LE & Myers AM. The Activities-specific Balance Confidence (ABC) Scale. *J Gerontol Med Sci* 1995; 50(1): M28-34

### Evidence regarding volume control:

- The vacuum-assisted socket has been shown to eliminate daily volume loss<sup>3</sup>
- Vacuum-assist ensures a good fit during the day in ambulatory trans-tibial traumatic amputees with mature stumps<sup>4</sup>
- The combination of reduced pistoning and maintenance of volume is thought to account for the more symmetrical gait observed with vacuum<sup>1</sup>
- Elevated vacuum suspension systems manage limb volume fluctuation, a problem that people with limb loss are challenged with<sup>5</sup>

<sup>3</sup>Beil, T. L.; Street, G. M.; Covey, S. J. Interface pressure during ambulation using suction and vacuum-assisted prosthetic sockets. *J. Rehabil. Res. Dev.* 39(6):693–700; 2002.

<sup>4</sup>Goswami, J.; Lynn, R.; Street, G.; Harlander, M. Walking in a vacuum-assisted socket shifts the stump fluid balance. *Prosthet. Orthot. Int.* 27(2):107–113; 2003.

<sup>1</sup>Board, W. J.; Street, G. M.; Caspers, C. A comparison of trans-tibial amputee suction and vacuum socket conditions. *Prosthet. Orthot. Int.* 25(3):202–209; 2001.

<sup>5</sup>Sanders, Joan E., et al. Effects of elevated vacuum on in-socket residual limb fluid volume: case study results using bioimpedance analysis. *Journal of Rehabilitation Research & Development*, 2011, 48. Jg., Nr. 10.

### Evidence addressing fit, comfort and limb health:

- When limb volume decreases, the socket is loose-fitting, often causing pressure to bony prominences, which may result in pain and/or injury to the limb<sup>1</sup>.



<sup>5</sup>Sanders, Joan E., et al. Effects of elevated vacuum on in-socket residual limb fluid volume: case study results using bioimpedance analysis. *Journal of Rehabilitation Research & Development*, 2011, 48. Jg., Nr. 10.



## Primary benefits of the Unity® system



Unity®

- + **SLEEVELESS:** Increased knee flexion range (TT) with greater comfort and user acceptance
- + **LIGHT WEIGHT AND DISCREET:** 130g added weight and housed within foot shell
- + **SIMPLE AND EFFICIENT:** Quick and easy to elevate and release vacuum levels
- + **INDEPENDENT PUMP:** does not depend on shock mechanisms and can be added to a wide range of performance Flex-Foot® systems to meet every mobility need.
- + **VOLUME STABILISATION:** Optimises socket stability, proprioception and comfort throughout the day while limiting the need to add socks
- + **INCREASED RELIABILITY:** Minimises risk of leaks and puncture issues associated with sleeve dependent vacuum methods
- + Integrates **PERFORMANCE FLEX-FOOT** technology to meet all activity requirements

## Unity<sup>®</sup> : Candidate Profiling

### Indicated user population:

- Transtibial and Transfemoral amputees
- Low to high impact levels
- Weight limit entirely based on recommended foot and knee modules
- Sufficient residual limb length to use Seal-In<sup>®</sup> V and Seal-In<sup>®</sup> X liners
- Very conical limbs may be addressed using a distal cup



### Contraindications for use:

- Very short residual limbs that cannot utilise Seal-In<sup>®</sup> V or Seal-In<sup>®</sup> X
- When total contact cannot be maintained distally between liner and limb
- When expecting significant volume changes



# Building Blocks of the Unity<sup>®</sup> system



## 1: Proven Seal-In<sup>®</sup> Technology



Seal-In<sup>®</sup> V (TT)



Seal-In<sup>®</sup> X (TT & TF)

## 2: Socket Connection



Unity<sup>®</sup> TT Valve

Unity<sup>®</sup> TF Valve Kit



Unity<sup>®</sup> 544 Valve Kit

## 3: Performance Flex-Foot

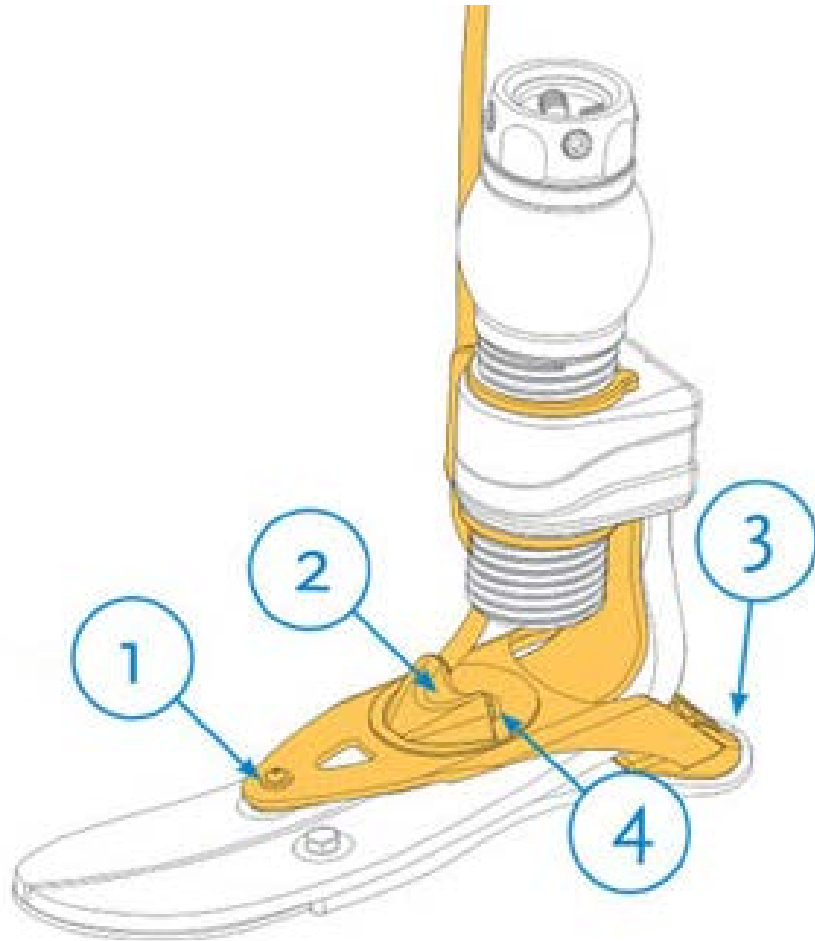


- Pro-Flex<sup>®</sup> Series
- Re-Flex<sup>®</sup> Series
- LP Rotate<sup>™</sup>
- Vari-Flex<sup>®</sup> Series
- Balance<sup>™</sup> Foot
- Balance<sup>™</sup> Foot J
- Flex-Foot<sup>®</sup> Assure
- Proprio Foot<sup>®</sup>

## 4: Vacuum Pump Mechanism



Unity<sup>®</sup> Pump



## 1. Frame & Support Blade:

Upon heel deflection, the frame moves up and the support blade moves down, thus expanding the membrane.

## 2. Check valves:

When air is efficiently drawn out of the socket, check valves ensure that air does not flow back into the socket (**Pre-assembled for L side**).

## 3. Heel pad:

The heel pad acts as a secure support for Unity's upper blade, and as a stop for heel displacement at high load.

## 4. Membrane:

When the membrane deflects, air is efficiently drawn out of the socket.

## Flex-Foot® with Unity®

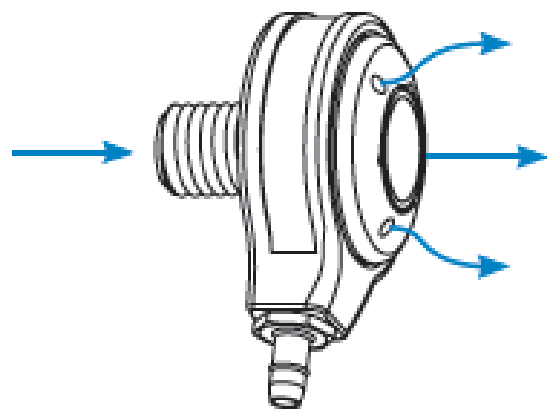
Fitting a Flex-Foot with Unity is no different from previous procedures:

- Select appropriate size and category
- Obtain good static alignment
- Remember to use wedges during dynamic alignment

- Unity Pump elevates vacuum up to -22inHg
- Normal operating pressures are -16 to -20 inHg
- Added weight is 130g (Pump, valve, tubing)
- Running the vacuum tube medially is recommended to prevent damage from foreign objects
- Vacuum/exhaust ports on the Unity pump are exchangeable for right and Left. Default shipping setup is for a left.

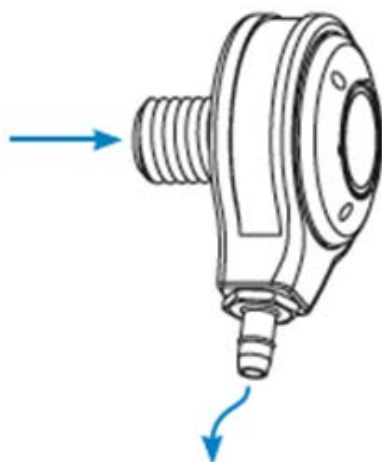


# TT Unity<sup>®</sup> Tri-function Valve



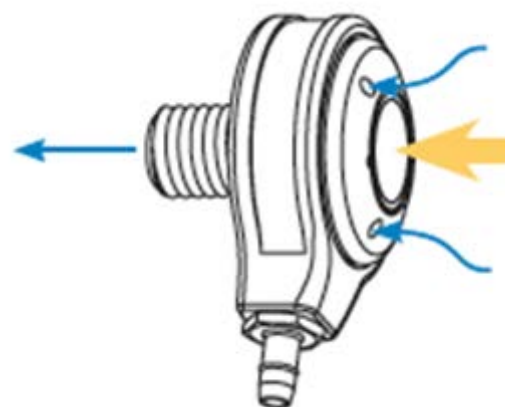
## EXPULSION

lets air through easily  
when donning the socket



## VACUUM BYPASS

lets air into the vacuum  
pump via a check valve,  
so the socket is still  
airtight in the unlikely  
event of tube failure



## RELEASE BUTTON

lets in air, so the vacuum  
is easily released for  
doffing the prosthesis

# TT Unity<sup>®</sup> Valve

## Unity TT Valve;

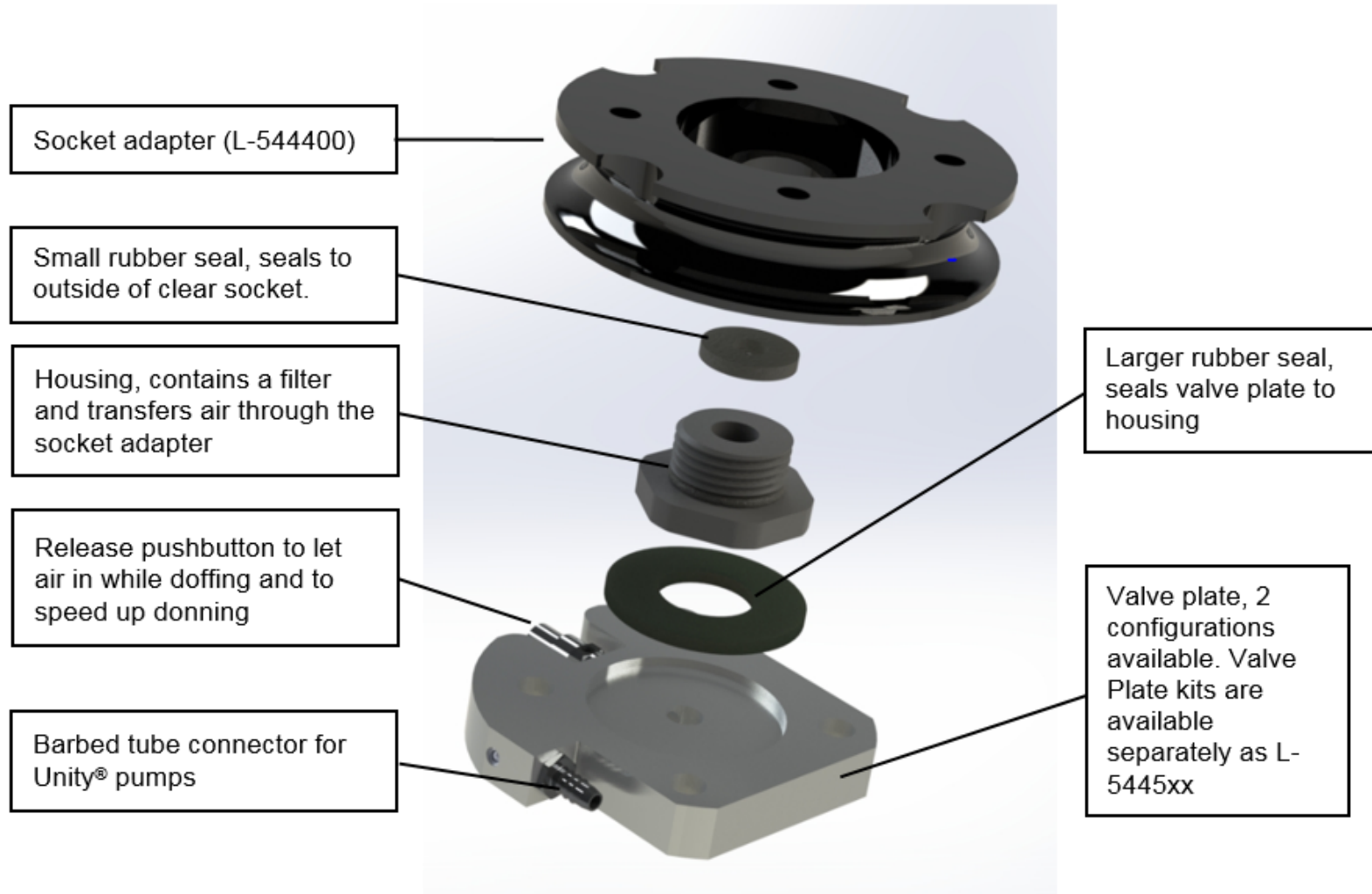
- Tri-Function (Expulsion, Vacuum, Release)
- No increased build height added to prosthesis
- Built-in particulate filter

- Disassemble valve before trimming thread. Metal shavings in duckbills and seals are no fun!
- Valve thread needs to be seated to the socket (inner) wall. **Use valve insert**
- Good quality industrial grade silicone sealant works well
- Avoid lateral placement for protection
- PETG is recommended to prevent leaks

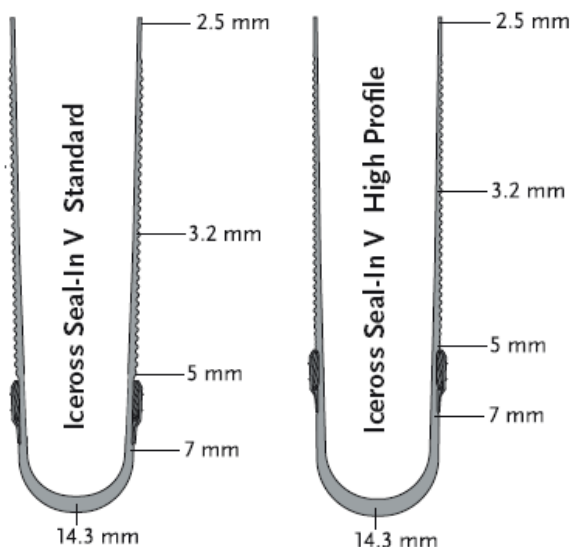




# 544 Valves - Unity® Plate



## Liner options for TT Unity®: Seal-In® V



- Designed and tested in combination with unity
- Dual sealing membrane enhances seal retention while the volume adaptive blades accommodate volume changes
- Utilises DermoGel Silicone- softest durometer available
- Active Skin Care and Silken inner surface
- Compatible with elevated vacuum and expulsion-only sockets
- Low-profile and high-profile (35+mm higher) seals available



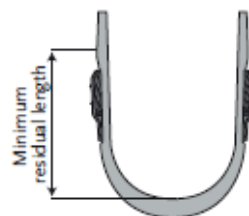
# Product Sizing and Fitting



- Measure circumference 4cm from end of soft tissues
- Select a liner as measured or next size below the indicated measurement
- On average the minimum residual limb length is 10-13cm(Std.) and 13-16cm(High Profile) depending on liner size

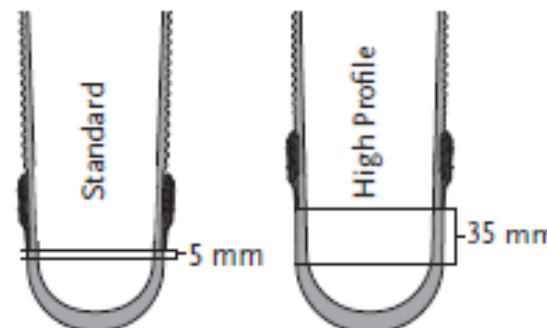
**Measurement @ 4cm level = 28cm >> Select liner size 28**  
**Measurement @ 4cm level = 24cm >> Select liner size 23.5**

LINER SIZE	MINIMAL RESIDUAL LENGTH*	
	STANDARD	HIGH PROFILE
18-20	10cm	13cm
21-25	11cm	14cm
26-30	12cm	15cm
31-36	13cm	16cm



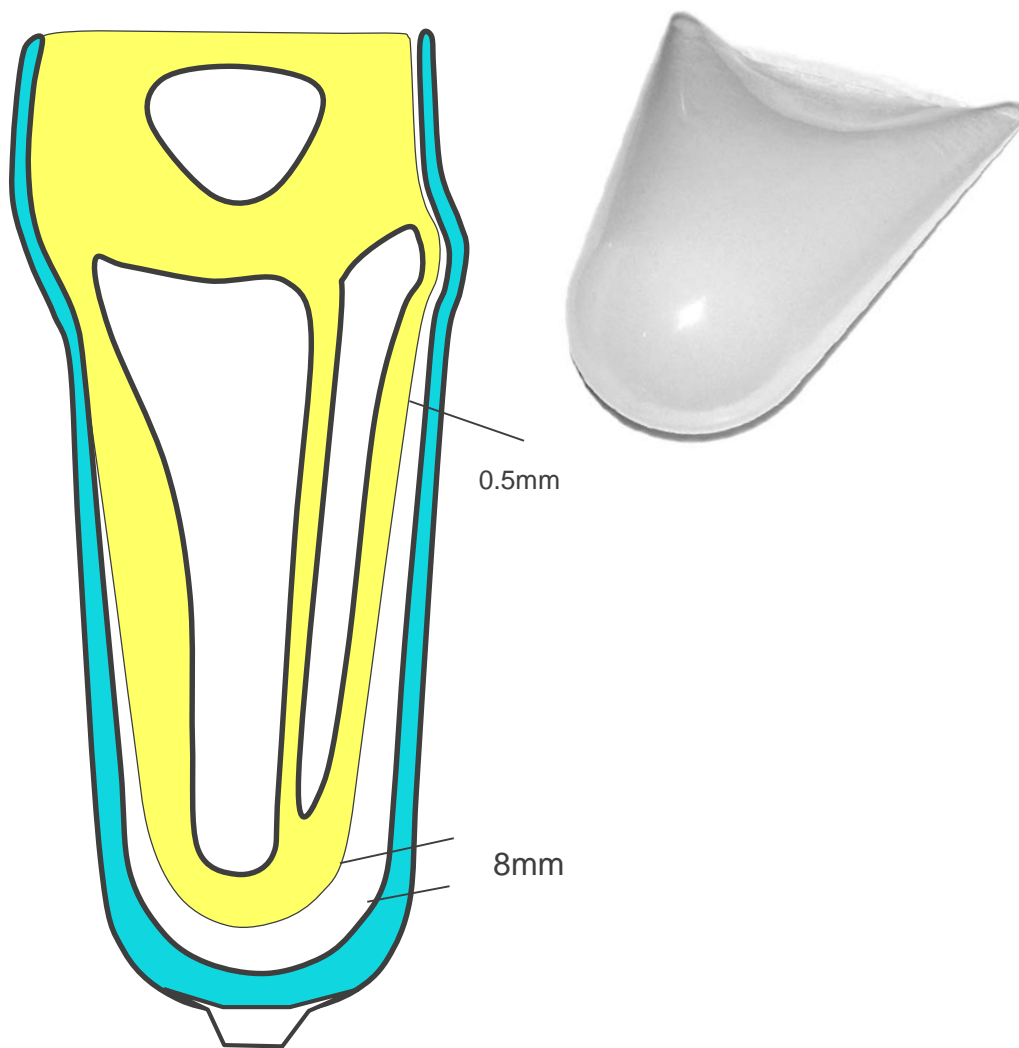
Seal-In V seal height is fixed at 5mm and 35mm from the start of the distal radius

PART#	PROFILE	DESCRIPTION
I-4713XX	Wave 3mm	Seal-In V
I-4723XX	Wave 3mm	Seal-In V High Profile



Liner "cup" size varies, which affects **minimal residual limb length**:

# Iceross<sup>®</sup> Distal Cup



- Iceross<sup>®</sup> Distal Cup assists fitting extremely conical limbs
- Modifies the overall profile of limb to a more “cylindrical” shape
- Extremely soft Dermogel<sup>®</sup> silicone assists in adding distal cushioning
- 8mm distal thickness, tapering to 0.5mm proximally
- Fit Distal Cup first, then measure for Icecross<sup>®</sup> liner and fit over the Distal Cup

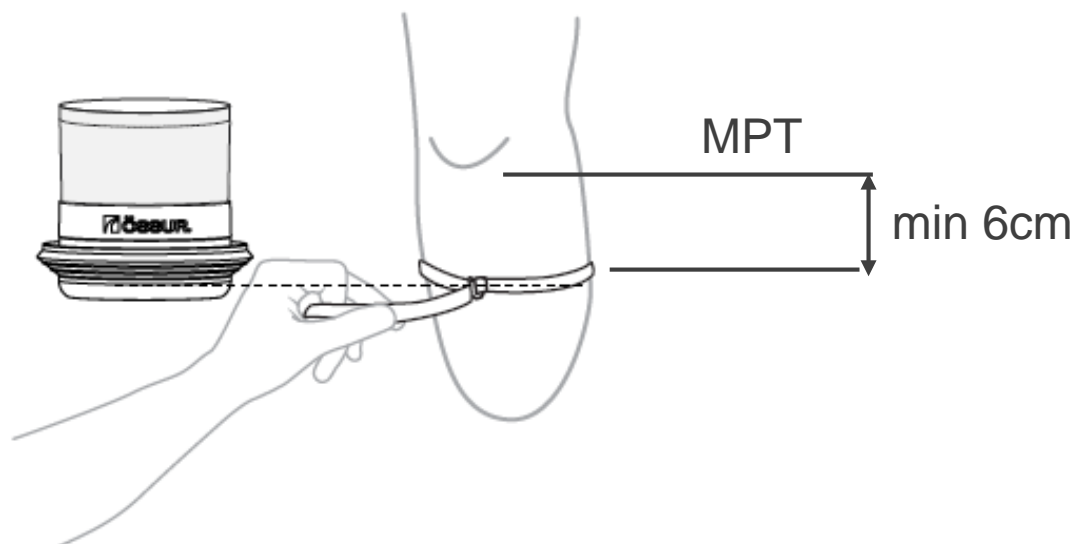
## Liner options for TT Unity: Iceross Seal-In® X

- Seal-In X is a combination of a cushion liner with a specifically designed Seal-In Ring for TT users
- Seal placement is customized to each individual, enabling users to position the ring more proximally or position it to avoid problem areas
- Donning and doffing is made much easier than with previous Seal-In designs
- Anatomy conforming fabric for ease of knee flexion
- If Seal-In Suspension is not practical for all circumstances, Seal-In X is still an excellent cushion liner in combination with Iceross® Sleeve



## Seal-In® X: Seal Ring Sizing

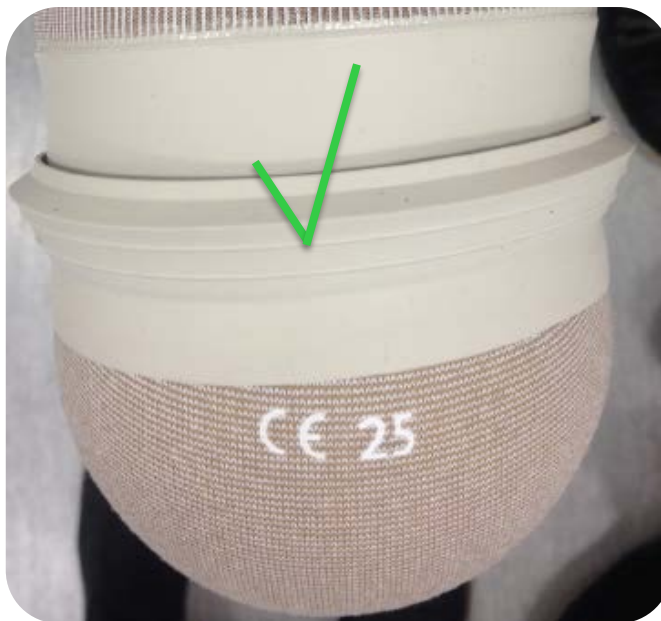
- Measure circumference distally, where the seal edge will sit
  - Measure on skin
  - Commonly, **6cm below MPT**
- For straight and bulbous residual limbs, chose a ring size **+1 size up**
- Conical residual limbs need **LARGER** sizing **+2 sizes up**
- 6mm liners may need and extra size up as the extra thickness is of the liner 19mm in circumference





# Seal-In® X: Evaluating Seal Ring sizing

Seal too small, lip of seal is compressed around circumference of limb



Optimal seal size, small gap but may be partially touching

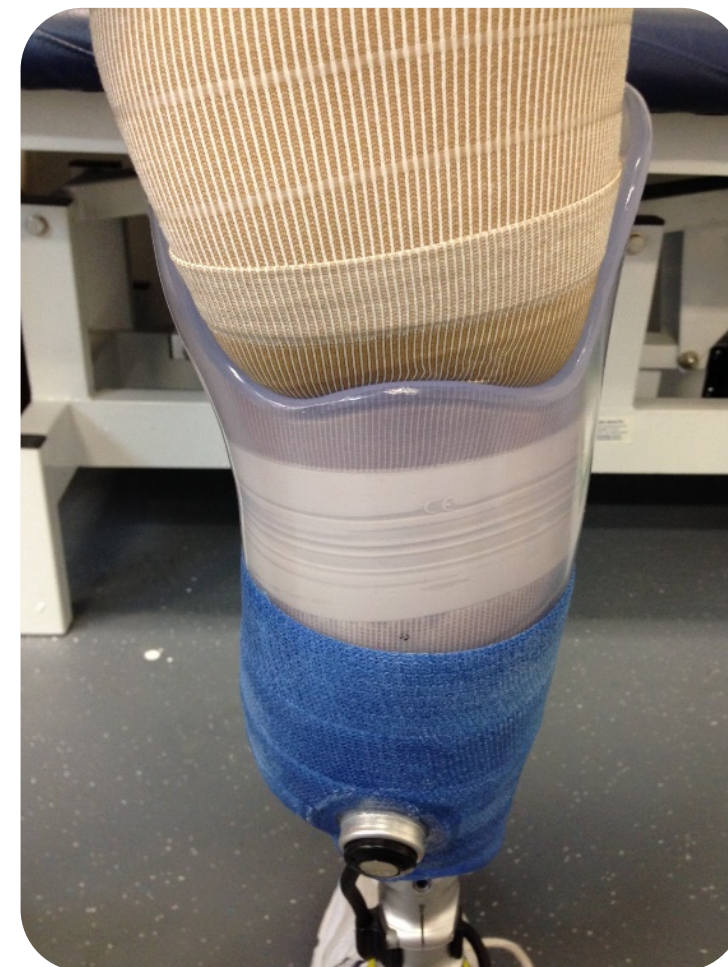
Seal too large, wide gap



**For optimal sizing, use a Seal Ring fitting kit. Two sets available with fully functional Seal Rings.**

## Seal-In<sup>®</sup> X: Seal Placement

- Avoid extreme proximal seal placement. Seek feedback from the user.
- More proximal is not always better for suspension
- Measure minimum 6cm below MPT
- Seal should remain below trim line for security





## Cast Method:

- Measure circumferences from MPT down in increments:
- Measure M-L- snug measurement-get patient feedback
- If using Seal in X then cast without Seal Ring
- Take a neutral cast with little tension using elastic the rigid plaster
- Cast proximal to distal
- 3-5° knee flexion
- Avoid tightening the cast and any distortion to limb shape
- Casting under vacuum is NOT required

**Note:** *Unity® should not be used as a remedy for already wide sockets or to counteract discomfort in existing sockets. Cavities and too wide sockets can cause pain and/or serious injury*



# Unity® Modification

- Global reduction of patient measures between 3-5% depending on residual limb shape/size
- Reductions of up to 6% possible for larger fleshier residual limbs
- Reduce cast to correct M-L dimension
- If using Seal-In V then level out the seal area on the positive model
- Avoid removing plaster over bony prominences or sensitive areas, such as fibula head and tibial crest
- Avoid building a posterior shelf to avoid widening the A-P
- Remove 6mm distally whilst maintaining distal end shape



## Evaluating the check socket: Seal-In<sup>®</sup> V



Ideal fit places the seal as high as possible on the limb (HP Seal shown here) with equal distribution of pressure around the seal. Seal should fully seat at least 1-2cm below the posterior socket trim lines.

Pressure against the V-seal can be "read" in a check socket:

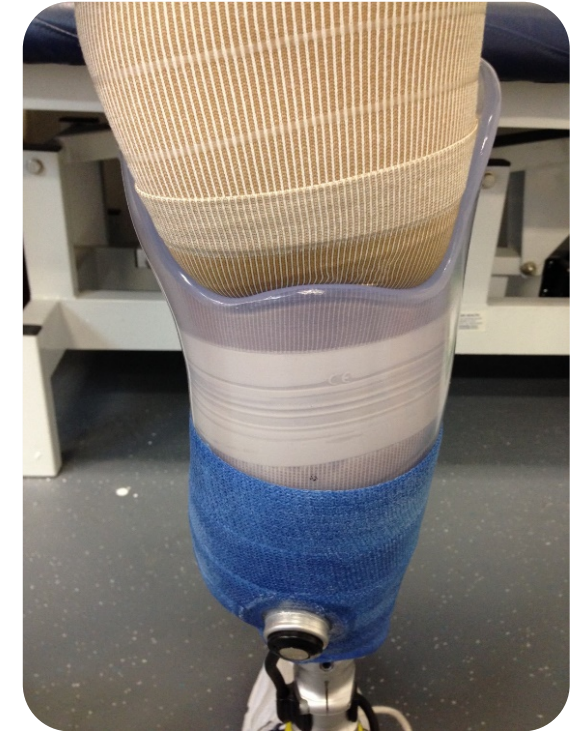
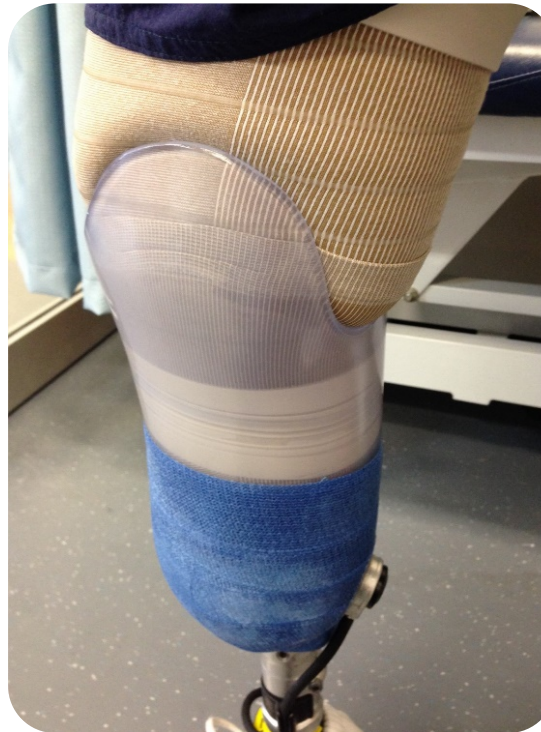


**Normal pressure.** Volume adaptive Blades flatten the seal against the socket wall (up to ~50% compressed when de-weighted, up to 100% upon full weight bearing)

**Low pressure area and increased risk of suction loss.** Blades are barely pushing the seal to the socket wall.



## Evaluating check socket : Seal-In® X



Seal should ideally seat 1-2cm below posterior trim line and show even pressure around the circumference of the limb. If seal appears folded or migrated, re-don socket with lubricant spray. If issues continue, re-verify sizing and placement of seal.

## Evaluating the check socket

### BWS Three stage fitting process:

- **Better**
- **Worse**
- **Same**

## Distal Volume Check

1. Add one **silicon spot** to the bottom of the socket
2. Ask if it feels better, worse or the same:
  - **Better**- you had a void distally, add another spot
  - **Worse**- your volume was correct, remove the last spot
  - **Same**- you had a void distally, add another spot
3. Repeat until you have gone from **Worse** to **Better**



## Evaluating the check socket

### BWS Three stage fitting process:

- **Better**
- **Worse**
- **Same**

## Circumferential Volume Check

1. Add one **sock** 1 ply, disregard the fact that the seal will not seal
2. Ask if it feels better, worse or the same:
  - **Better**- your socket was too big, add another sock
  - **Worse**- your volume was correct, remove the last sock
  - **Same**- your socket was too big, add another sock
3. Repeat until you have gone from **Worse** to **Better**

---

Correct for volume and length differences on the positive model and fabricate another check socket if necessary.

# Unity® Knee solutions for K1-K3



Depending on user needs, activity level and impact level choose the suitable knee system

The Ossur range features knees with weight activated breaking mechanism, polycentric 4 bar knees and pneumatic cylinders for users capable of varied cadence





## Knee solutions for K3-K4



Depending on user needs, activity level and impact level  
choose the suitable knee system

The PASO features an autoadaptive pneumatic cylinder,  
capable of walking speeds of 7km/hr +

The Rheo Knee<sup>®</sup> XC is weatherproof, featuring stair ascent  
capability, automatic cycling recognition and running



PASO

OH5

OH7

Total Knee range

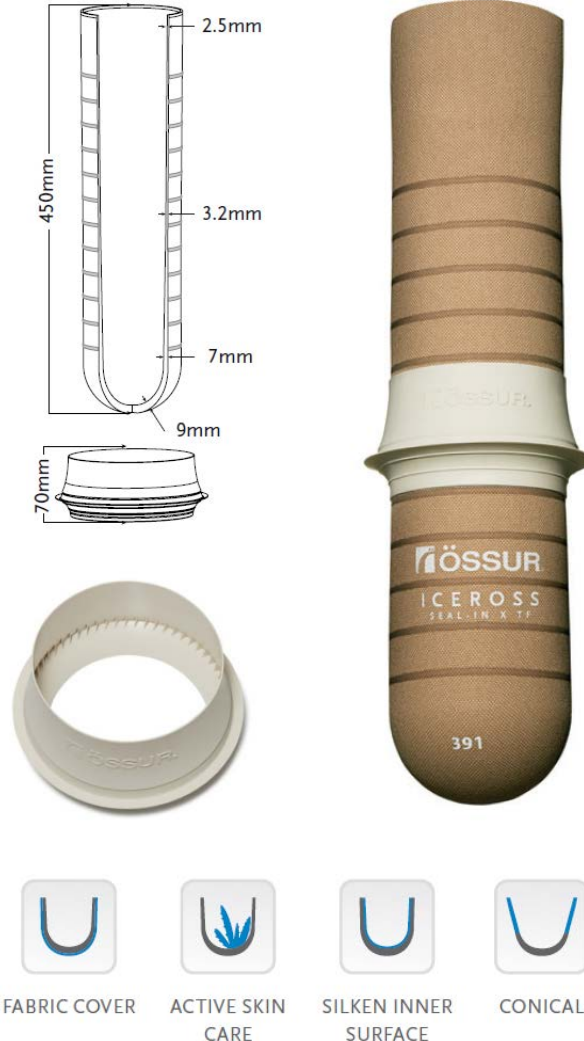
Mauch Knee

Mauch Knee  
Plus

Rheo Knee 3

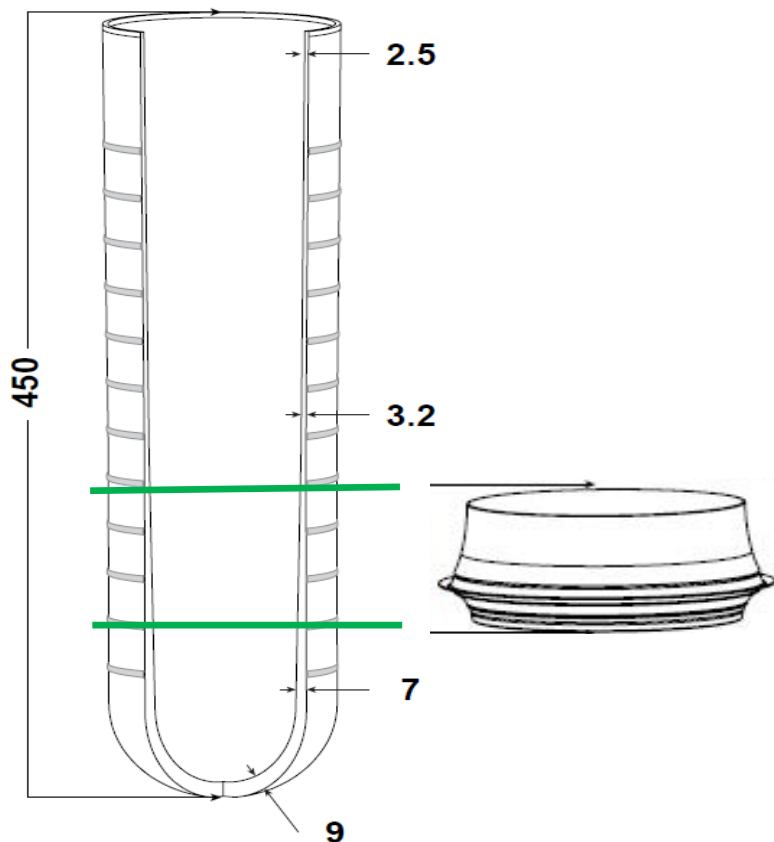
Rheo Knee XC

# Iceross® Seal-In® X TF



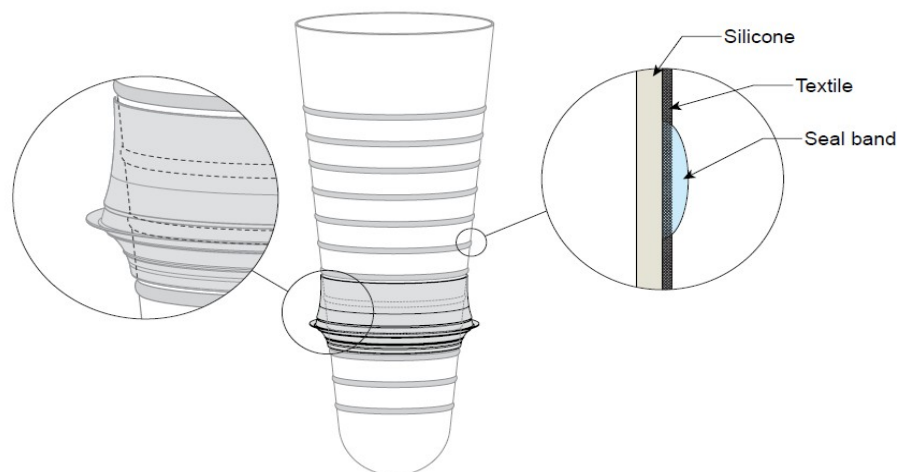
- Modular Seal-Rings are sized and positioned to meet individual needs:
  - Shape
  - Sensitivity
  - Tissue consistency
  - Skin condition
- Standard and Conical profiles
- Slightly stiffer to give better stability and support to proximal tissues
- Thinner distal thickness (9mm) for easier donning and better conformance to limb shapes
- Liner length 5cm longer- benefit long TF and KD users
- New textile cover with 2X adhesion strength and abrasion resistance compared to existing range

# Seal-In® X Dimensions



Seal bands on the liner make sealing through the fabric possible

- Iceross Seal-In X TF is approximately 5cm longer than previous Iceross TF models
- Seal bands on the liner are spaced 25mm apart
- It is recommended to place the Seal-Ring over **2 seal bands**
- One seal band should be visible "just below" and "just above" the Seal-Ring

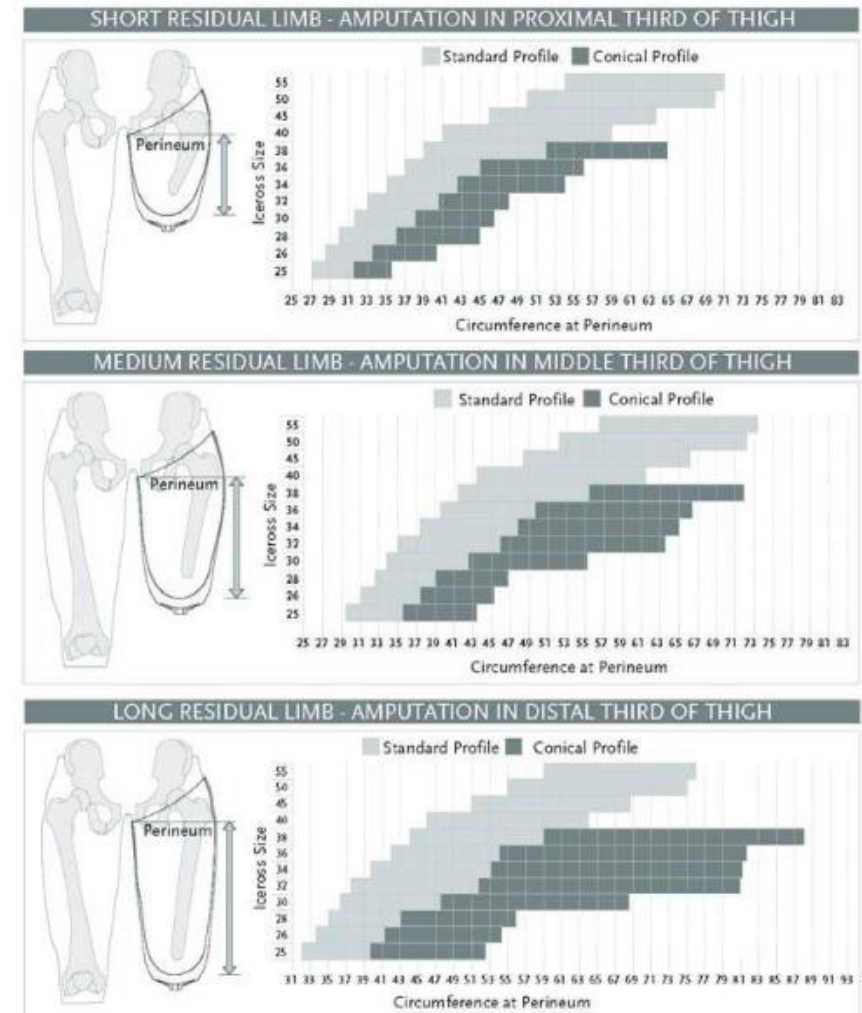
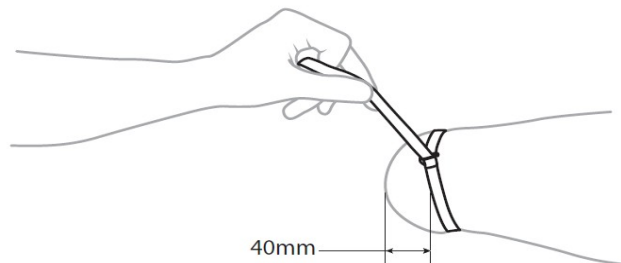


Separate Seal-Ring provides sealing bridge to the socket inner wall

# Seal-In® X Sizing and profile Selection

Conventional ICEROSS sizing and profiling methods are used to select liner:

- Measure 4cm from distal end of the soft tissues to determine size.
- Choose the size measured or if between sizes, the size below.
- Take perineal circumference and reference profile charts – Conical or Standard



# Seal-Ring Sizing

- Decide preferred Seal-Ring placement on the limb
- Recommend placement at least 10-15cm below perineum
- Take a circumference measurement directly over the limb where the **lower edge** of the Seal-Ring is expected to rest
- Choose the closest Seal-Ring size to the measurement. If between sizes, choose the smaller size.
- **Conical or "fleshy" limbs may require downsizing one ring size**



**RIGHT**



**TIGHT**



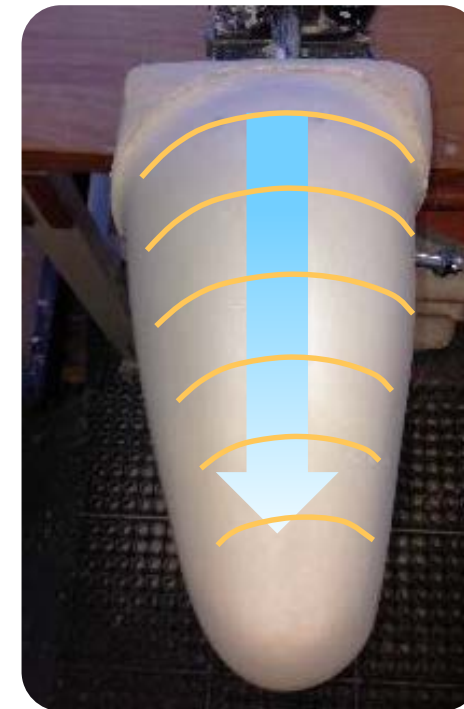
When test fitting a liner with a selection of Seal-Rings, observe tension of ring on limb and interface.

**Seal-Ring should flatten out on liner without deforming the limb shape.**



## TF Casting and Modification

- Standard paster cast- Casting over Seal-Ring is not required
- Use elastic plaster then rigid
- Avoid excessive proximal weight bearing
- Do a graduated reduction of 3-5% proximally from patient measures
- Reduce up to 6mm distally



## Check socket fitting



Lubricate Seal-Ring and socket well to avoid any folding or migration of Seal-Ring.

Seal-Ring should remain in contact with the socket at all times:

- Weight bearing
- Apply negative force
- Sitting
- Hip Flexion





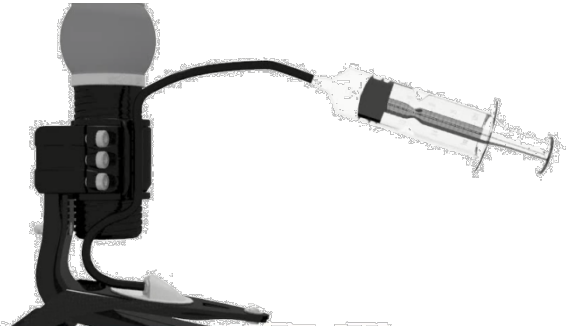
## Unity TF kit (UTF0001)



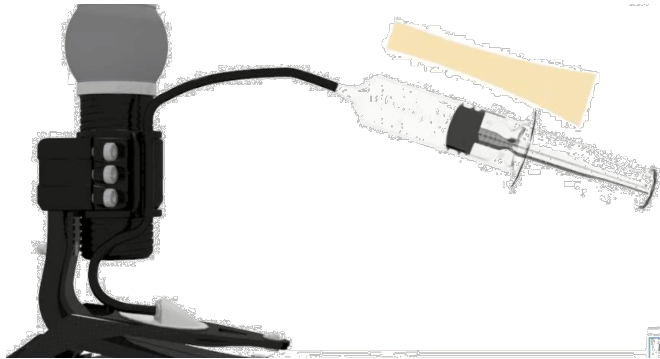
Unity TF tubing complete with nylon 'snakeskin' reinforcement. Typically used as reinforcement for electrical cabling, this protective sleeve provides extra resistance to kinks, abrasion and tears.

Clamps and elastic keepers neatly run Unity tubing from foot to socket. Accessory kit available (UTF0006)

## Testing the Unity vacuum system



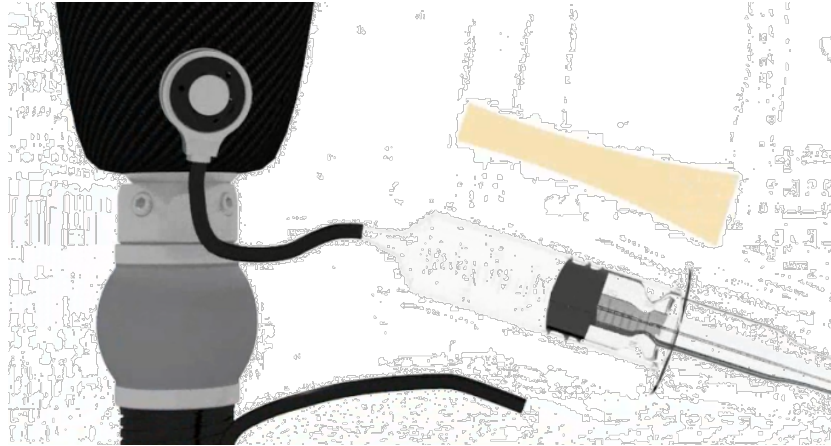
- Connect a half-air-filled syringe to pump
- Cycle pump housing to empty the syringe



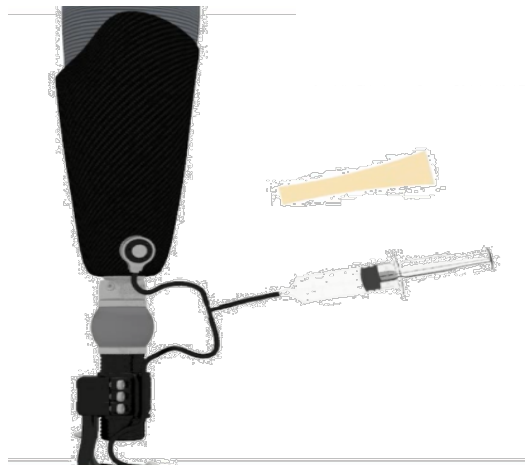
- Once empty, pull and hold the syringe for a few seconds
- If syringe piston returns to original position, there is no back-leak in pump

In case either of these tests fail; tear down, clean and rebuild pump. Clean water, mild soap and isopropyl alcohol are safe to use. Repeat test after rebuild.

## Testing the vacuum system



- With inside of socket blocked with a piece of tape, pull and hold for a few seconds
- If syringe piston returns to original position, there is no leak in the valve. If not, clean valve and repeat.

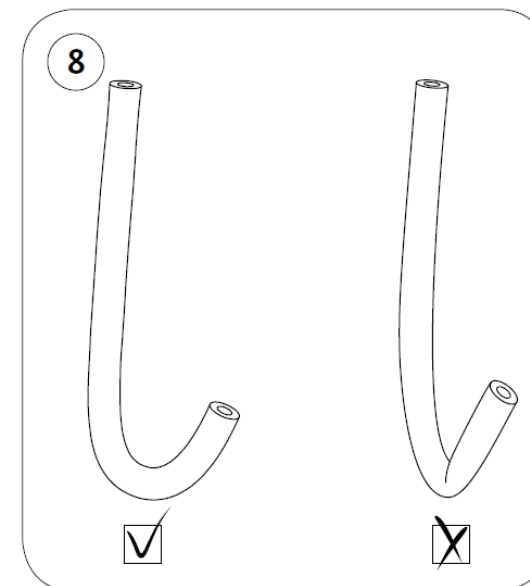


- Using a T connector and with the user wearing the socket, cycle syringe a few times then hold for a few seconds.
- If the piston returns to original position there is no leak. If not, check seal, socket and valve sealing to socket.

## Troubleshooting checklist

### If vacuum is not being achieved to desired level, please check:

- Is the tube punctured?
- Is there a leak in the socket?
- Is the membrane punctured or torn?
- Has the membrane been pulled out of the membrane housing?
- Is there dust or grit inside the system?
- Are the inlet and outlet ports tightened?
- Is the Unity™ Socket valve leaking?
- Is the tube fully inserted onto inlet ports? (Check barbs at the Unity™ Socket valve and at the Unity™ Membrane housing)
- Is the sock inside the foot cover affecting the systems mechanical movements?



## Subischial Socket design: Nu-FlexSIV

- Ryan Caldwell and Stephania Fatone have worked with Northwestern University, and have developed a teachable technique for flexible subischial vacuum sockets:
  - Northwestern University Flexible Sub Ischial Vacuum Socket (NU-FlexSIV Socket)
- Ryan Caldwell has been fitting NU-FlexSIV sockets for over 10 years and to 125+ amputees
- The main aim of the subischial socket is to **provide comfort** for the user **without limiting function**
- NU-FlexSIV trim lines typically sit **25mm below the ischial tuberosity** and **50mm below the greater trochanter**:
  - Global compression of soft tissue to relieve pressure on the distal femur
  - User benefits from increased ROM as socket wall no longer limits movement
  - Utilises TT liners which are undersized 10-30% depending on tissue consistency
  - Definitive socket consists of flexible inner socket and carbon fibre outer socket
  - Research has shown that elevated vacuum increases socket comfort with the Nu-FlexSIV

<sup>6</sup>Prosthetics and Orthotics International: Northwestern University Flexible Subischial Vacuum Socket for persons with transfemoral amputation-Part 1: Description of technique. Stefania Fatone and Ryan Caldwell

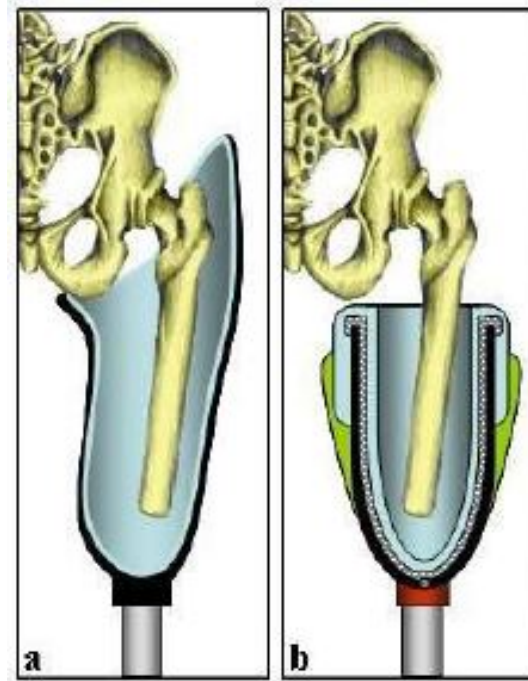


# Ischial Containment vs Nu-FlexSIV

## Ischial Containment

The most proximal aspect of the socket includes ischial ramal containment and trim lines proximal to the ischial tuberosity

Lower proximal trim lines  
Flexible socket construction  
Vacuum assisted suspension



## Nu-FlexSIV

Trim lines typically 25mm distal to the ischial tuberosity and do not impinge on the pelvis

Improve comfort and function

<sup>7</sup>Development of the Northwestern University Flexible Sub-Ischial Vacuum (NU-FlexSIV) Socket for Persons with Transfemoral Amputation  
Ryan Caldwell, CP/L FAAOP, and Stefania Fatone, PhD, BPO(Hons), Northwestern University Prosthetics-Orthotics Center (NUPOC)

## Candidate profiling

### Indicated user population:

- Fatone and Caldwell suggest that the Nu-Flex-SIV method is best suited for experienced, complaint amputees with residual limbs that are well healed with well-regulated volume
- Caldwell however has over 10 years of clinical experience with technique, successfully fitting more complex limbs with open wounds, scarring, invaginations, heterotrophic ossification, bone spurs, and skin grafts, suggesting that with experience, broader application may be possible.

### Contraindications for use:

- stump length < 12cm
- deep longitudinal invaginations
- significant muscle bunching
- issues with silicone liners



<sup>6</sup>Prosthetics and Orthotics International: Northwestern University Flexible Subischial Vacuum Socket for persons with transfemoral amputation-Part 1: Description of technique. Stefania Fatone and Ryan Caldwell

## Liner Selection

- TT liners are used to compress the limb to create a generic cylindrical shape, stiffening the soft tissues to achieve stability of the socket with respect to the residual limb,
- Heavily scarred or bulbous residual limbs can be addressed with a custom liner to ensure total contact
- Most limbs can be fit with an off-the-shelf TT liner
- TT liners are preferred as their non tapered, cylindrical profile provides a relatively high compression of the softer proximal tissues
- Recommend **downsizing the liner from 10%-30%** ensuring compression and total contact distally
- Liners which incorporate fabric are on the exterior surface are preferred, to wick air from between the liner and socket to maintain suction

### Recommended liners:

- Relax 3C Cushion: Users with Soft tissue
- Synergy Cushion: Users with firm tissue
- Seal-In X TF

<sup>6</sup>Prosthetics and Orthotics International: Northwestern University Flexible Subischial Vacuum Socket for persons with transfemoral amputation-Part 1: Description of technique. Stefania Fatone and Ryan Caldwell

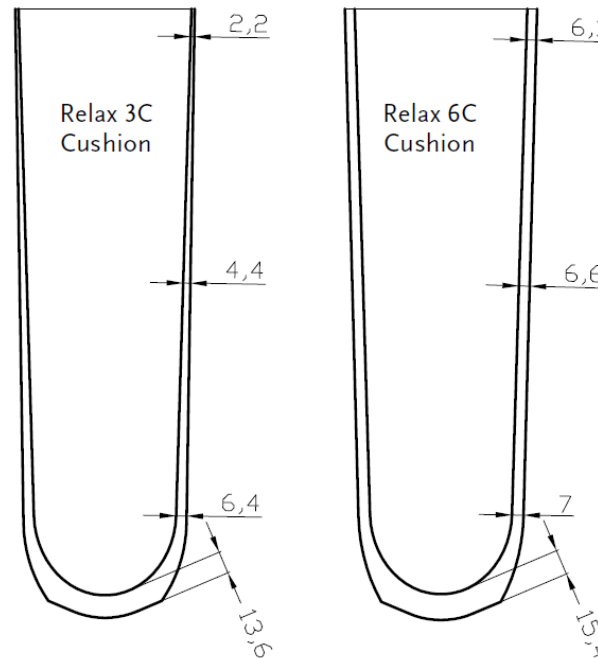
# Relax 3C Cushion

Silicone liner with a unique Umbrellan textile cover for phantom pain relief

User profile:

- Transtibial amputation
- Phantom pain, phantom sensations, idiopathic residual limb pain
- All K-levels
- 3 mm (3C) and 6 mm (6C)

The innovative Umbrellan knit – woven into the RELAX products – has a shielding action against electromagnetic influences and can help reduce, or even abolish, phantom pain and sensations – there are no known side effects for this. The efficacy has been proved by a scientific study and recognised by the allocation of a medical aid number by the central association of the German statutory health funds.



UMBRELLAN



FABRIC COVER

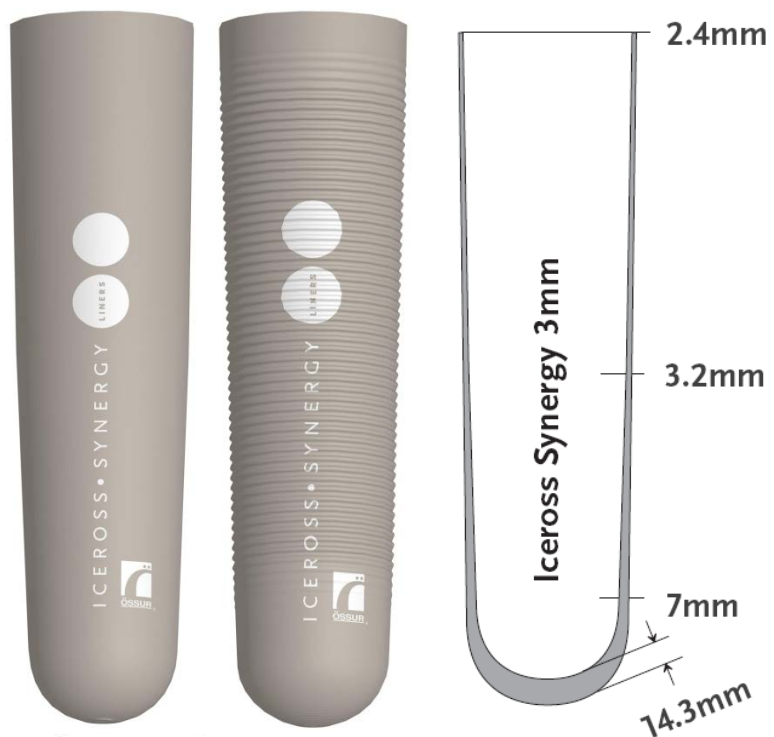
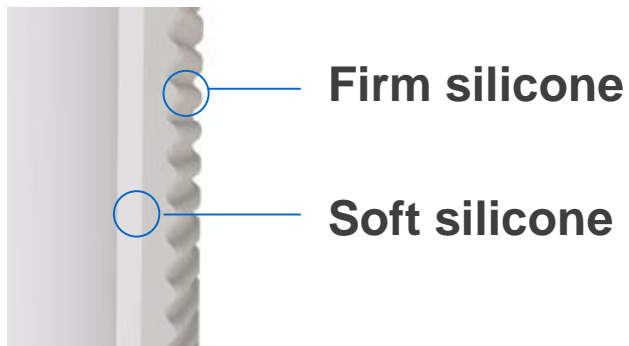


STABILIZING MATRIX



CUSHION

# Iceross® Synergy Cushion

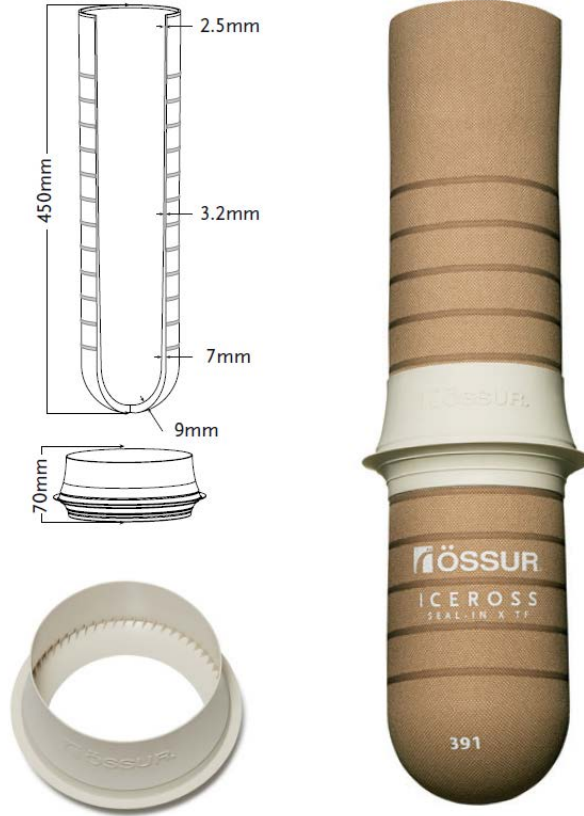


- Standard 3mm profile
- Soft & firm silicone layers offer soft tissue stability, cushioning and impact protection
- Outer layer Silicon- DermoSil® Firm durometer
- Inner layer Silicon- DermoGel® Softest durometer
- Active Skin Care:
  - Aloe Vera
  - Vaseline
  - Menthol
- Available only with cover:
  - Sizes 16-45 cm
- Matrix options:
  - 10cm
  - Custom (2-14cm)

Warranty: 9 months



# Iceross® Seal-In® X TF



- Use without Seal Rings for Nu-FlexSIV sockets
- Standard and Conical profiles
- Slightly stiffer to give better stability and support to proximal tissues
- Thinner distal thickness (9mm) for easier donning and better conformance to limb shapes
- Liner length 5cm longer- benefit long TF and KD users
- New textile cover with 2X adhesion strength and abrasion resistance compared to existing range



FABRIC COVER



ACTIVE SKIN CARE



SILKEN INNER SURFACE



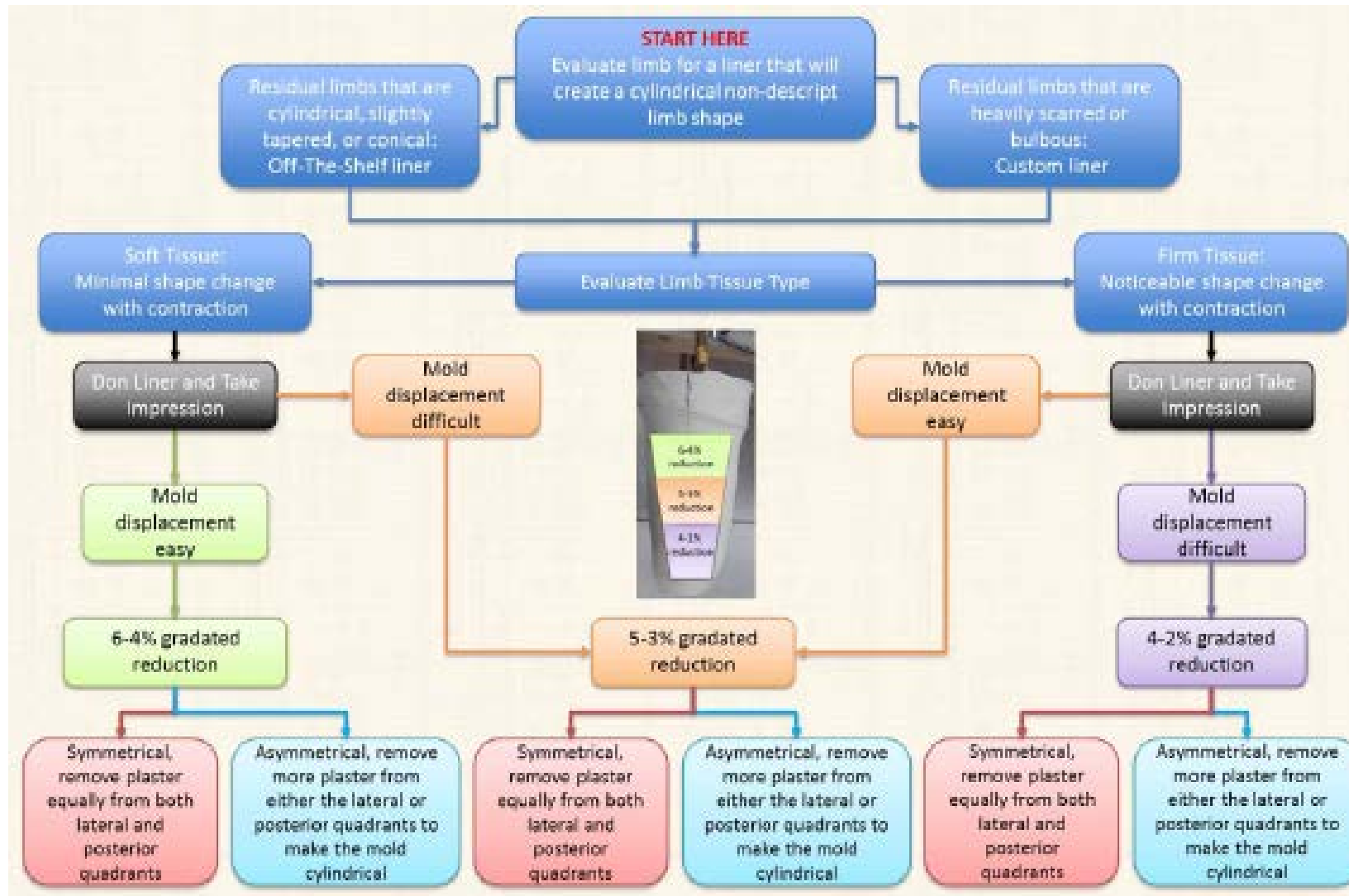
CONICAL

## Casting Technique

- Don liner ensuring proximal portion of liner sits at the gluteal fold and is deflected, this increases compression on residual limb and helps create the shape for casting
- Don thin sock and mark Anterior midline
- Measure in 3cm increments
- Snug M-L measure from proximal edge of liner at perineal level, noting how much compression can be achieved when pushing sub-trochanterically
- Cast with client sitting, with residual limb flexed and abducted using Fibreglass tape
- Start casting proximally on the lateral side, wrapping medially
- Take note of how easy/hard it is to remove the mould
- Classify the residual limb as symmetrical or asymmetrical



# Modification Algorithm



<sup>7</sup>Development of the Northwestern University Flexible Sub-Ischial Vacuum (NU-FlexSIV) Socket for Persons with Transfemoral Amputation Ryan Caldwell, CP/L FAAOP, and Stefania Fatone, PhD, BPO(Hons), Northwestern University Prosthetics-Orthotics Center (NUPOC)

## Determining tissue consistency

- Evaluate tissue consistency with the patient sitting down
- Classify the tissue as either soft or firm:

### Soft tissue:

- Minimal shape change with contraction

### Firm tissue:

- Noticeable shape change with contraction

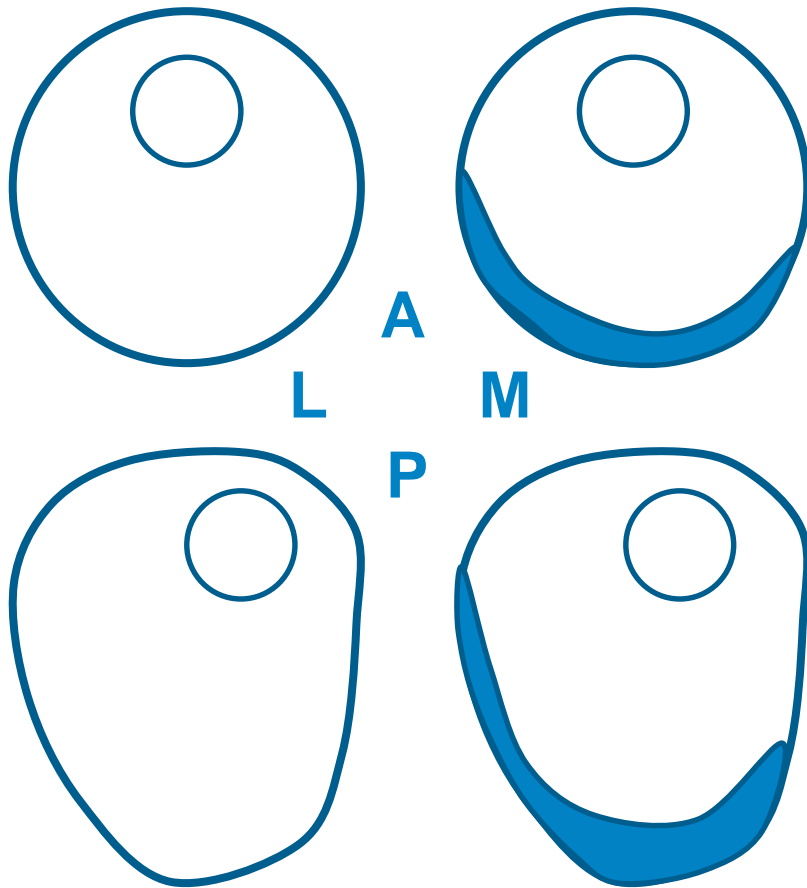


<sup>6</sup>Prosthetics and Orthotics International: Northwestern University Flexible Subischial Vacuum Socket for persons with transfemoral amputation-Part 1: Description of technique. Stefania Fatone and Ryan Caldwell



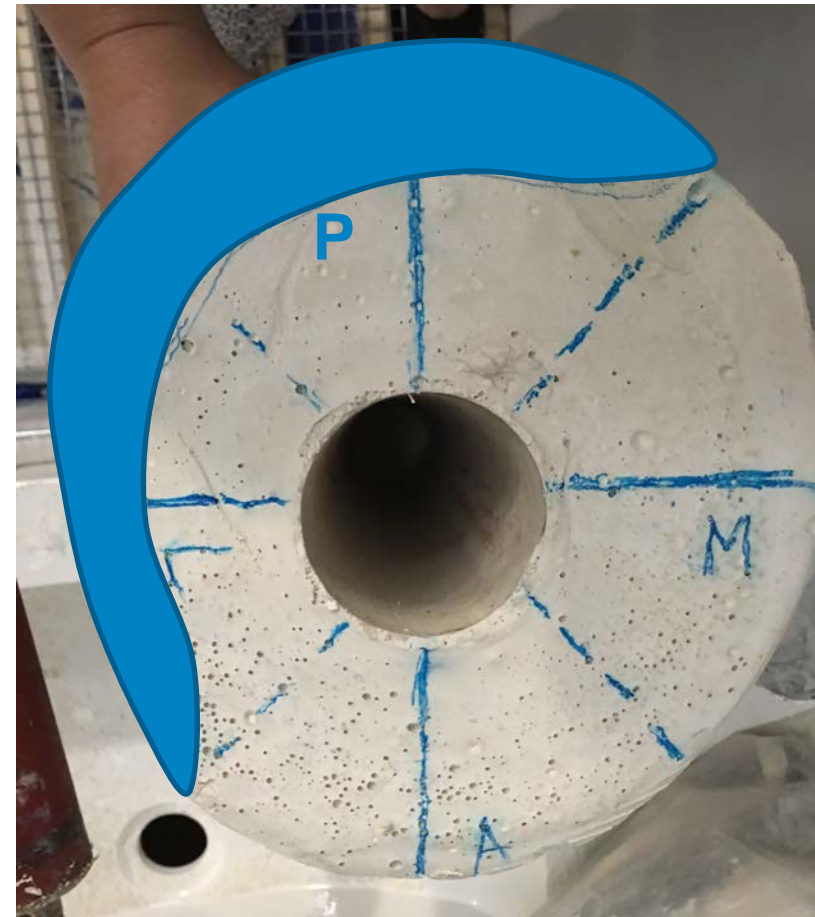
# Cast Modification

Symmetrical



Asymmetrical

 Plaster Removed



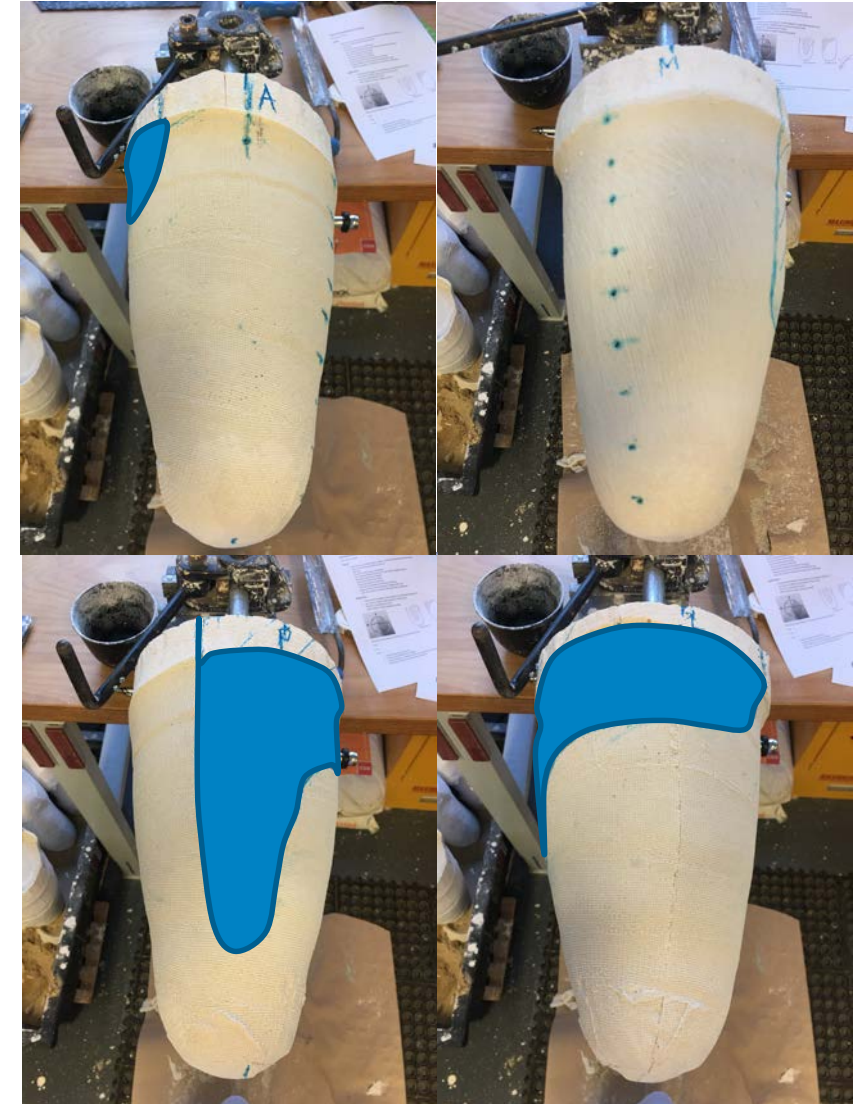
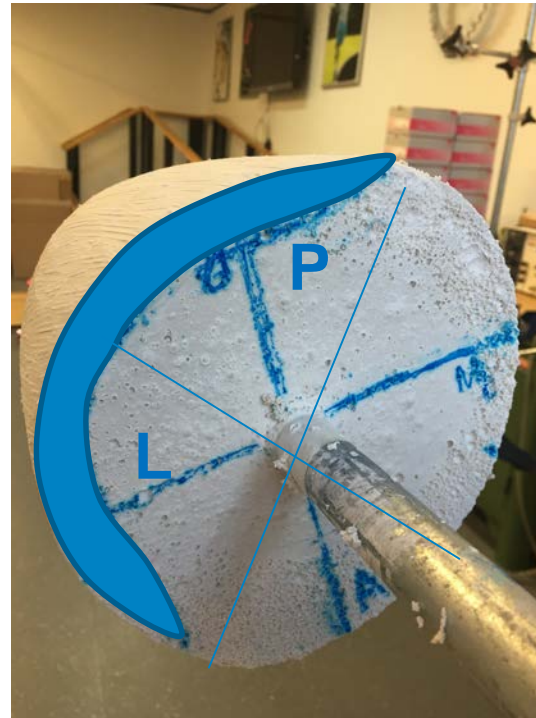
Asymmetrical cast example

<sup>6</sup>Prosthetics and Orthotics International: Northwestern University Flexible Subischial Vacuum Socket for persons with transfemoral amputation-Part 1: Description of technique. Stefania Fatone and Ryan Caldwell



# Modification

- Transfer Anterior reference mark and line of progression to positive model
- Reduce cast to recommended reductions
- Focus reduction in the proximal posterior and lateral area, flattening them into a 'boomerang' shape
- Blend in these modifications creating a round barrel like shape
- Smooth rest of cast removing any bumps



<sup>8</sup>Notes from AAOP meeting, Chicago Illinois, March 2017 "NU-FlexSIV workshop"

# Positive model



Anterior



Lateral



Posterior

<sup>8</sup>Notes from AAOP meeting, Chicago Illinois, March 2017 "NU-FlexSIV workshop"



## Evaluating check socket



- Assess circumferential volume using socks (BWS)
- Assess proximal trim lines- looking to sit 25mm below IT and 50mm below GT
- Deflect liner over proximal top of socket
- Seal using Iceross Sleeve to seal against deflected liner
- Check for lateral gapping
- Proximal tissue should feel firm

<sup>8</sup>Notes from AAOP meeting, Chicago Illinois, March 2017 "NU-FlexSIV workshop"

## Evaluating the check socket

- Recommend doing a static fitting on rigid check socket to assess volume on a standing frame
  - Once happy with volume proceed to dynamic alignment
- Typical socket adjustments will be in the posterior or lateral areas
- Recommend not to trial rigid socket any longer than initial check fit as the rigid check socket will not feel comfortable proximally and will also cut into the liner
- If happy with volume and shape of check socket go to definitive socket
- Elevated vacuum is not imperative however it has been shown to increase socket comfort
- Definitive Socket utilises Flex EVA (distributed by Össur) and carbon outer socket
  - Carbon socket trim lines cover 1/2 to 2/3 of flexible socket
  - Carbon socket can be lower on posterior side



<sup>8</sup>Notes from AAOP meeting, Chicago Illinois, March 2017 “NU-FlexSIV workshop”





## Definitive socket

- Materials:
  - Flex EVA White- 10mm: 1820610
  - Flex EVA White- 12mm: 1820612
  - Flex EVA White- 15mm: 1820615
  
- Casting tape: 404DP



## References

1. Board et al. (2001) J Int Prosth & Orth
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3. Beil, T. L.; Street, G. M.; Covey, S. J. Interface pressure during ambulation using suction and vacuum-assisted prosthetic sockets. J. Rehabil. Res. Dev. 39(6):693–700; 2002.
4. Goswami, J.; Lynn, R.; Street, G.; Harlander, M. Walking in a vacuum-assisted socket shifts the stump fluid balance. Prosthet. Orthot. Int. 27(2):107–113; 2003.
5. Sanders, Joan E., et al. Effects of elevated vacuum on in-socket residual limb fluid volume: case study results using bioimpedance analysis. Journal of Rehabilitation Research & Development, 2011, 48. Jg., Nr. 10.
6. Prosthetics and Orthotics International: Northwestern University Flexible Subischial Vacuum Socket for persons with transfemoral amputation-Part 1: Description of technique. Stefania Fatone and Ryan Caldwell
7. Development of the Northwestern University Flexible Sub-Ischial Vacuum (NU-FlexSIV) Socket for Persons with Transfemoral Amputation Ryan Caldwell, CP/L FAAOP, and Stefania Fatone, PhD, BPO(Hons), Northwestern University Prosthetics-Orthotics Center (NUPOC)
8. Notes from AAOP meeting, Chicago Illinois, March 2017 “NU-FlexSIV workshop’

Prosthetics and Orthotics International: Northwestern University Flexible Subischial Vacuum Socket for persons with transfemoral amputation: Part 2 Description and Preliminary evaluation. Stefania Fatone and Ryan Caldwell

AOPA workshop on Thursday 5<sup>th</sup> October



- This workshop will focus on subischial socket design with Unity Elevated vacuum system, in conjunction with training techniques for the Rheo Knee XC and a new microprocessor-controlled foot solution.
- Prescription considerations, client selection, and casting and modification techniques will be covered.
- The session will include a practical demonstration of the NU-FlexSIV subischial socket fitting method.
- Optimising mobility outcomes for clients will be covered in this practical workshop, with training methodologies demonstrated by Cathy Howells.
- The full range of Ossur mechanical knee solutions for K1-K4 users will also be reviewed including prescription considerations, fitting and adjustment techniques, and the PASO, an autoadaptive pneumatic knee.







# WE IMPROVE PEOPLE'S MOBILITY

