Total Surface Bearing Trans-Tibial Socket Design Impression Techniques

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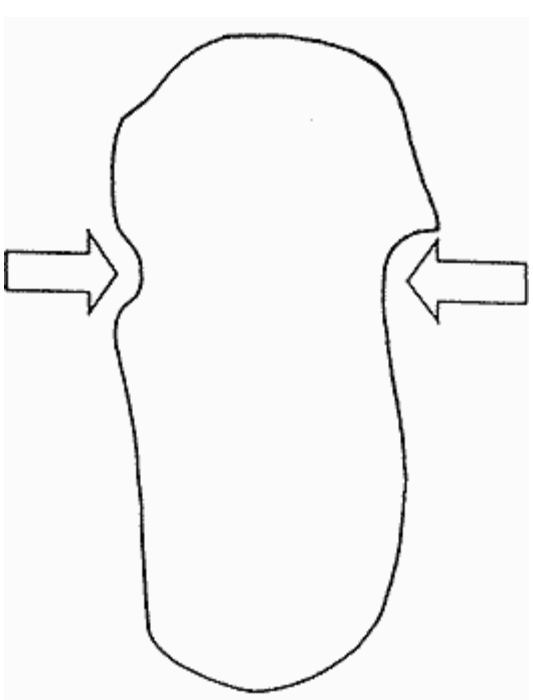
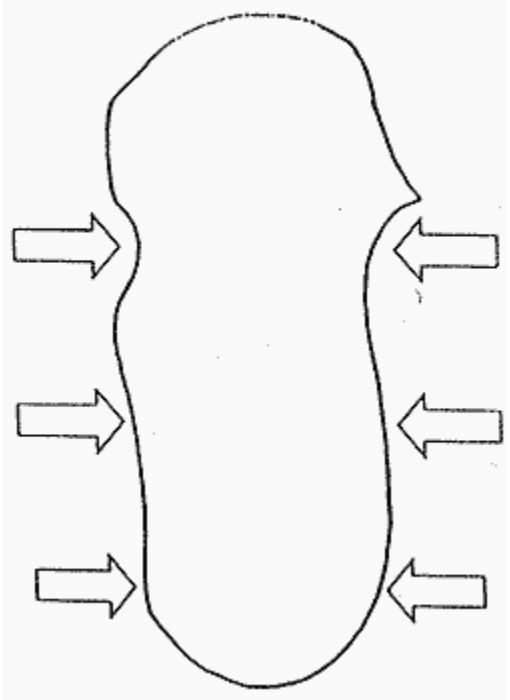
Agenda

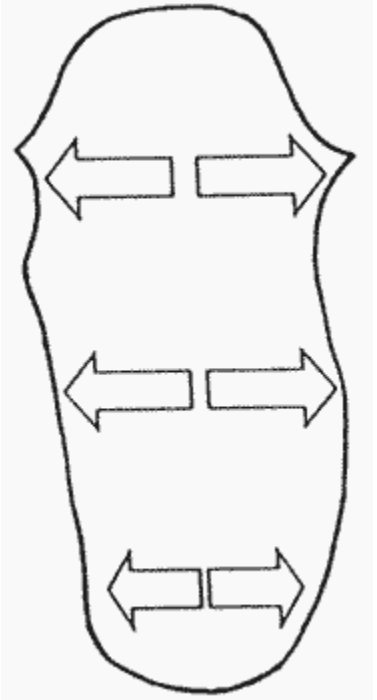
- Introduction
  - TSB
  - History
  - Hand casting
  - Negative pressure casting
  - Positive pressure casting
- Breakout session
  - Hands-On application

What is TSB

PTB vs. TSB vs. Hydrostatic







Kale, Conventional and Hydrostatic TT interface comparison, JPO, Vol 11, #4, Fall 1999

History

- Redhead
- Fillauer
- Staats
- Kristensen
- Others

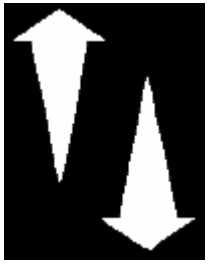
Patient comfort

- **Balanced and controlled socket environment**
- **No single force or combination of forces to reach a level of distress and damage tissue.**
- **Dr. Sanders and Dr. Burgess identify five forces inside the socket that can be managed but not eliminated.**

- Journal of Rehabilitation Research and Development Vol. 29 No. 4, 1992, Pages 1-8

Impact

Rotational



Sheer

Repetitive

Resultant

PTB vs TSB

- Pressure Focus
  - Specific Weight Bearing vs Equal Weight bearing
  - Volume Match

Specific-Weight Bearing Socket

Tight Anterior-Posterior
- round peg in the triangle hole
- constrict systems

Heavy emphasis on Patella Tendon
- creates high/low pressures
- increases shear force

Relief in socket design
- creates harbor for fluid retention
- decreases surface to distribute pressures

Total Surface Weight Bearing Socket

Anatomical Shape

- round peg in the round hole
- reduces forces implied by shape

Natural Anterior-Posterior shape

- does not constrict systems

Socket shape is determined by patient

- no relief to harbor fluids
- uses total limb surface to distribute pressures

Standard PTB Circular Wrap Cast

Making tucks in the plaster

Radcliffe-Foort PTB holding technique

Molding the medial flare of the Tibia

Holding AP while compressing ML

Dimpling shaft of fibula at mid-shaft

Light compression over lateral shaft of pre-tibial compartment

Compare ML of Cast to ML of stump: + 3/8" - 1/2" okay
THEN, Today ¼”

Compare AP of Cast to AP of Stump: +3/4" okay
Then, Today ½”

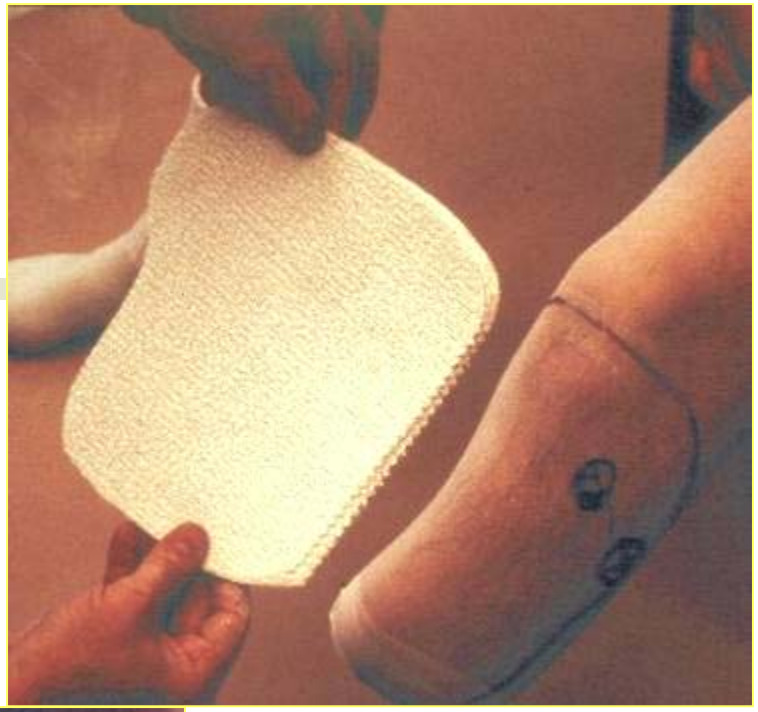
Compare length of Cast to Length of Stump: "On" dimension or long

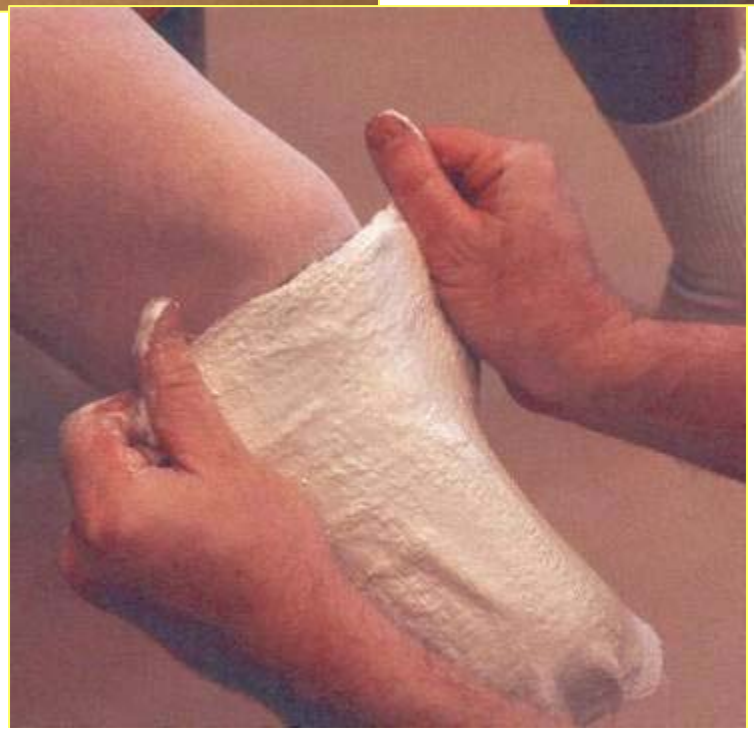
TSB Handcasting Technique

- Tim Staats UCLA 1985
- Carlton Filluaer
- Others

Carlton Fillauer at UCLA teaching 3 stage casting

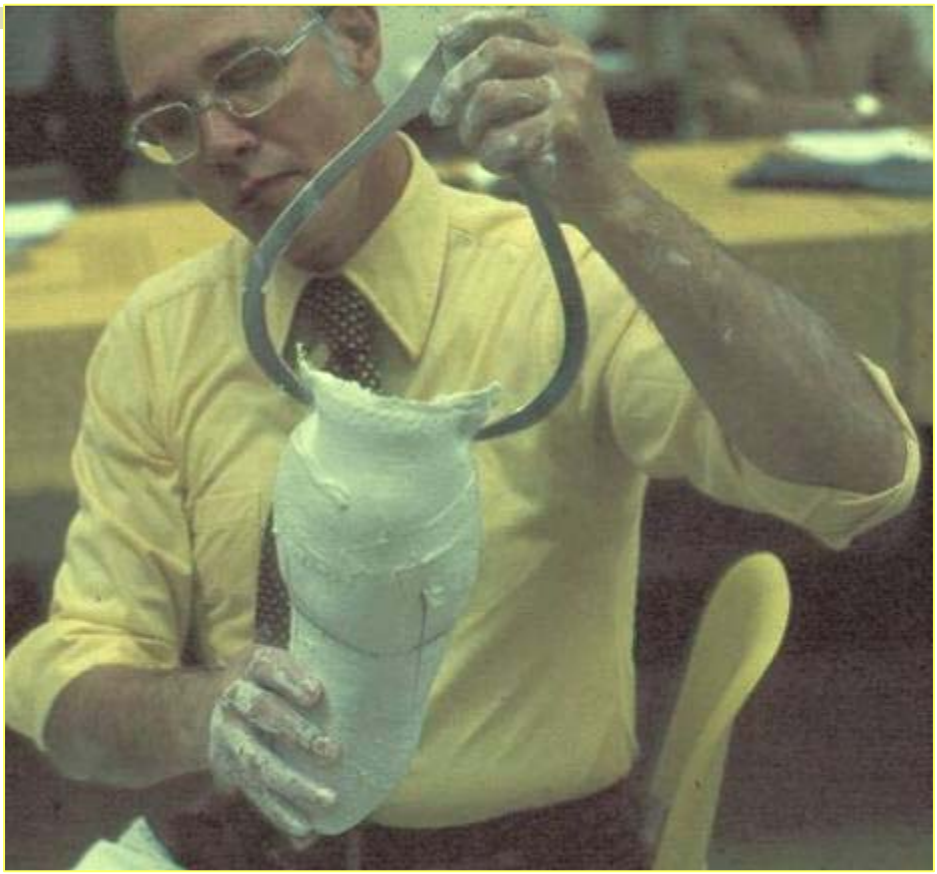
1st Stage encompasses anterior bony structures





Second stage is circular wrap to draw soft tissue up to MTP

Third stage for SC-SP if needed

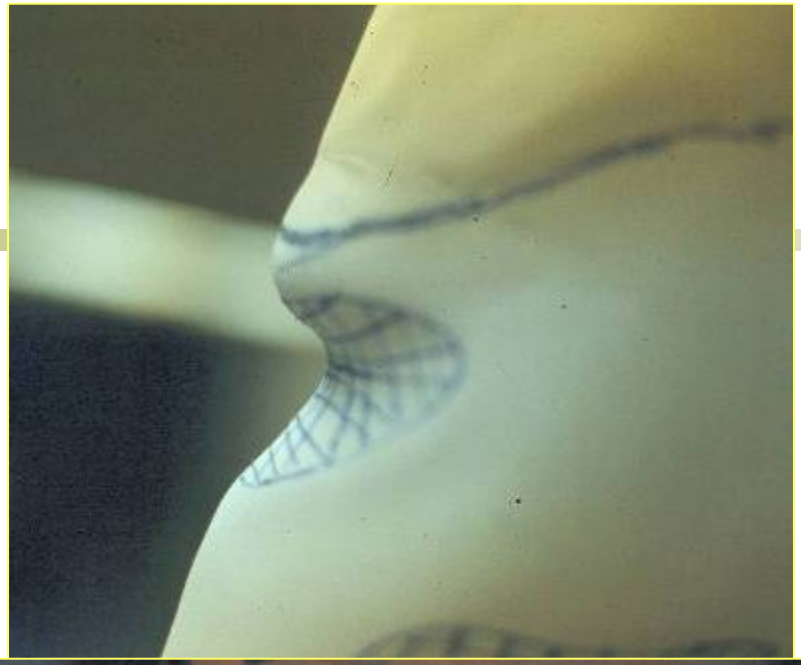


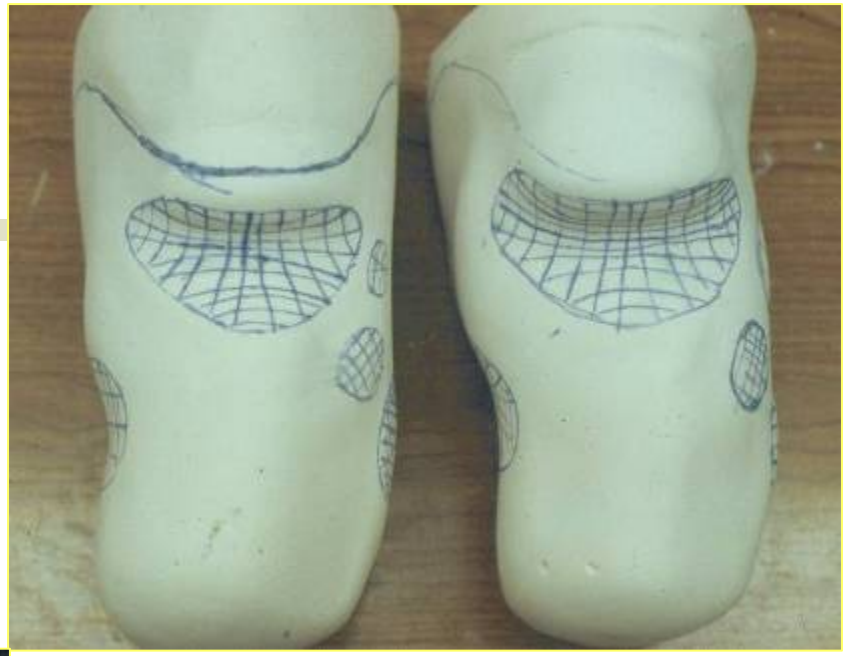
Fourth stage to capture hamstrings

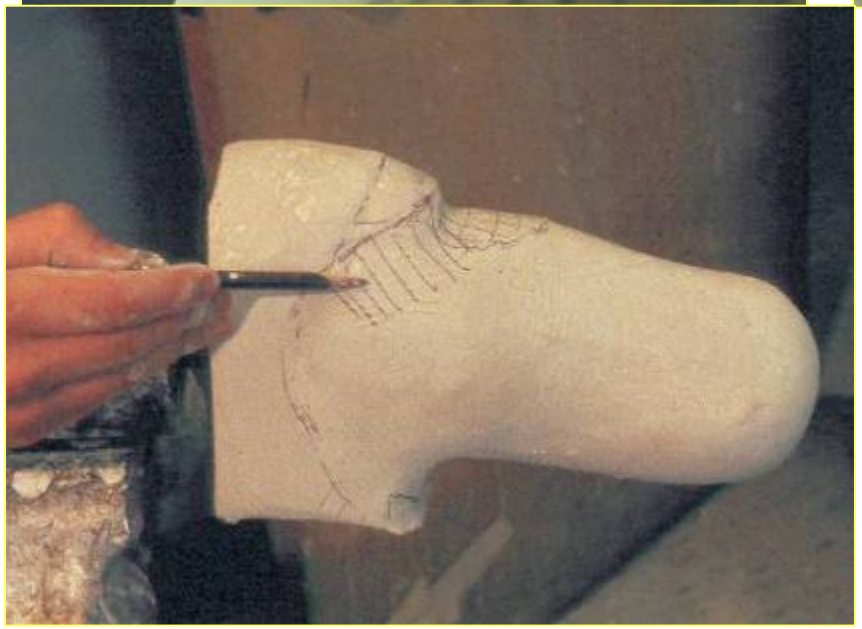
Other Techniques

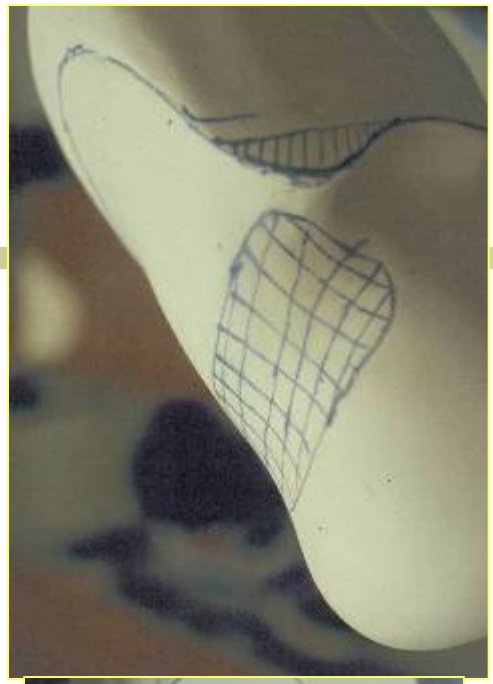
Modification of TSB Hand Cast

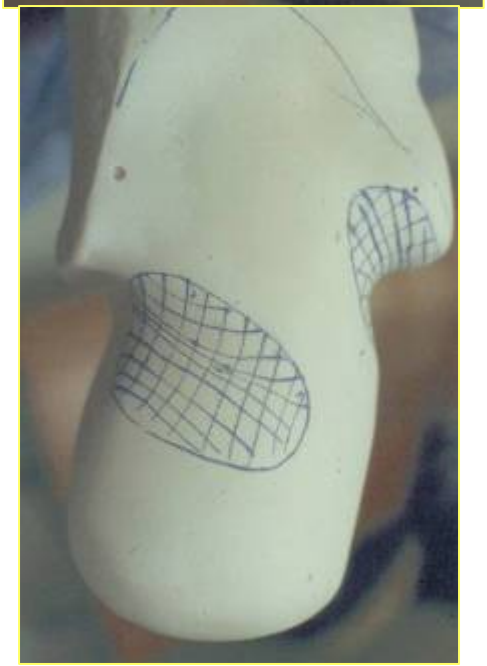
- Mild Patella Tendon impression
- Mild reduction around patella
- Volume reduction
- Hamstring relief
- No Build-Ups



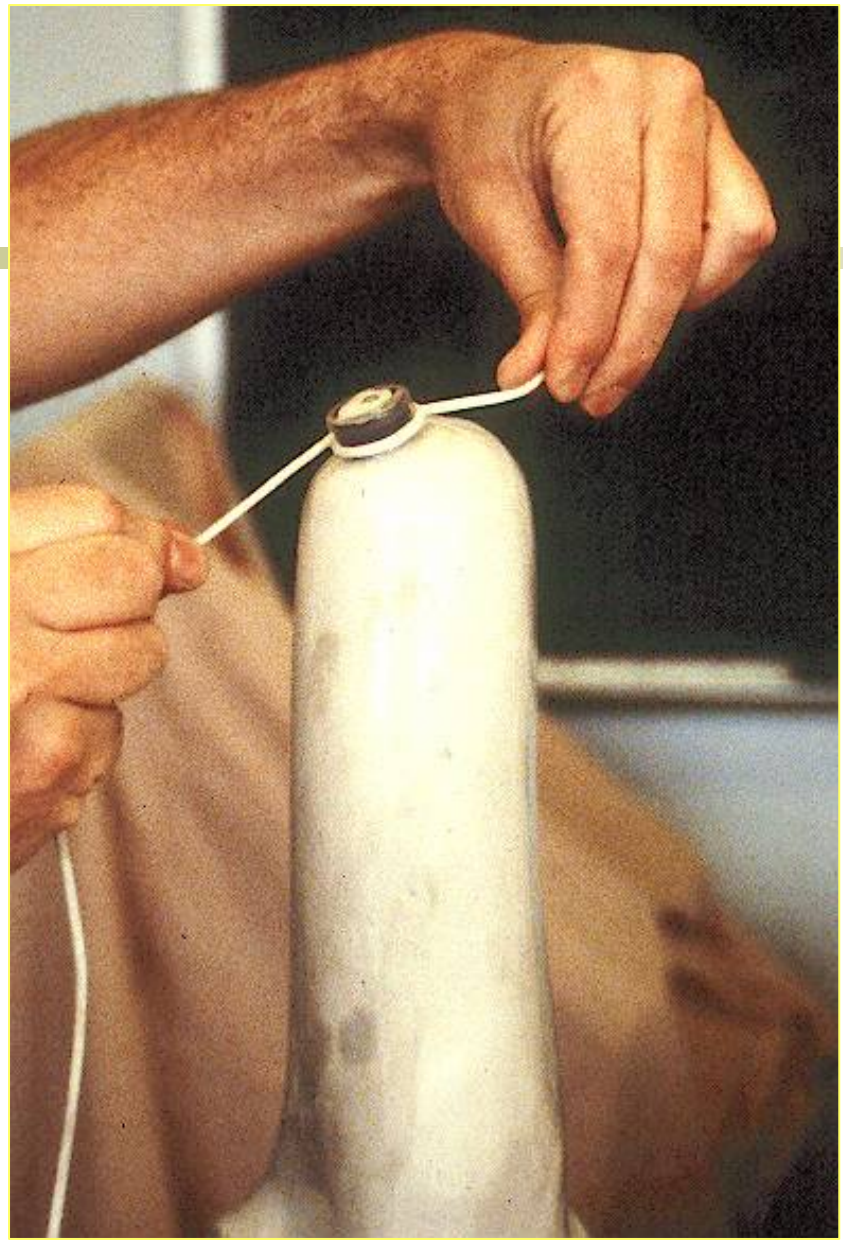


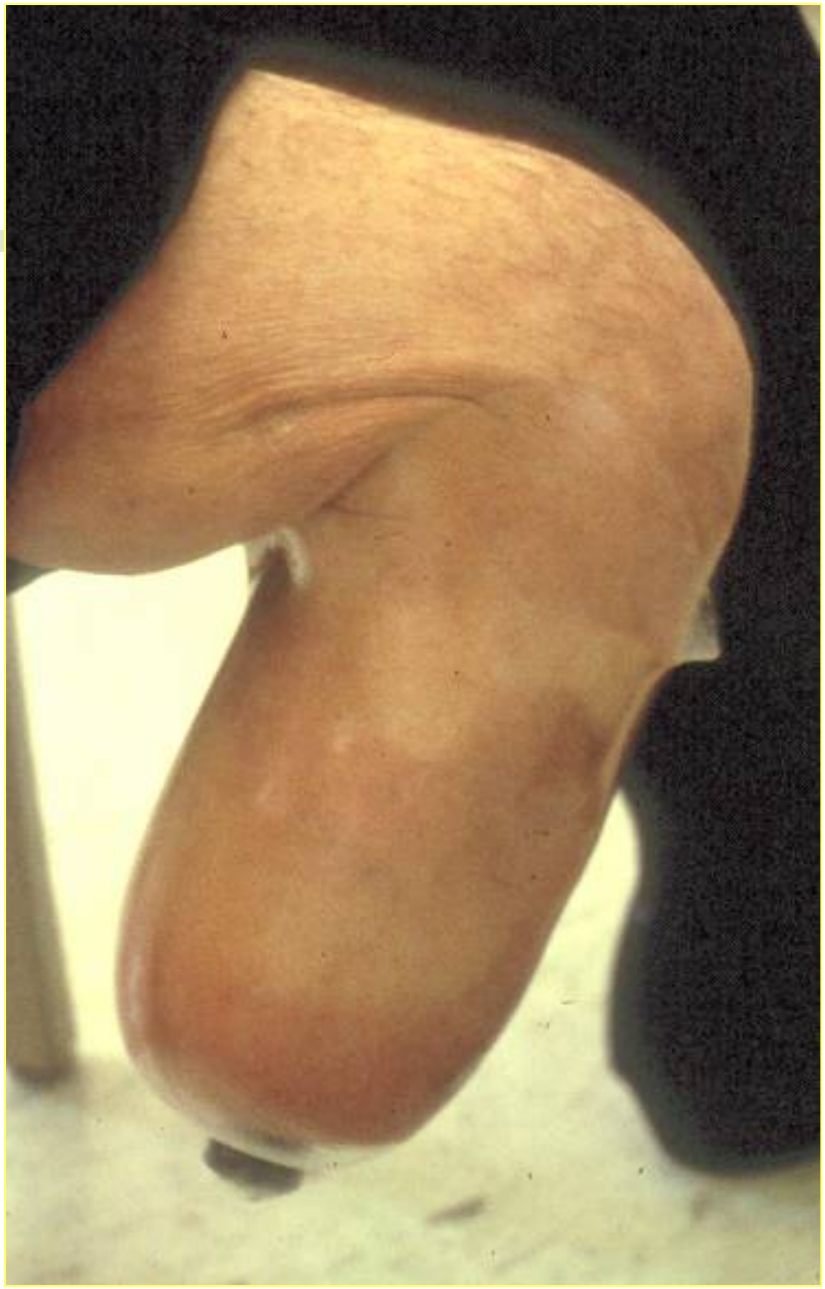


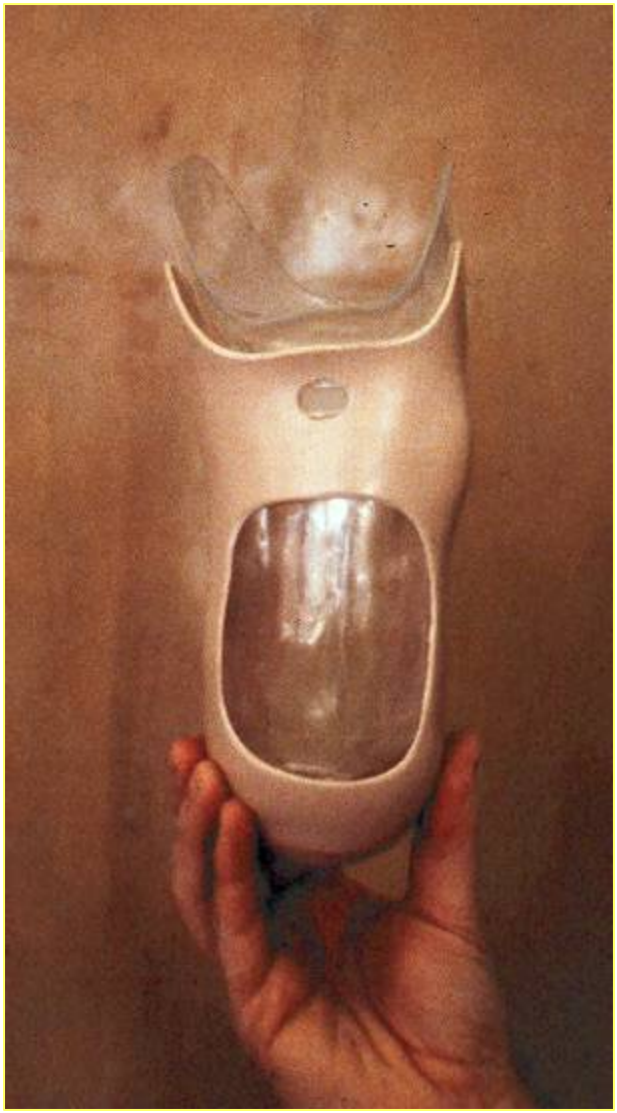




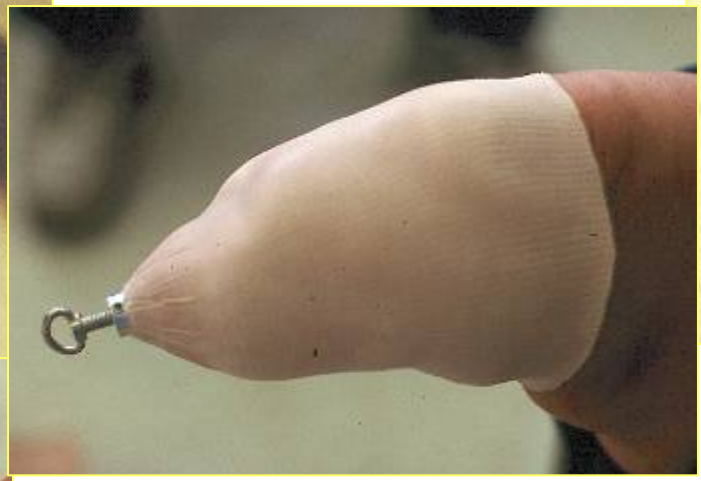
TSB Suction Socket with valve
1986

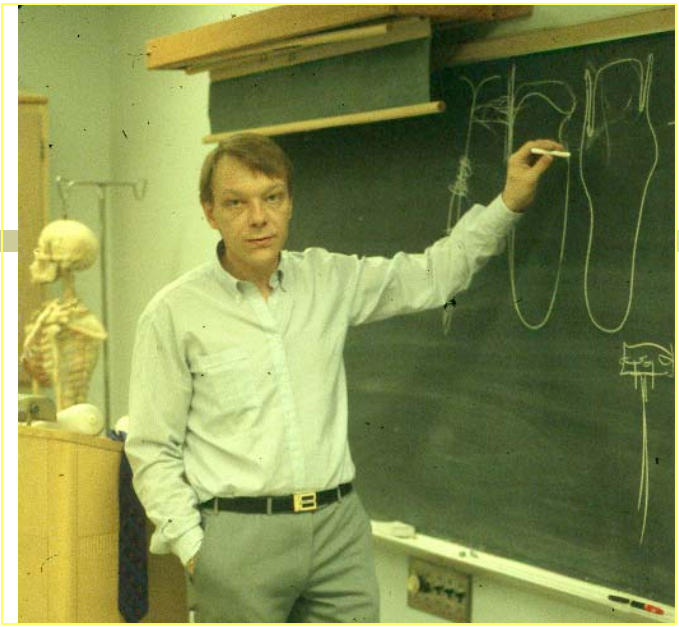


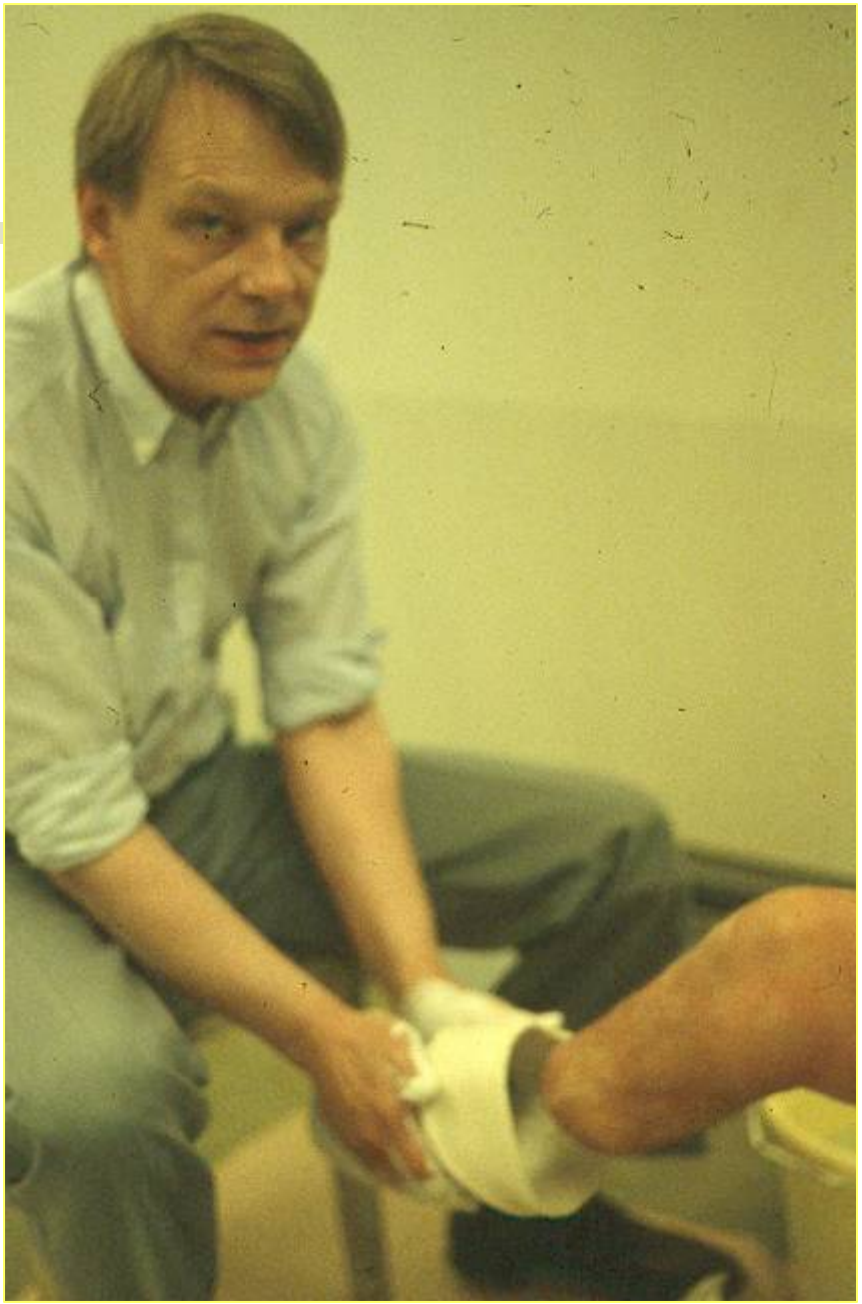




Variations including Surlyn and Pelite carriers with laminated sockets







Total Surface Weight Bearing Socket Design Casting Technique for Suction and Elevated Vacuum Systems

Michael R. Leach, CPO

Otto Bock HealthCare

“The Gods are in the details”

- Systems approach
- Interdependence between the casting technique, modifications, liner interface material and problem solving
- All aspects must be integrated for optimal outcomes

Harmony Liner Recommendations

- Urethane Interface Material
  - Only material that will flow under vacuum
- Custom
  - Better fit on thigh and limb
  - Tapered from MPT to top
  - Built in knee flexion
- Uncovered
  - Sleeve will seal on top of liner not on skin
- Tapered
  - Thin proximal is more comfortable under vacuum

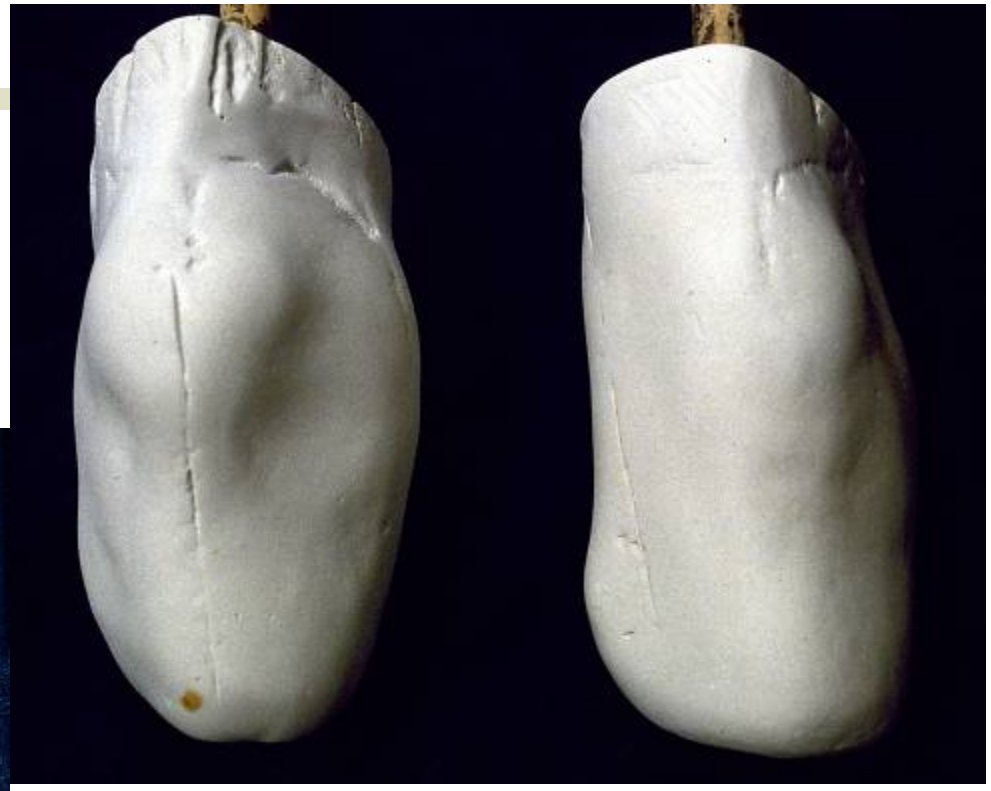
Casting for the Custom Liner

- Don thin casting sock
- Take measurements per form
- Figure eight wrap with rigid plaster
- 10 degrees of knee flexion
- 6” Proximal to the superior border of the patella
- Use vacuum

Three Stage Casting Technique

Anterior

- 30 degrees flexion
- 0 degrees



Posterior

- 30 degrees flexion
- 0 degrees

Casting Preparation

- Apply Sensi-Care to residual limb
- Don custom urethane liner noting correct orientation
- Work air out of liner
- Apply nylon over the liner terminating 1 – 2”

  distal to the liners proximal edge

Casting

Casting Stage 1

- Capture Femoral Condyles
- Prepare 6 layer plaster splint
- Midline to midline, distal half of patella to tibial tubercle
- 80 degrees of knee flexion
- Apply 2 layers of nylon over splint
- Apply casting balloon, sealing against liner proximally

Casting Stage 2

- Capture remaining bony anatomy including fibular head
- Prepare 6 layer plaster splint
- Midline to midline including fibular head
- Terminate 1/8”-I/4” proximal to distal end of tibia
- 5-10 degrees of knee flexion
- Apply 2 layers of nylon over splint
- Apply casting balloon over nylons

Casting

Casting Stage 3

- Capture volume
- Circumferential wrap terminating proximal to the patella
- 5-10 degrees of knee flexion
- Apply 4 layers of nylon over cast
- Apply casting balloon over nylon
- Apply 15” Hg - 20” Hg
- Manage redundant tissue

Vacuum Casting Review

- 3 part cast to capture anatomical differences between flexion and extension
  - First anterior shell ≈ 80 degrees flexion midline to midline
  - Second anterior shell 5 -10 degrees include fib head
  - Circumferential cast over anterior shell 5 -10 degrees
- Vacuum captures true limb shape
- Consistency and reproducibility
- Cast over liner being fit
- Hands Off

Modification

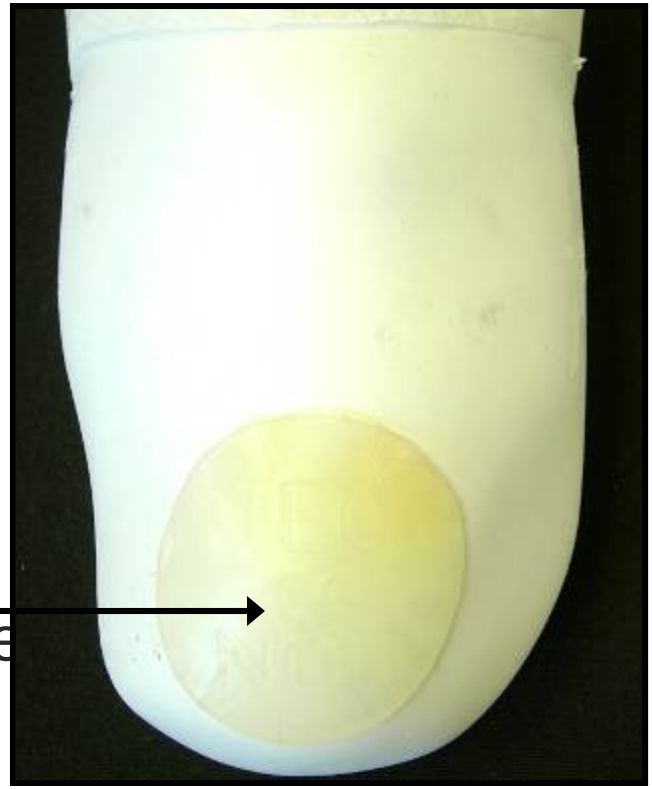
Modification, cont.

Modification, cont.

Modification, cont.

Modification

- Why Reduce?
  - Create the drive/flow of the liner in TSB socket
- Global Circumferential 4% reduction
- ¼” distal reduction mandatory
- No relief's or voids
  - Can create a relief using a urethane Spot
- Utilize scribing tool if needed to verify reduction



Socket Design Considerations

- **MUST be total surface weight bearing**
- **No more than 3-ply fit**
- **No built-in relief's or voids**
- **No single wall sockets in a supracondylar or suprapatella/supracondylar configuration**

In Conclusion for negative pressure technique

- Type of suspension (pin, suction, elevated vacuum) will often direct you to you liner material (silicones, urethanes, TPE).
- Means of suspension will often lead you to your casting technique
- Every patient is unique type of suspension, liner material, and socket designs are dictated by clinical presentations.
- No one method, technique or approach is appropriate for everyone.
- Study, learn, practice, and become experts through repetition. Have a deep tool box.

Transtibial Pressure Casting with ICECAST® Anatomy

Ian Fothergill, CPO

Total Surface Bearing

DEFINITION

- Volume match, Residual Limb - Socket
- 100% surface contact maintained during gait cycle.

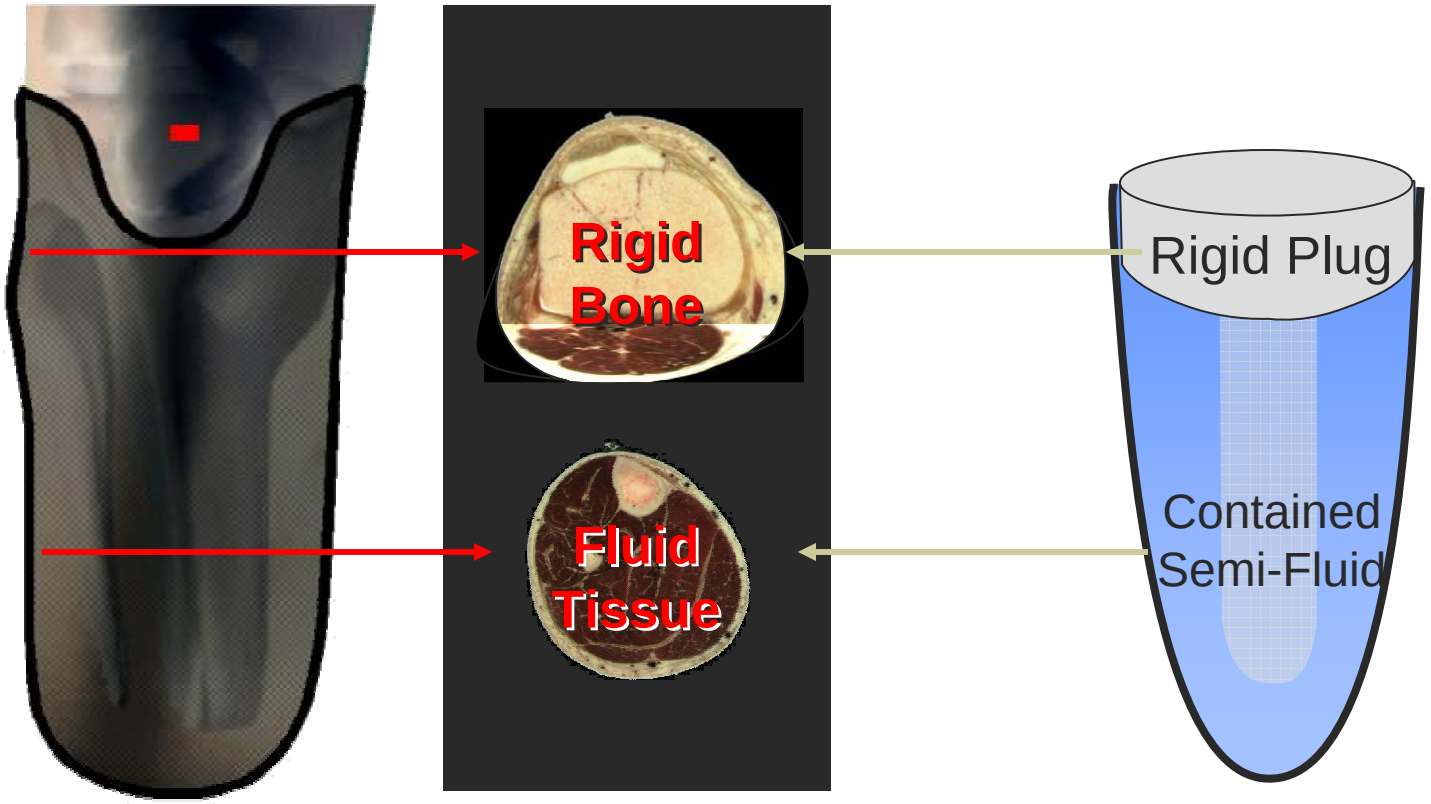
SUCESSFUL FITTIING REQUIRES

- Control of soft tissue
- Minimized pressure peaks
- Distribution of load over max surface area

Pressure Casting Technique

- Ensures Total Surface Bearing
- “Positive Pressure” re-distributes tissue
- Minimizes required modifications
- Provides Consistent Results

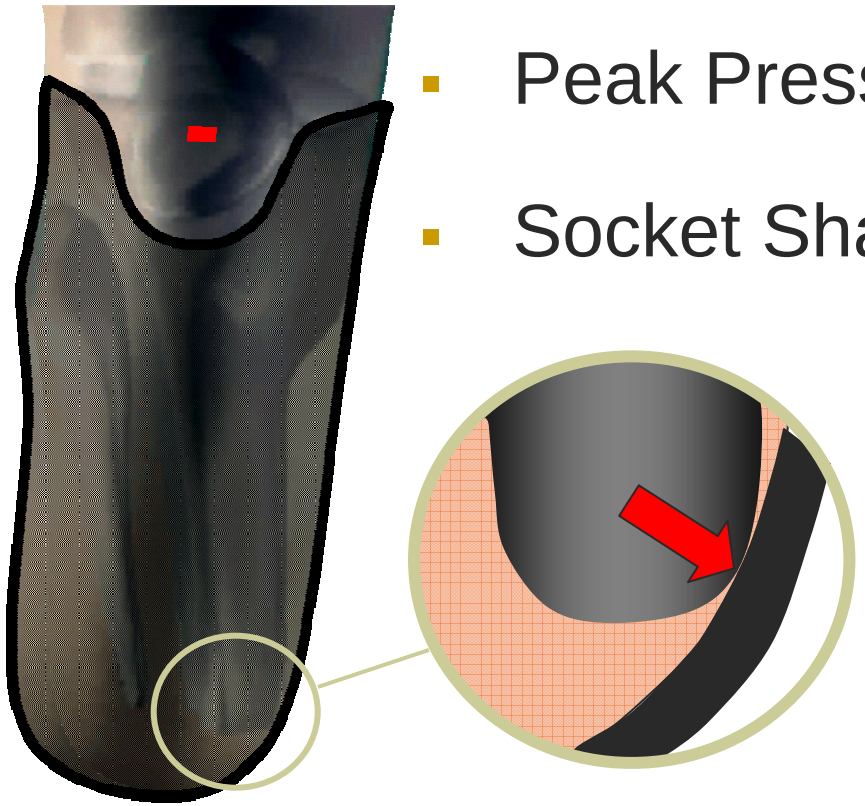
PRESSURE CASTING – OBJECTIVES
Quasi-Hydrostatic Loading



PRESSURE CASTING – OBJECTIVES
Quasi-Hydrostatic Loading

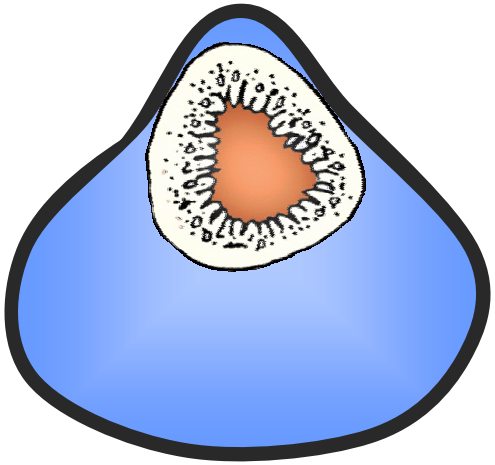
- Minimal movement of bone in relation to socket
- Reduced Shear Forces
- Even distribution of load through soft tissue
- Optimized with Pressure Casting

PRESSURE CASTING – OBJECTIVES
Dynamic Comfort



- Peak Pressure redistribution
- Socket Shaping

PRESSURE CASTING – OBJECTIVES
Rotational Control



- Socket shape stabilizes the skeleton.
- “Anatomical Shaping” required in socket

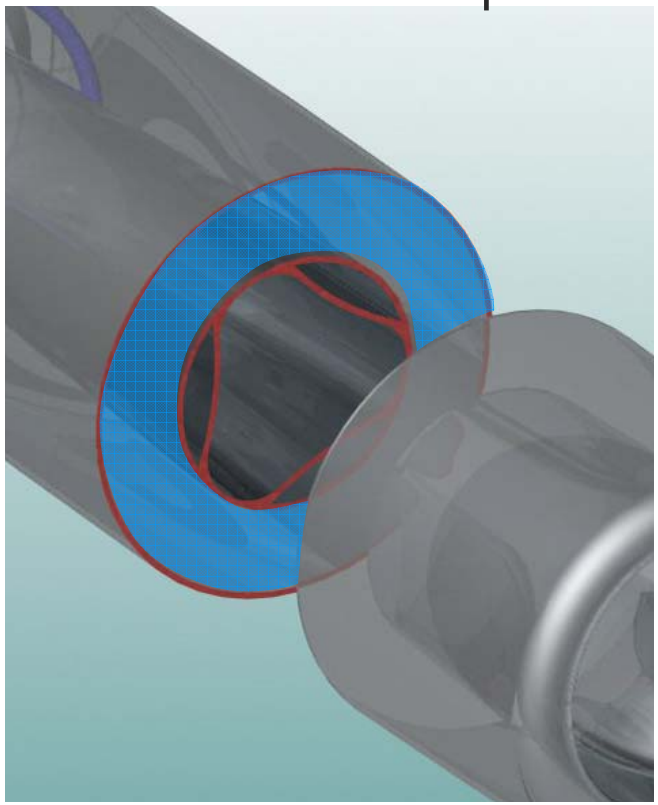
ICECAST® Anatomy

Icecast Anatomy

Casting Bladder

Main Chamber

Provides “total surface” pressure

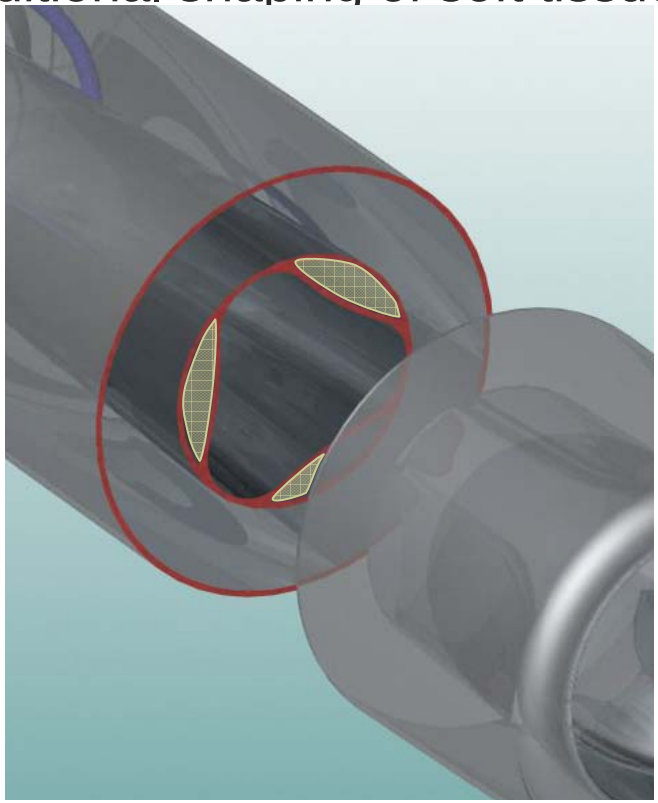


Icecast Anatomy

Casting Bladder

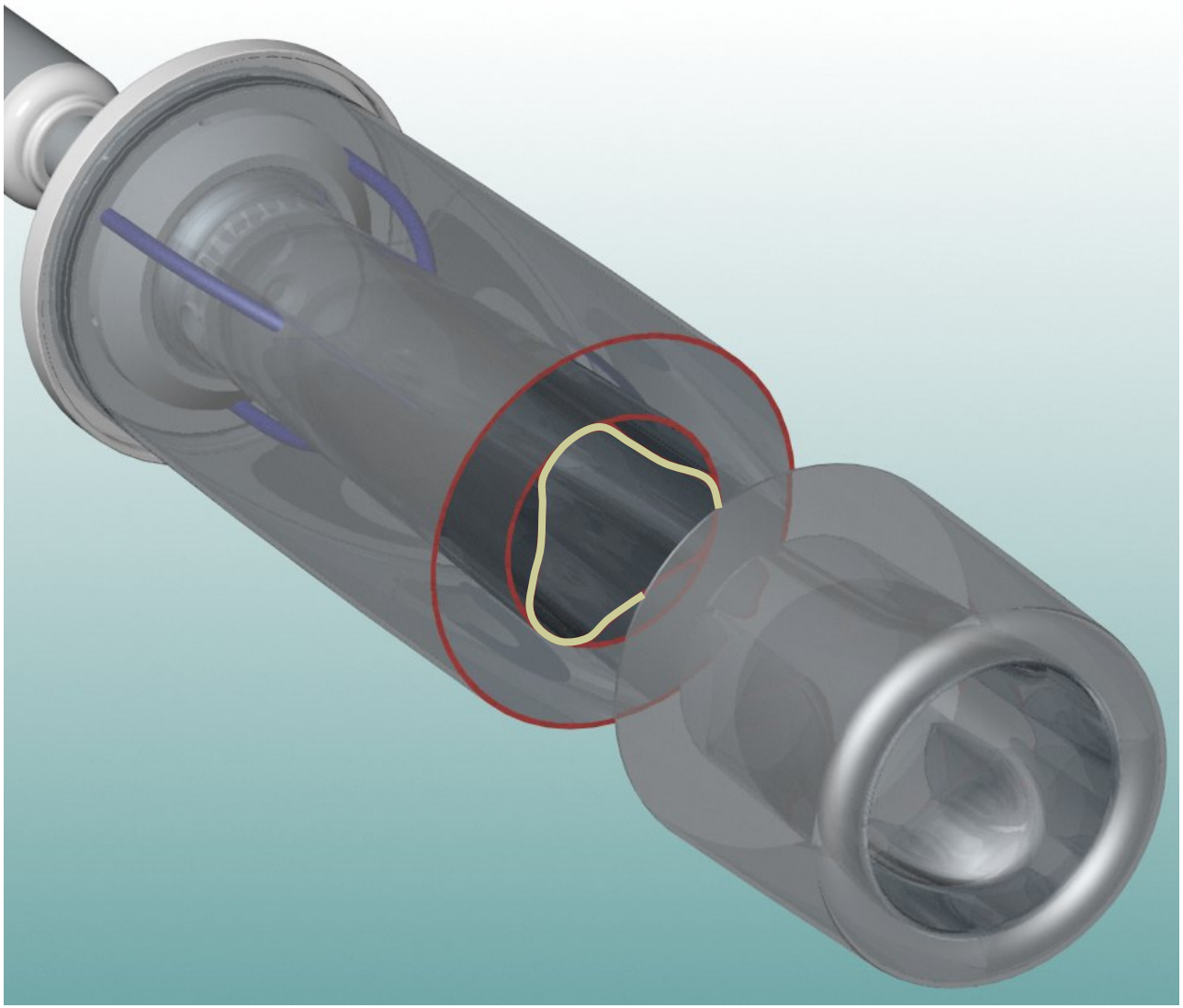
Contour Cell™ Shaping Chambers

Additional shaping of soft tissue



Icecast Anatomy

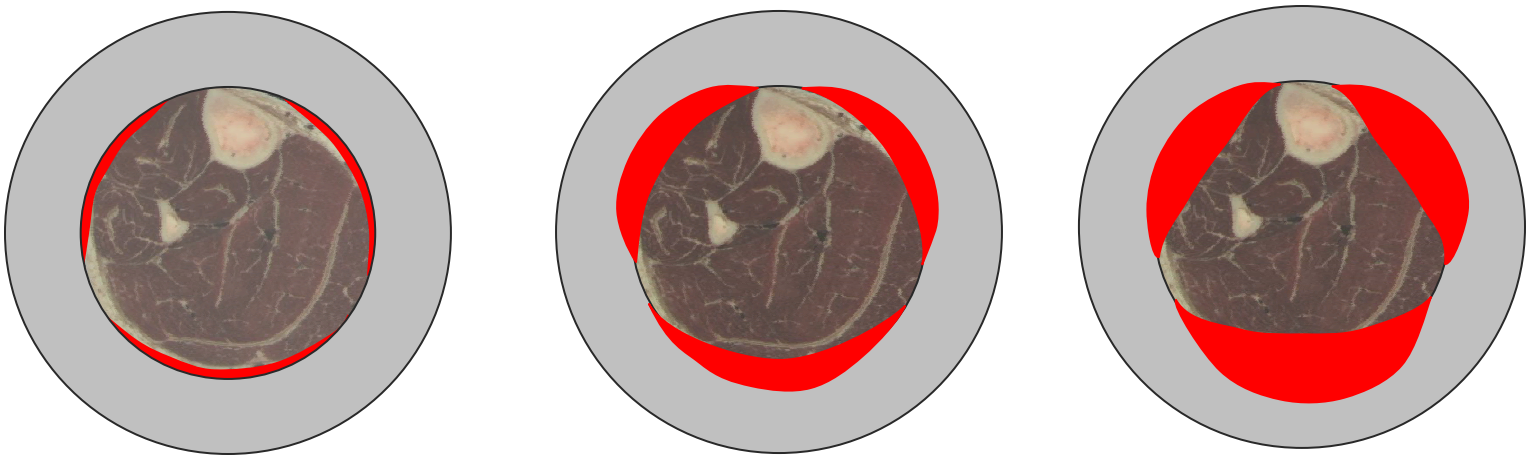
Casting Bladder



Icecast Anatomy

ContourCell™ Shaping Chambers

Effect of Different Pressures



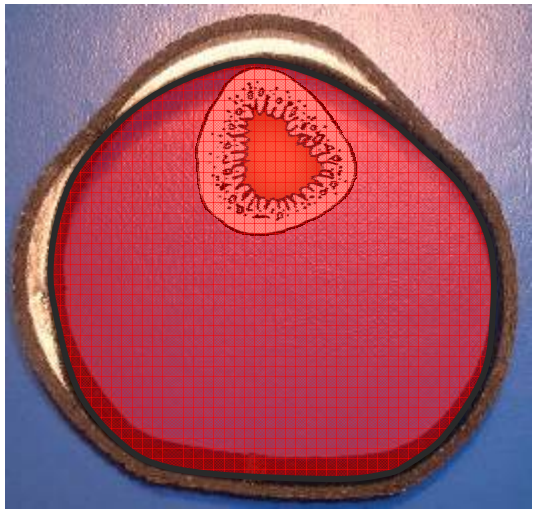
No Additional Shaping

Gentle Shaping

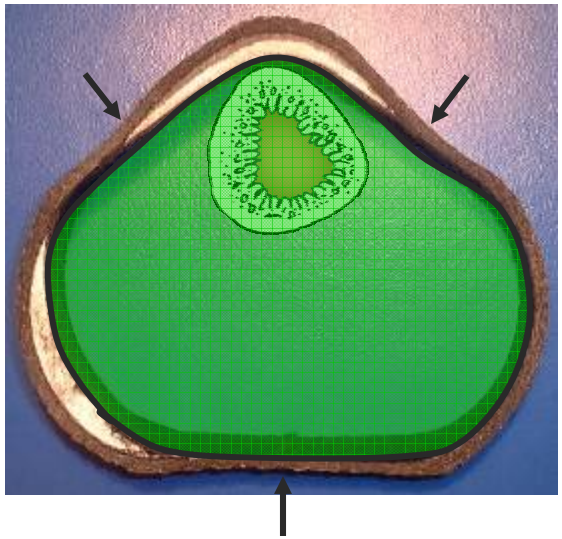
Moderate Shaping

Icecast Anatomy

ContourCell™ Shaping Chambers



Icecast Compact
(previous design)



Icecast Anatomy

Icecast Anatomy

ContourCell™ Shaping Chambers

Positioned over soft tissue areas

- Para-Tibial
- Supracondylar
- *Popliteal*

Shaping of soft tissue

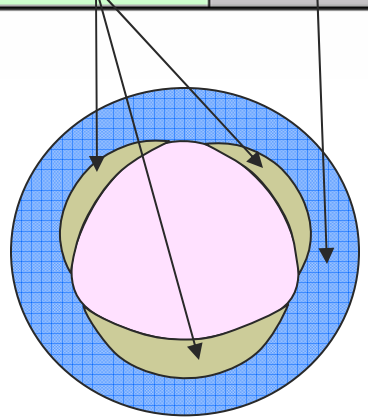
Icecast Anatomy

Pressure Guide

Pressures Chart

		FLESHY		MUSCULAR		BONY	
		Contour Cell™	Main Chamber	Contour Cell™	Main Chamber	Contour Cell™	Main Chamber
ACTIVITY	LOW	*40*	*60*	*50*	*60*	*60*	*60*
	MED	*50*	*80*	*60*	*80*	*70*	*80*
	HIGH	*60*	*100*	*70*	*100*	*80*	*100*

* All values in mmHg



Thank You!!!

Please select a technique you would like to master and go to the work station