

# 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)

## Background

Current transfemoral prosthetic sockets restrict function, lack comfort and cause residual limb problems. Although designed to support the body and enable effective load transfer during walking and other activities (1), prosthetic sockets interface with soft tissues that are neither accustomed nor well-suited to the high pressure and shear loading that occurs during prosthetic ambulation (2). Despite high daily use, lack of socket comfort is the most common complaint of prosthesis users (3-6). Residual limb skin problems have been reported by 25% to 63% of persons with amputation with a negative influence on ability to perform household tasks, prosthesis use, social functioning, and participation in sports (3, 7-9). The development and availability of a more comfortable and possibly functional socket may contribute to improving quality of life of persons with TF amputation.

## NU-FlexSIV Socket

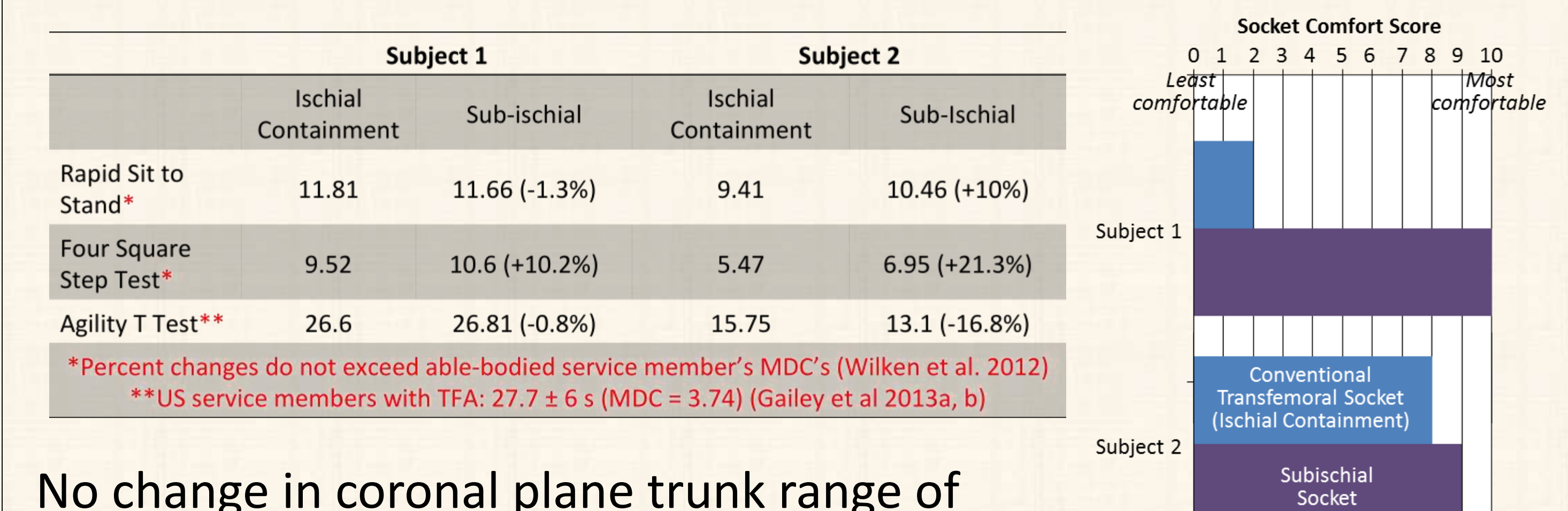
### Novel Sub-Ischial Transfemoral Socket



- Lower proximal trim lines
  - Flexible socket construction
  - Vacuum assisted suspension
- Improve comfort and possibly function

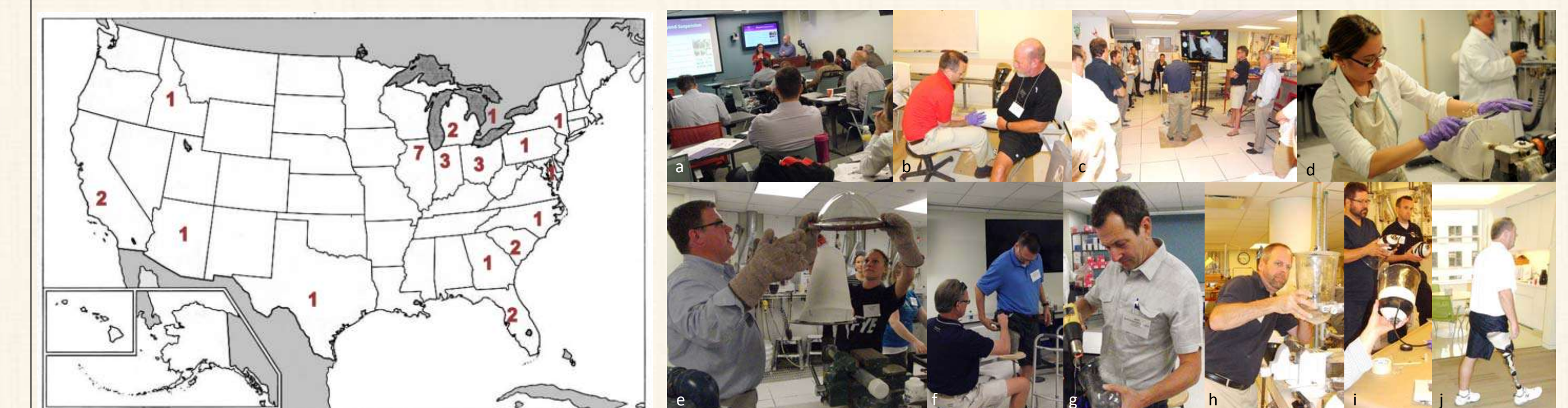
## B. Preliminary performance results on two test subjects

	Subject 1	Subject 2
Age	29	26
Sex	M	M
Height (cm)	181	188
Weight (kg)	84.4	89.6
Amputation	R TFA	L KDA
Cause of Amputation	Trauma	Tumor
Time since Amputation	9 years	15 years
Activity Level	Very active (construction worker)	Very active (athletic trainer)



No change in coronal plane trunk range of motion and inconsistent changes in hip extension during walking.

## C. Dissemination of the technique to prosthetists



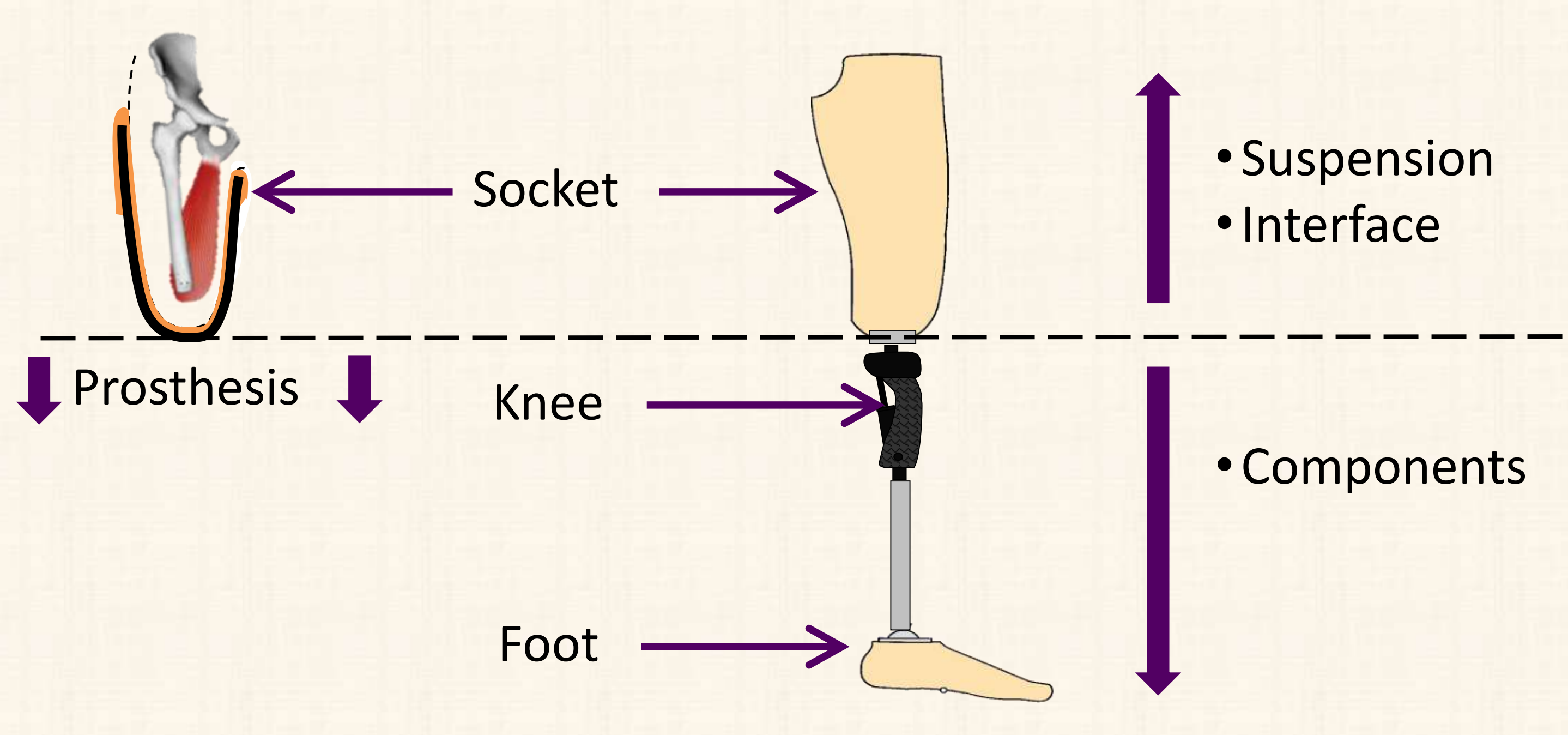
Trained 30 Certified Prosthetists from around North America in 2015 through continuing education, hands-on workshops. Additional national and international workshops scheduled for 2016.

## Conclusions

The NU-FlexSIV Socket is the first teachable sub-ischial socket technique that results in improved comfort and comparable function to ischial containment sockets.

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### Orientation to a Transfemoral Prosthesis



### Purpose of the Project

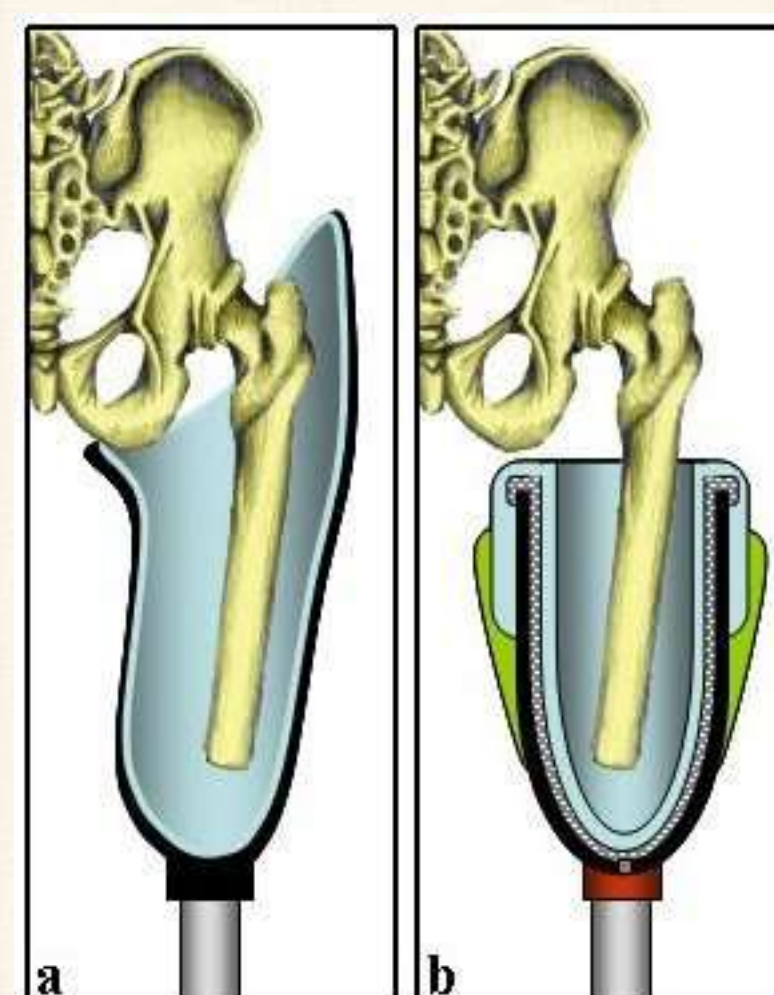
To develop a more comfortable socket technology for highly active persons with transfemoral amputations (TFA).

- Develop the clinical technique for socket fitting and fabrication
- Perform preliminary performance tests
- Disseminate the technique to prosthetists

### Transfemoral Socket Design Comparison

#### Ischial Containment (Standard of Care)

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

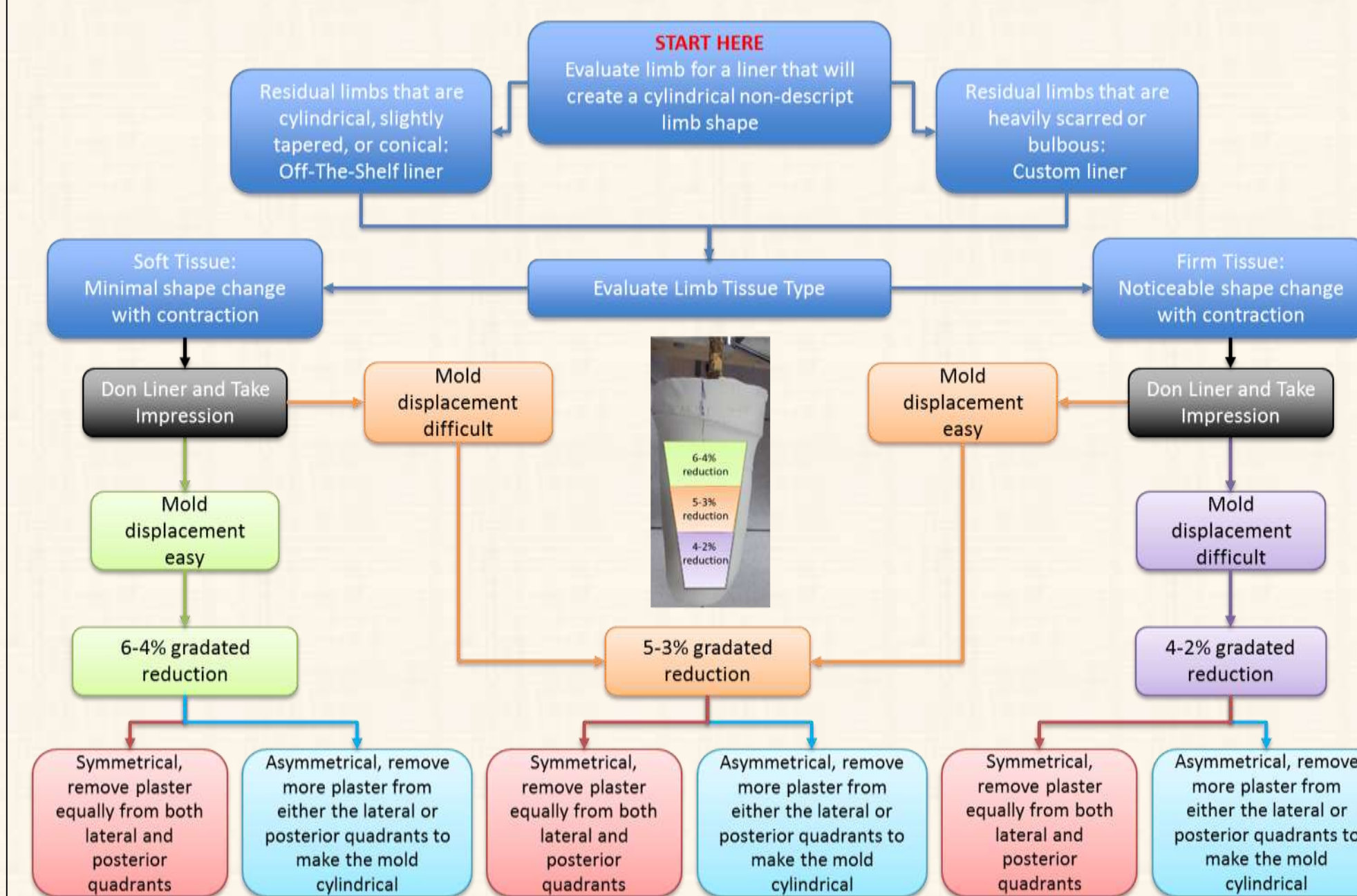


#### NU-FlexSIV (New Design)

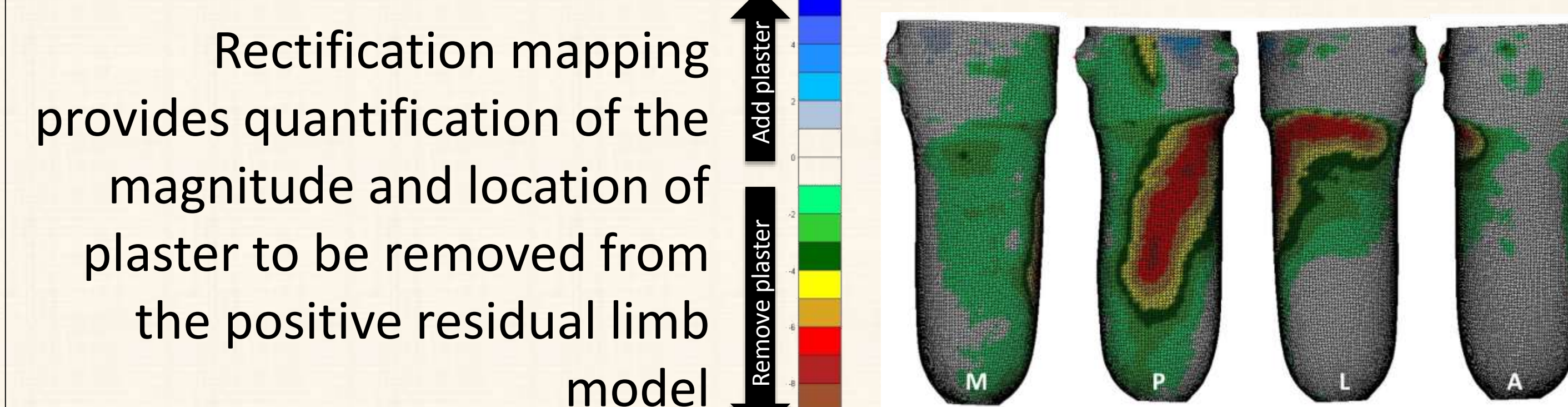
Trim lines typically 25mm distal to the ischial tuberosity do not impinge on the pelvis

### A. Clinical technique for NU-FlexSIV fabrication and fitting

Novel to our technique is use of a transtibial silicone liner for a transfemoral limb along with casting the limb in a sitting position



Clinical decision making algorithm assists the prosthetists with residual limb evaluation, liner selection, and mold reductions



Fabrication of both flexible check socket and final flexible definitive socket has been described