Effect of Prosthetic Foot-type and Walking Velocity on Vertical Ground Reaction Forces in Individuals with Transtibial Amputations

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Effect of Prosthetic foot design:

- 1. Effect of prosthetic foot design on loading characteristics of the involved limb
- 2. Effect of prosthetic foot design on loading characteristics of the sound limb
- 3. Differential loading of the sound and involved limb

Effect of Walking Velocity:

- 1. Walking velocity influences peak forces and loading rates
- 2. Most studies done at ‘self-selected walking velocity’
- 3. Wide variation:
  - SACH: 66.9 - 90.2 m/min (2.50 - 2.60 mph)
  - Flexfoot: 69.3 - 102 m/min (3.38 - 3.82 mph)
- 4. Walking velocity as a confounding factor

Purpose:

- To examine the effect of prosthetic foot type on vertical ground reaction forces characteristics, in the sound and the involved limb in individuals with transtibial amputation while controlling for walking velocity.

Subjects:

- 8 male subjects
- Nonvascular unilateral transtibial amputation
- Duration since amputation: at least 1 year

	Age	Height	Weight
Mean ± S.D.	28.7 ± 3.4 years	1.74 ± 0.62 m	81.4 ± 11.2 kg

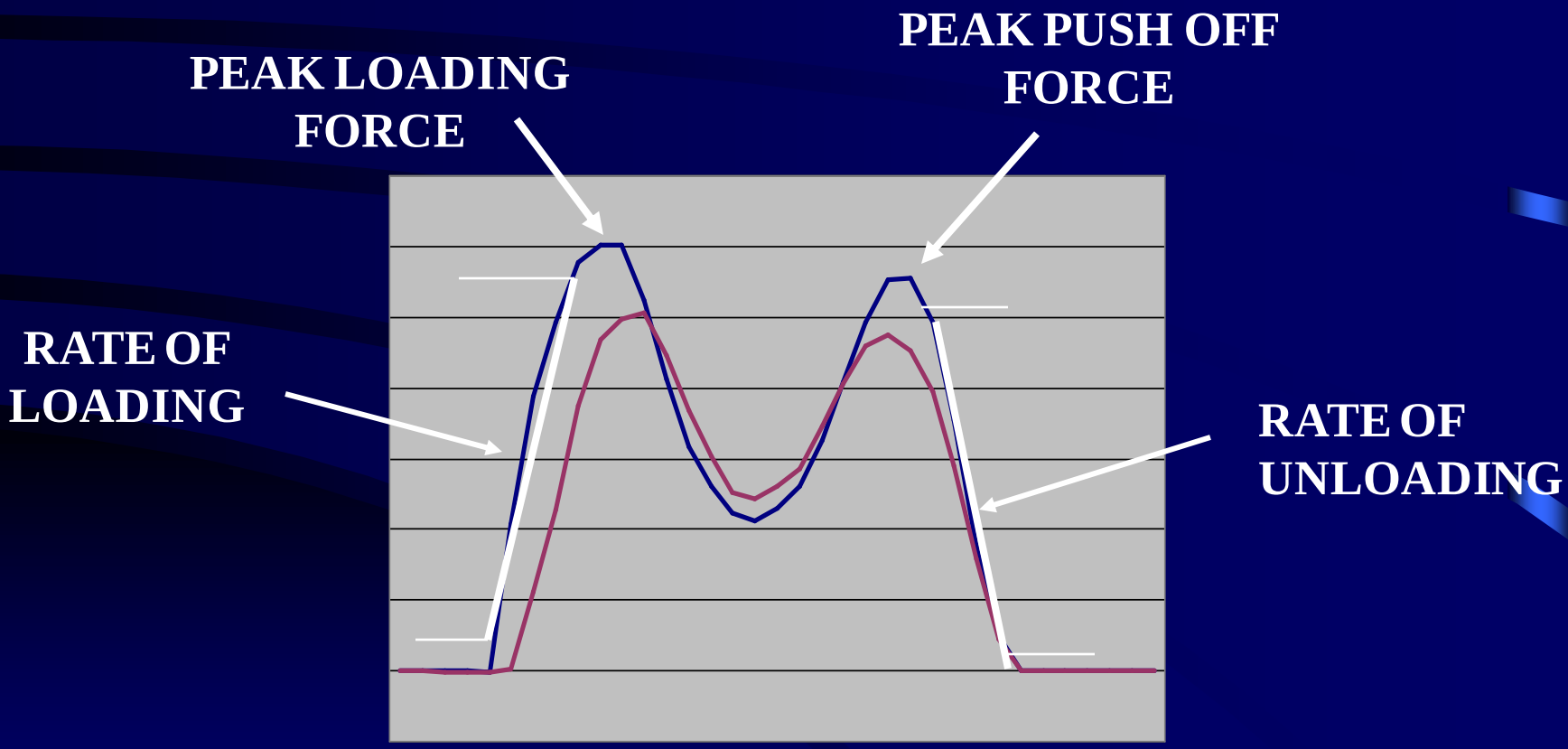
Methods:

- 3 different prosthetic feet: SACH, OttoBock C-walk, Flexfoot
- Attached to the same socket, aligned by the same clinician
- 1 month to accommodate
- 3 testing sessions

Kistler GAITWAY™

Data Acquisition:

- 30 second trial in the 4th minute of walking
- Sampling rate of 50 Hz
- Averaged over 15 strides



Force Time Curve

Results:

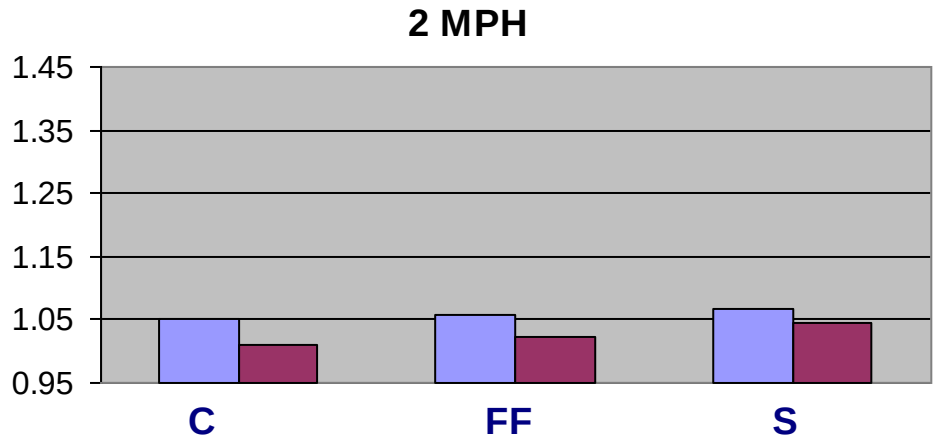
	SACH	FLEXFOOT
SSWV	2.46	2.67

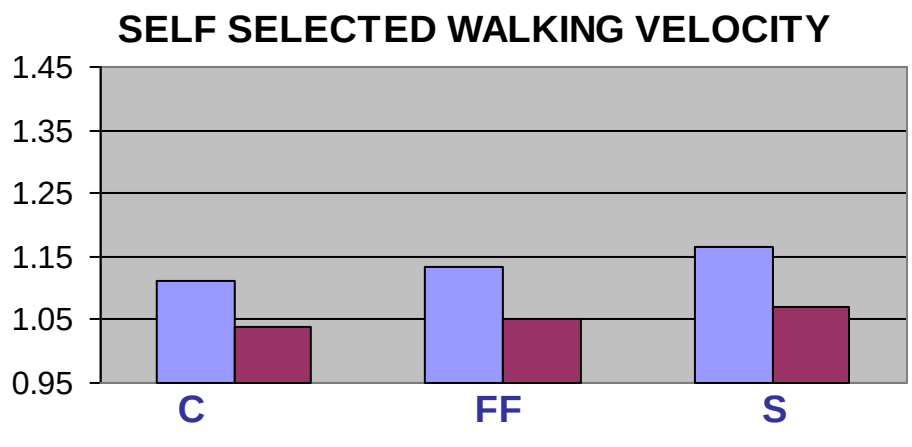
- Self Selected walking velocity

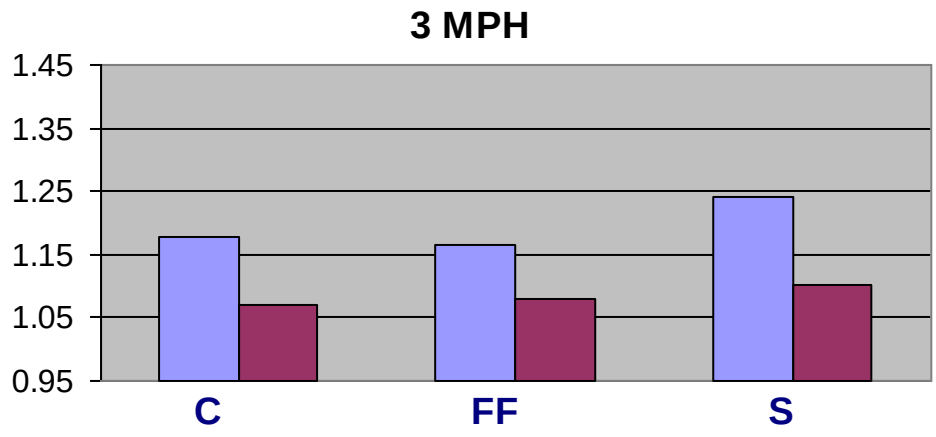
	SACH	FLEXFOOT	C-WALK
SSWV (MPH)	2.46	2.67	2.56

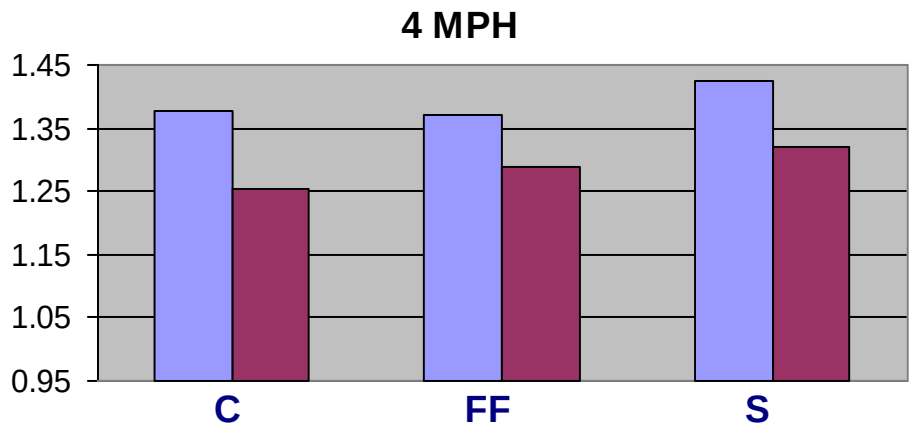
Peak Loading Force

(Normalized to Body Weight)





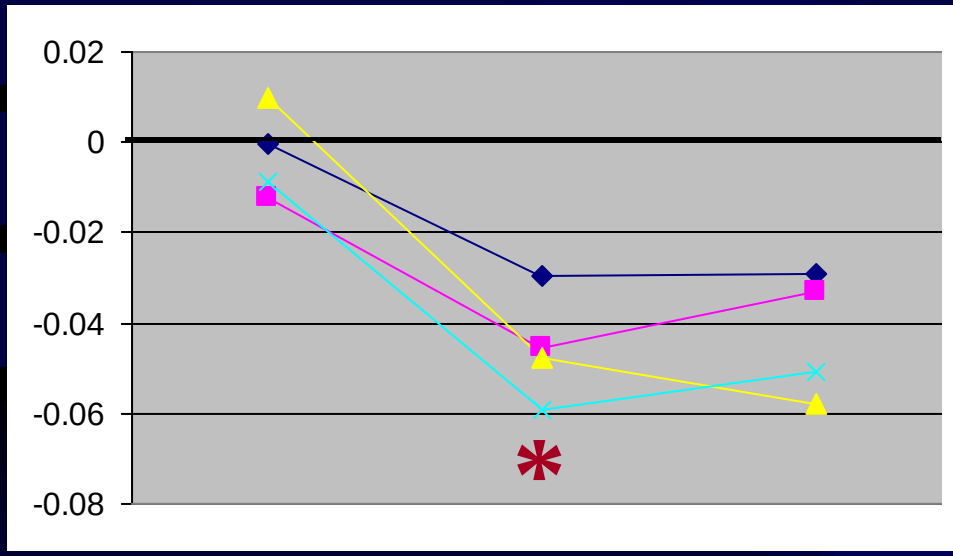




Pair-Wise Comparison Between Feet

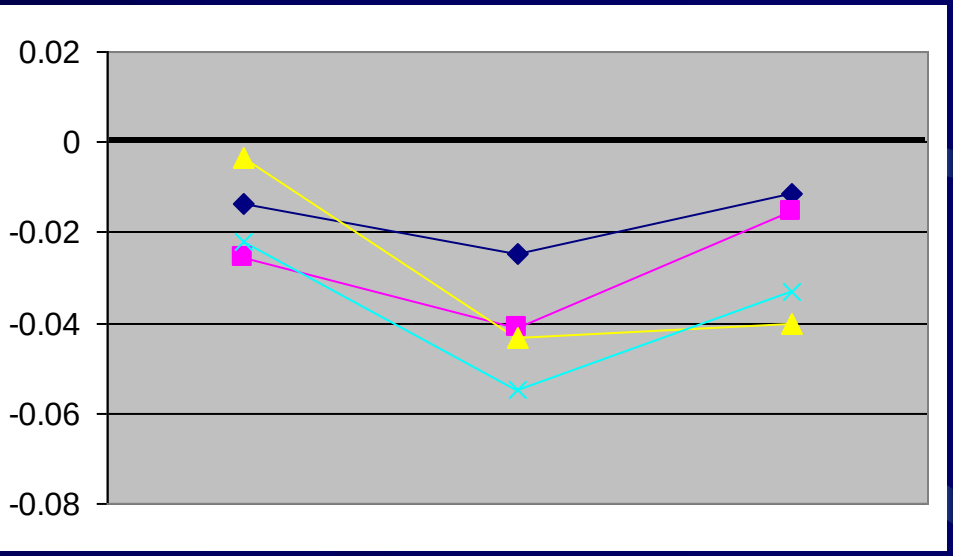
(Normalized to body weight)

Sound Limb:



FF-C FF-S C-S

Involved Limb:



FF-C FF-S C-S

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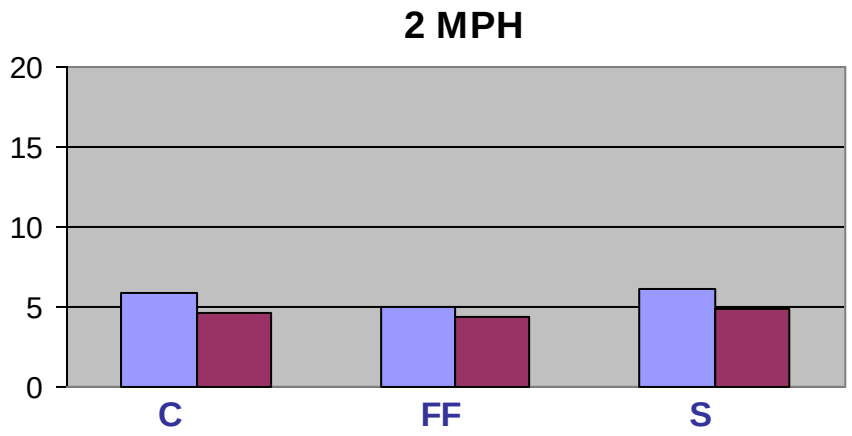
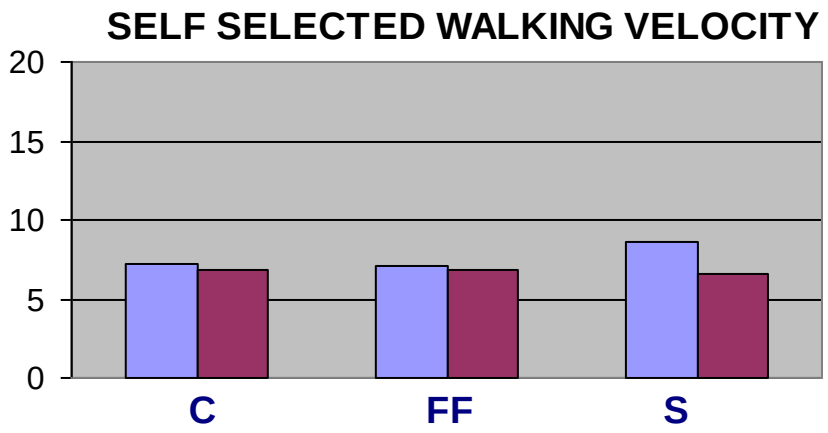
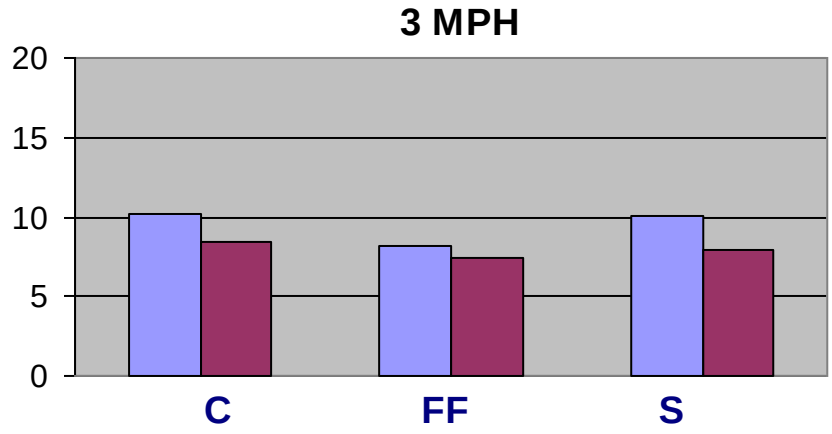
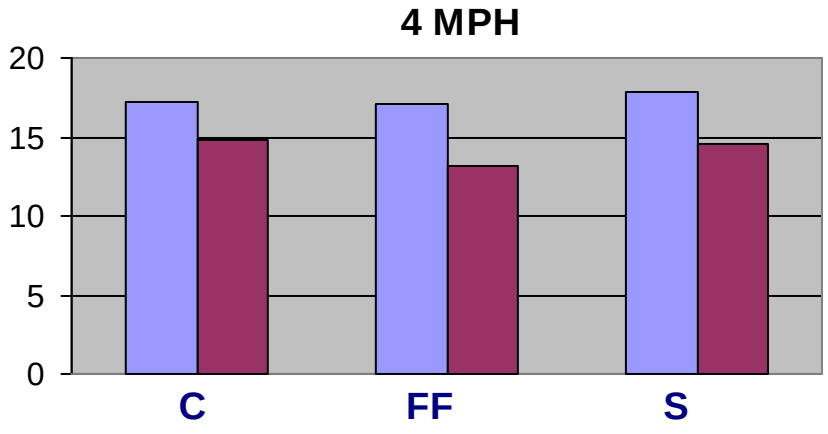
Peak Loading Rate
(Normalized to Body Weight)





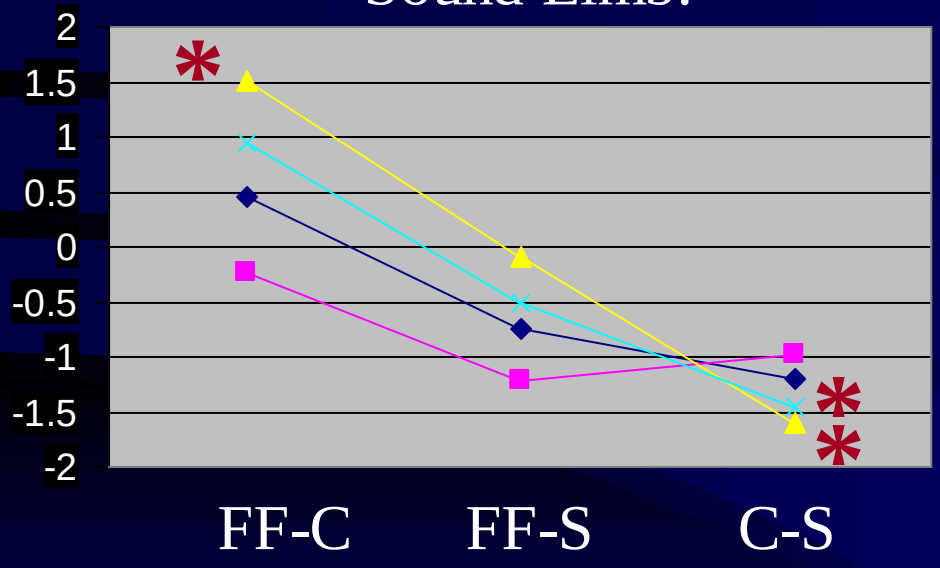




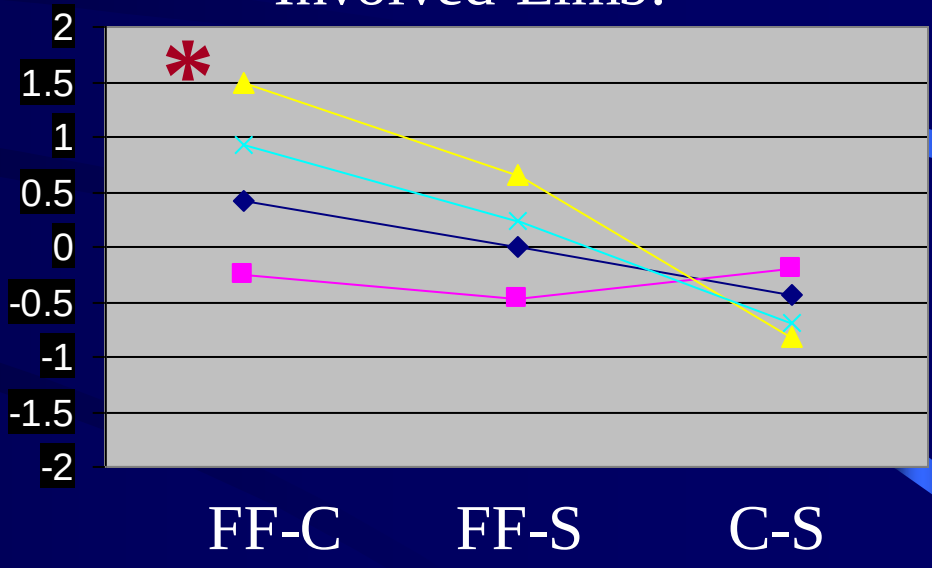
Pair-Wise Comparison Between Feet

(Normalized to body weight)

Sound Limb:



Involved Limb:



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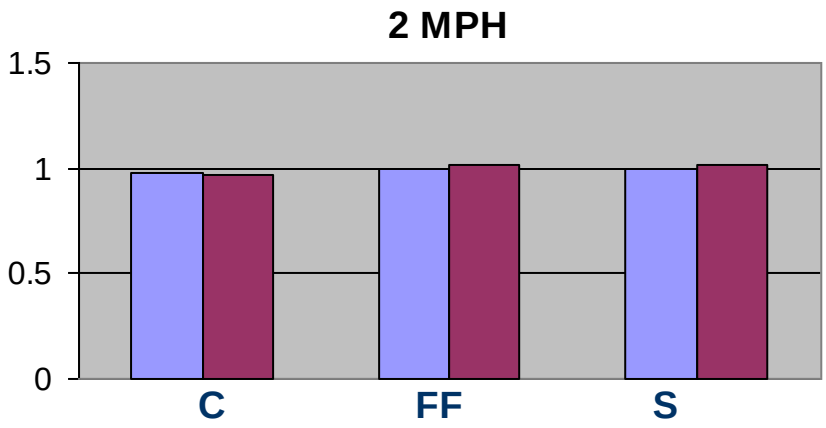
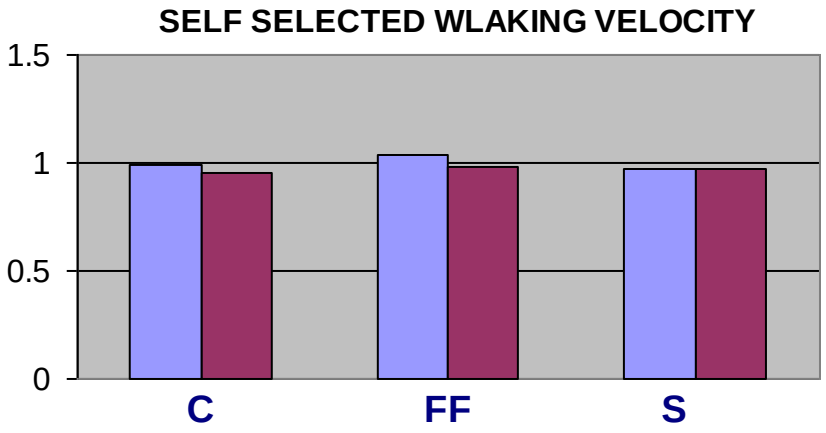
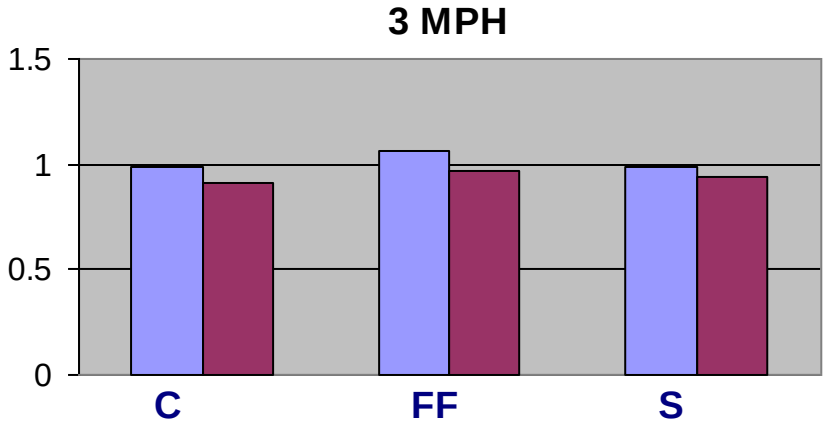
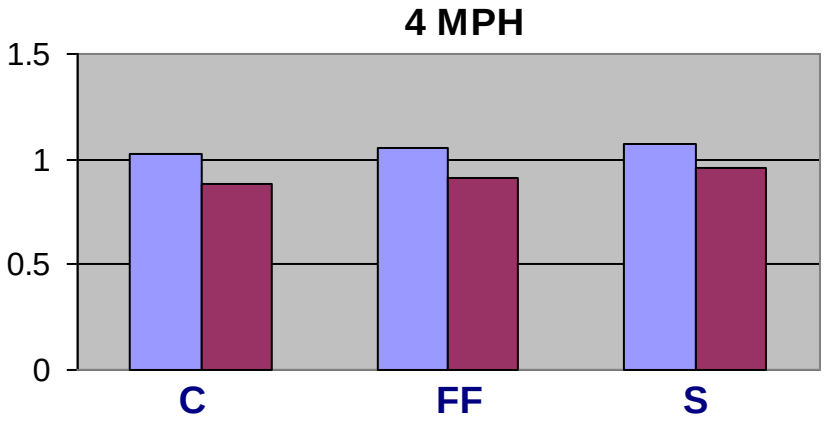
Peak Push-off Force
(Normalized to Body Weight)





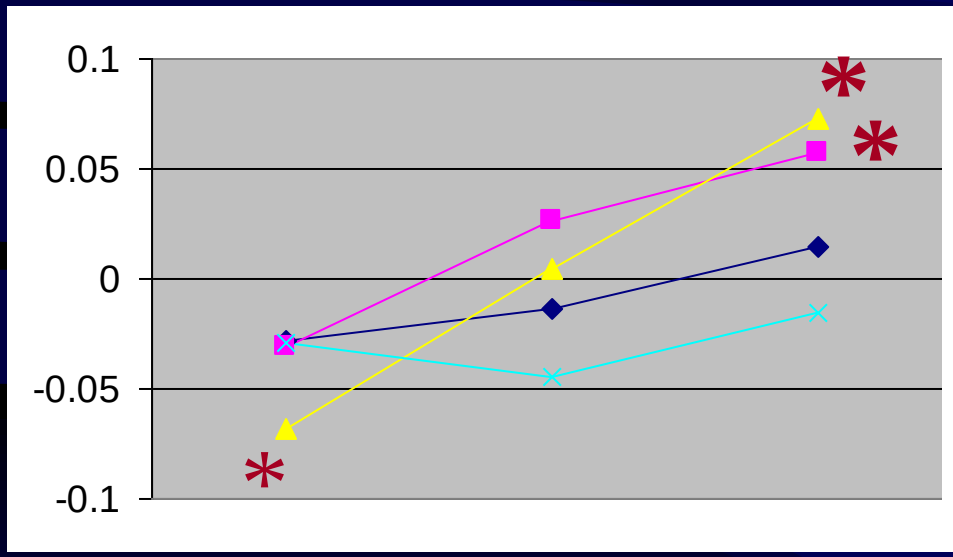




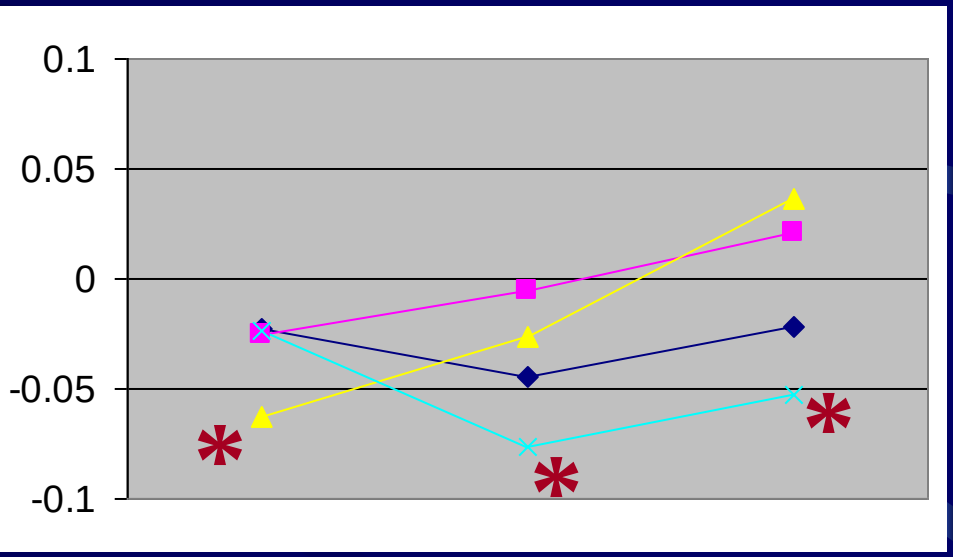
Pair-Wise Comparison Between Feet

(Normalized to body weight)

Sound Limb:



Involved Limb:



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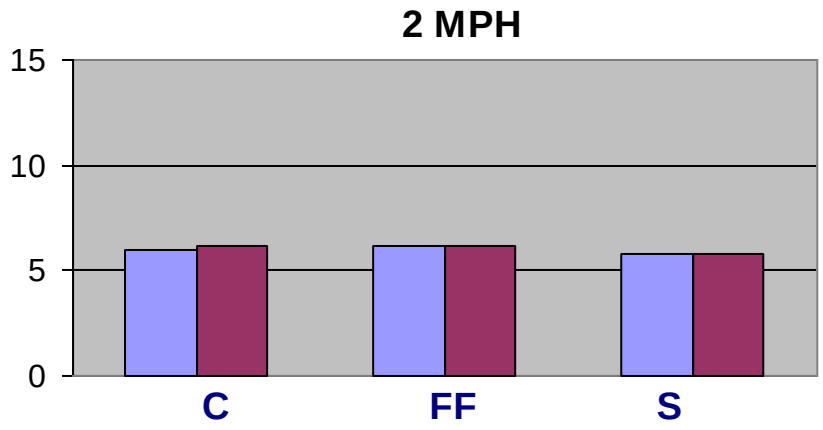
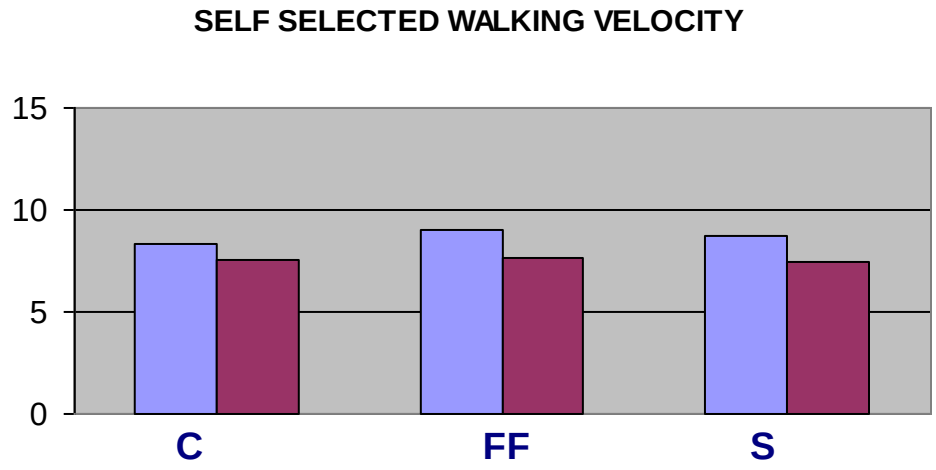
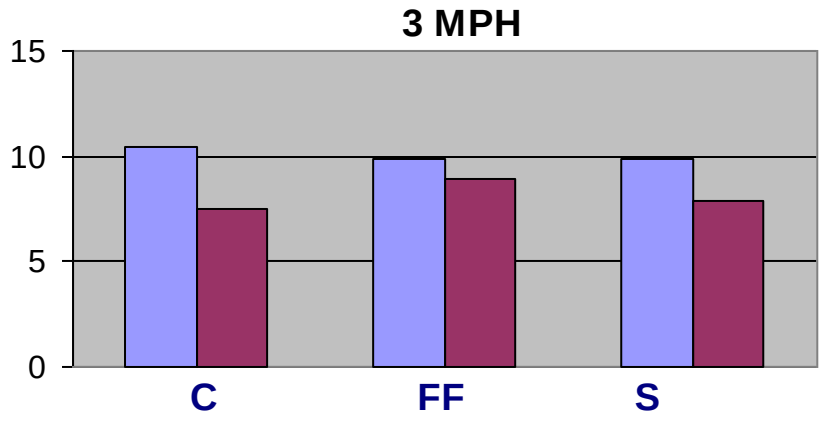
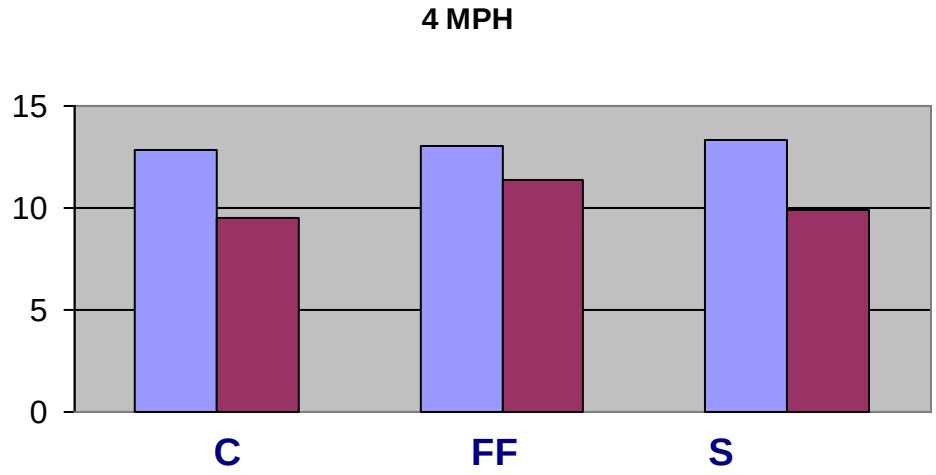
Rate of Unloading
(Normalized to Body Weight)





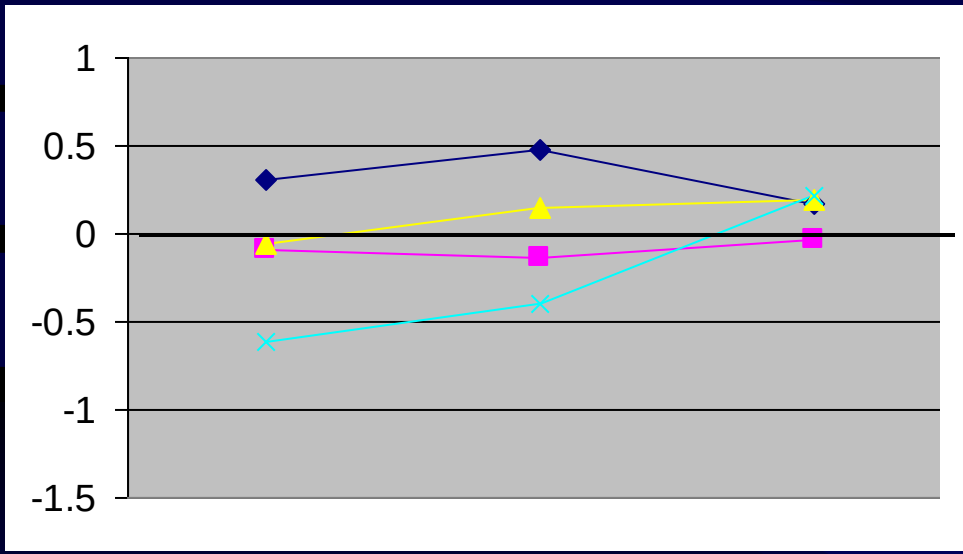




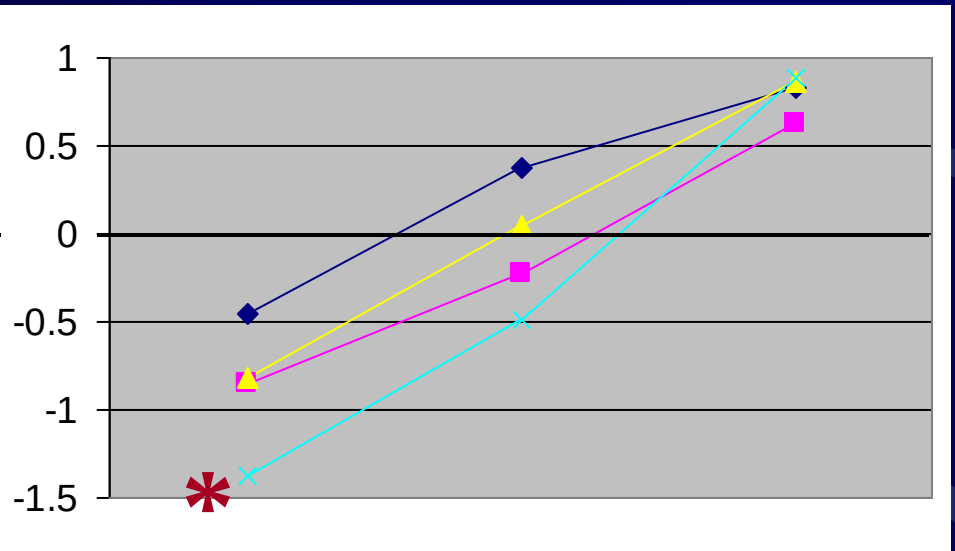
Pair-Wise Comparison Between Feet

(Normalized to body weight)

Sound Limb:



Involved Limb:



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Summary and Conclusions:

- 1. Difference between Sound and Involved limb
- 2. Differential effect of Velocity
- 3. Effect of prosthetic foot design

	SACH	FF	C-WALK
LOADING FORCE	+++	++	+
RATE OF LOADING	++	+	+++
PUSH OFF FORCE	+++	++	++
RATE OF UNLOADING	+++	+	+++

Acknowledgements:

Manufacturers of Flex foot and OttoBock C-walk for partial support