



FUNCTIONAL TRAINING WITH MECHANICAL KNEES

Chris Doerger PT, CP

FUNCTIONAL LOWER LIMB GAIT ASSESSMENT



- Step Width
- Step Length
- Toe Load
- Knee Flexion
- Pelvic rotation
- Trunk rotation



Robert Gailey PT, PhD

GAIT DYSFUNCTION



Posture:

- Preferentially load sound limb
- Sound limb biased to midline
- Externally rotated sound limb

Gait:

- Absent toe load
- Decreased prosthetic knee flexion
- Limited pelvic rotation



MECHANICAL KNEES



Categorizing prosthetic knees

	K1	K2	K3	K4
Manual Locking	X	X		
Weight-Activated Control		X		
Pneumatic Control			X	
Polycentric Linkage Systems		X	X	X
Hydraulic Control			X	X
Microprocessors			X	

MECHANICAL KNEES



Properties of prosthetic knees

- Resistance
 - When?
 - How?
 - Fixed?
- Axis of movement
 - Single axis
 - Polycentric
- Locks and other features

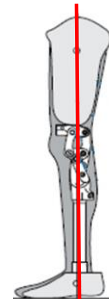


CONTROL OF THE PROSTHETIC KNEE



Dependent on 3 factors:

- Patient's voluntary control
- Alignment of the prosthetic knee
- Stability of the prosthetic knee



CONTROL OF THE PROSTHETIC KNEE



Patient variables:

- Limb length
- Joint ROM
- Muscle strength
- Proprioception
- Tactile sensation
- Surface area



Amputee Coalition of America

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CONTROL OF THE PROSTHETIC KNEE



Raya MA, Gailey RS, et al. Impairment variables predicting activity limitation in individuals with lower extremity amputation. Prosth Orth Intl. March 2010; 34(1): 73-84

Variable	Partial correlation
Hip extension	30.90%
Plantarflexion	5.91%*
Symmetrical step length	17.30%
Age	17.93%
Single limb stance (sound limb)	18.10%
Grip strength	11.71%
Level of amputation	8.61%
Cause of amputation	5.84%*
Time since amputation	6.72%

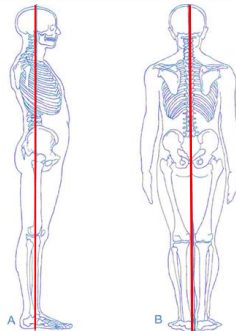
An * indicates a variable was not significant in the model at p=05

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CONTROL OF THE PROSTHETIC KNEE



Alignment



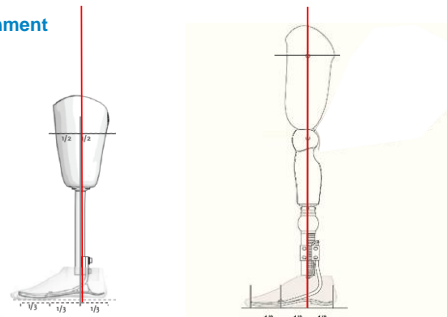
- Stability
- Minimize stress
- Conserve energy

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CONTROL OF THE PROSTHETIC KNEE



Alignment

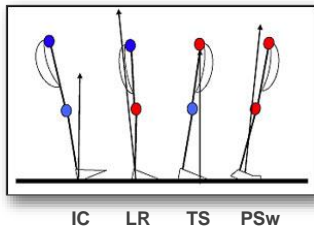


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CONTROL OF THE PROSTHETIC KNEE



Ground Reaction Forces

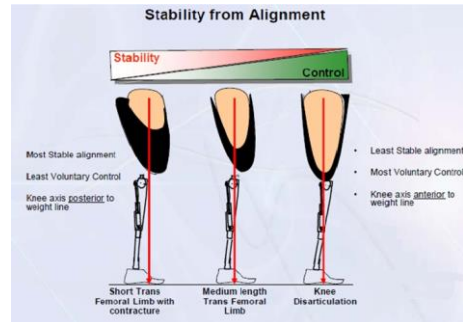


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CONTROL OF THE PROSTHETIC KNEE



Stability from Alignment



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CONTROL OF THE PROSTHETIC KNEE



Inherent stability of the knee

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FUNCTION AND TRAINING OF ÖSSUR KNEES



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TOTAL KNEE 2000/2100 - INDICATIONS



Patient profile:

- Unilateral or bilateral TF/KD amputees
- < 275 lbs
- K3 amputees

Primary mobility priorities:

- Level and uneven ground walking
- Variable cadence
- Shallow ramps
- Limited need for stairs

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TOTAL KNEE – FEATURES



Össur Total Knee:

- Polycentric (7-axis) structure
- Geometric Lock
- Bumper/shim adjustability
- Hydraulic swing phase control

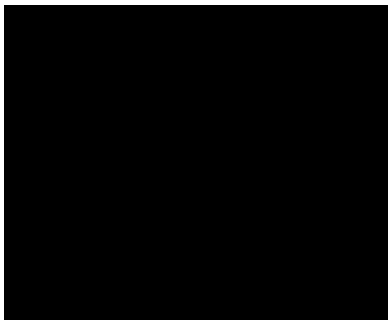
K3



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GEOMETRIC LOCK - TOTAL KNEE



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STANCE FLEXION – TOTAL KNEE



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INCLINES/DECLINES - MAUCH



Declines



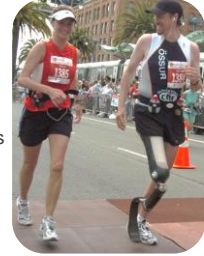
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MAUCH KNEE – CLINICAL BENEFITS



Össur Mauch Knee:

- Cadence responsive
- Easy to negotiate hills
- Support on stairs
- Support during sitting
- Specific functional activities



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STAIR TRAINING - MAUCH



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MAUCH KNEE - TRAINING



Össur Mauch Knee:

- Release point
- Swing and stance control
- Lock and free swing features
- Sitting down
- Ramps
- Stairs



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SUMMARY



- It can be difficult for therapists to stay current with prosthetic technology due to the volume of products
- Develop a close relationship with your patient's prosthetist to identify features of a prosthetic device
- Use what you already know as a therapist to incorporate the features of the device into training and maximize the patient's outcome
- Web resources such as YouTube and manufacturer's websites can be valuable sources of information

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