

BIOMECHANICS & FUNCTION: OSSEOINTEGRATION



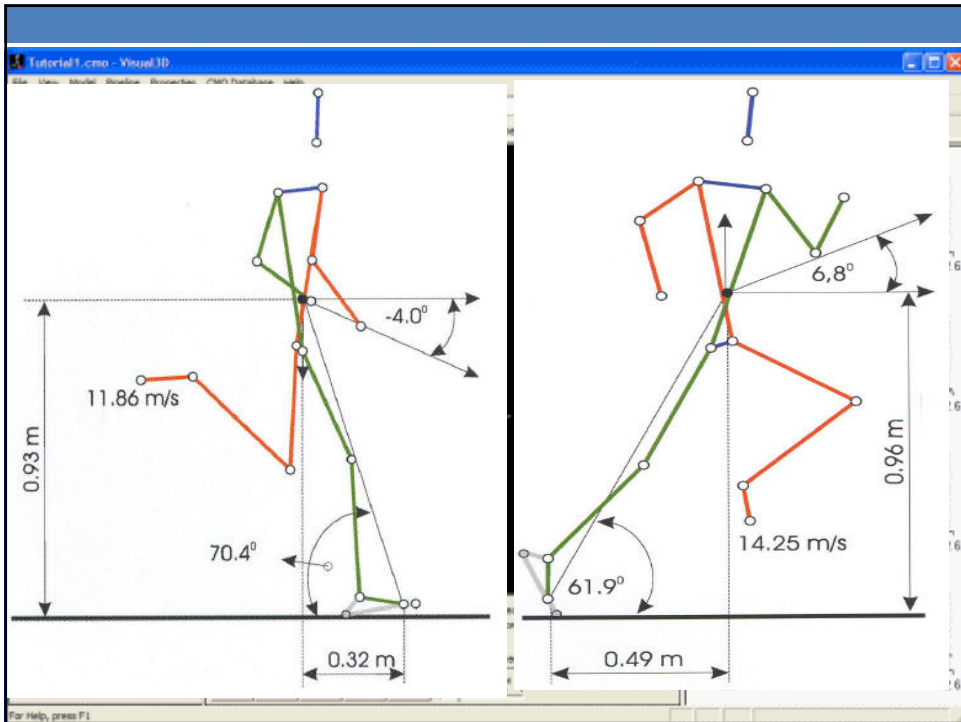
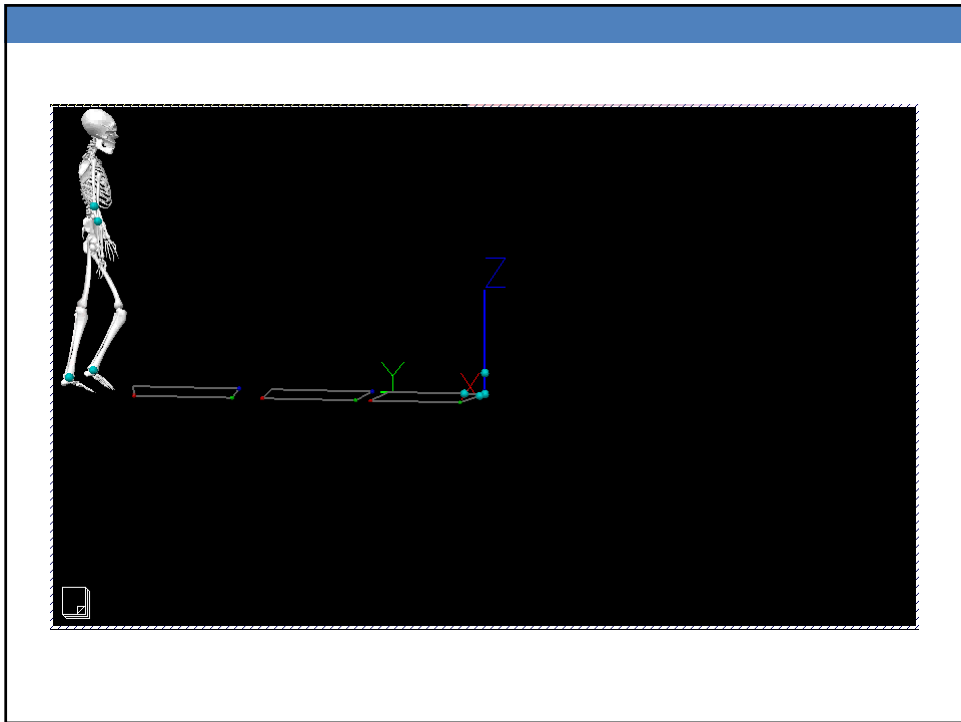
Brendan Burkett Ph.D. OAM

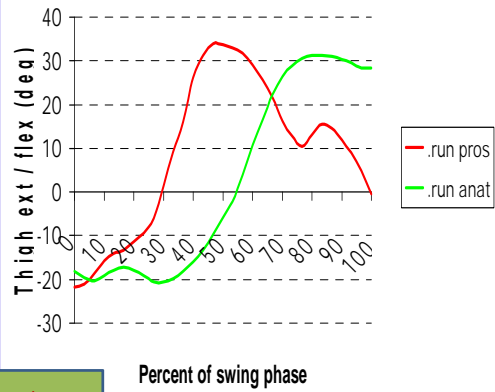
University of the
South Coast
Australia
CHASE
Centre for Healthy Activities Sport and Exercise

Session overview

- Prosthetic knee considerations
 - (Stefan Laux)
- Physiotherapy after amputation
 - (Cathy Howells)
- The OGA AP rehab protocol
 - (Sarah Benson)
- Perspective of a nurse
 - (Jennifer Martin)
- Afternoon tea



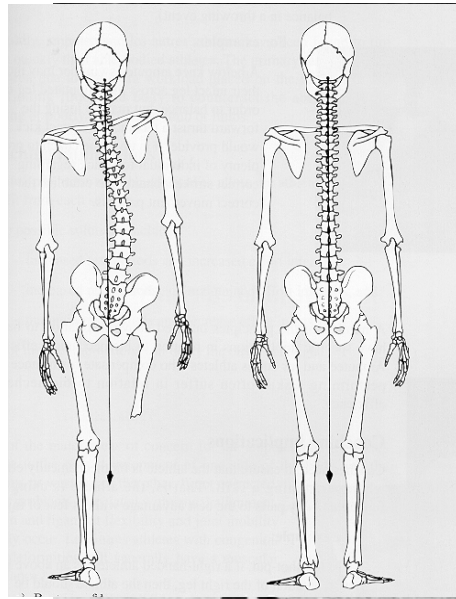




9% ↑ asymmetry ~ device
 [Burkett, B., Smeathers, J., & Barker, T. 2003]

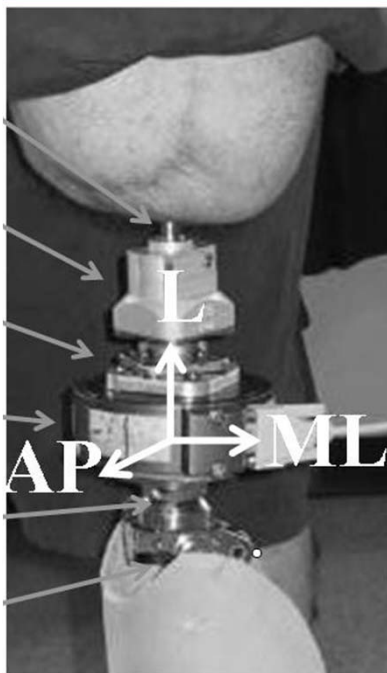
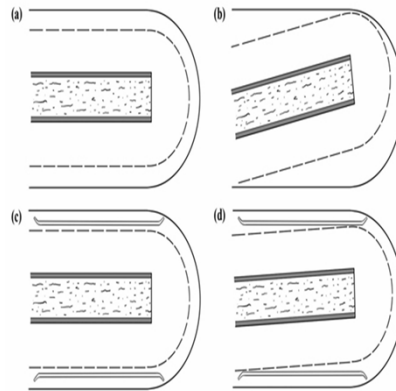
Transfemoral gait

- Energy Expenditure
 - Traumatic 68% ↑
 - Vascular 100% ↑
- Abnormal movements
 - Displacement of COG
- The 6 optimizations
 - Pelvic rotation & obliquity
 - Knee flexion (stance)
 - Ankle & foot mechanisms
 - Lateral displacement



Major components/issues

- Stance phase
 - Knee buckling
 - No knee flexion (<30%)
 - Hip extensors
- Swing phase
 - Hip flexors
- Proprioception
 - Dulled
 - Alternative loading...



Osseointegration Loads

- Straight-line level walking
- Ascend & descend stairs
- Ramp
- Walking around a circle.

No difference

- $Force_{Long} \sim 770N$
 - $M_{AP} \sim 27Nm$
- Femur load generated**

[Lee, et al. 2007]

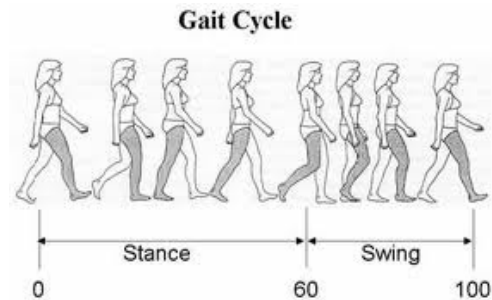
Socket v Osseointegration v AB

- Osseointegration v's Socket

- Cadence 2% quicker
- Duration 3% shorter
- Support 6% shorter
- ✓ Osseointegration

- Osseointegration v's AB

- Cadence 11% slower
- Duration 9% longer
- Support 6% longer
- ✓ Able-bodied



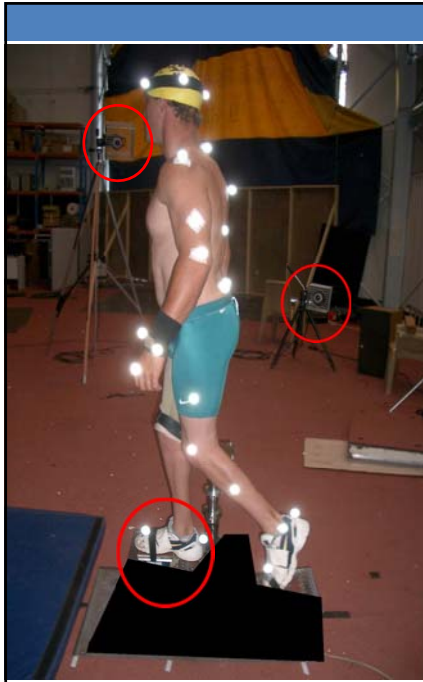
Function: Socket v Osseointegration

- Socket group
 - Hip Ext/Flex ROM ↓
- Osseointegration
 - No hip ROM restriction

[Hagberg et al. 2005]
- ↑ Sensory feedback
- ↑ Suspension
- Consistent alignment

[Sullivan et al. 2003]

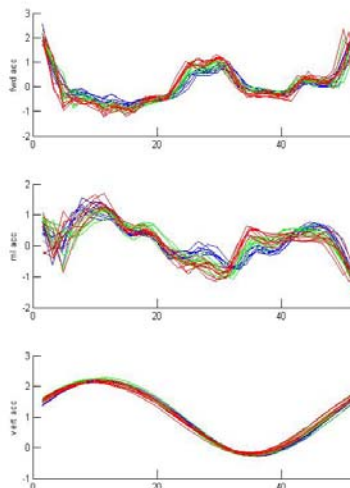




- Reliability
 - SEE 0.6%
 - $r = 0.96$
 - TEE 4%

[Fulton, Pyne, Burkett 2009]

Able bodied
Patient with stroke



[Lee, Mellifont, Burkett 2009]

- Variations with human & prosthesis
- Amputee needs control
- Future studies (inertial sensors)

↑ **Bio & Mechanics**

