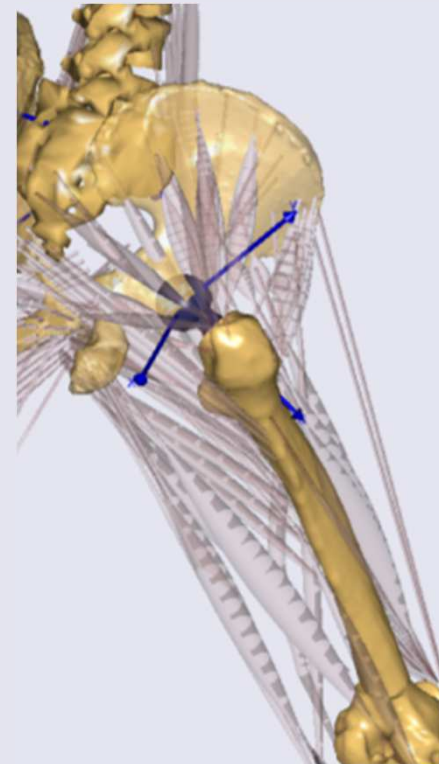
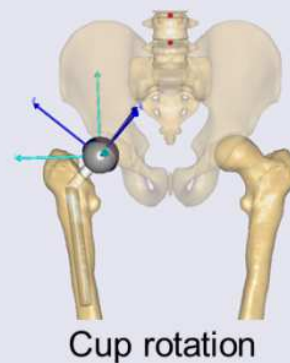


Orthopaedic AnyBody Applications for the Hip



The webcast will begin in a few minutes...

Agenda & Presenters

- Who is AnyBody?
- AnyBody Modeling System (AMS)
- AMS Applications in Hip Biomechanics
- Q & A (submit questions anytime)

Tony Petrella
AnyBody Technology, Inc.
Senior Consultant, USA
(Presenter)



Associate Professor, Mechanical Engineering
Director, Computational Biomechanics Group
Colorado School of Mines

Manager, Computational Biomechanics
DePuy Orthopaedics, Inc. (2000-2006)

Arne Kiis
(Host/Panelist)



Amir Al-Munajjed
(Panelist)



AnyBody Technology

- Software licenses
- Consulting
- Training
- Support
- US Office
- AnyGait

2002



2006



2010

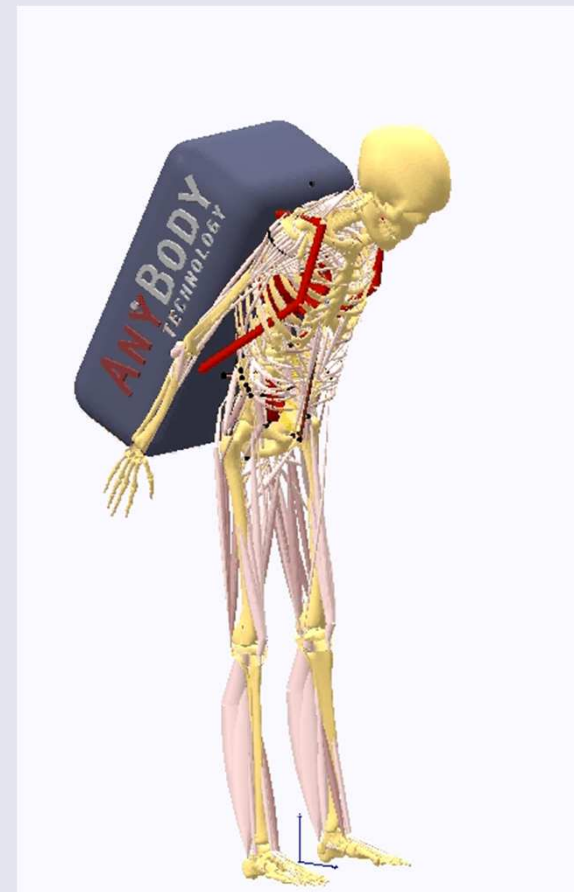


2011

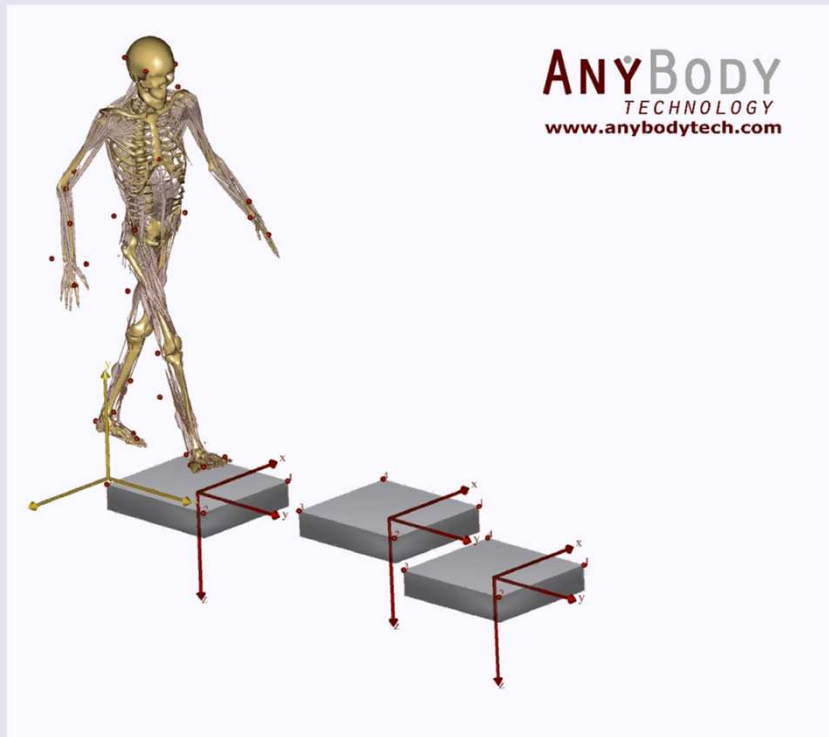
2012

AnyBody Modeling System

- Developed in-house for musculoskeletal analysis
- Self-contained system
- Interfacing to...
 - motion capture
 - image-based bone and muscle data
 - finite-element software
 - office systems
- Open body model
- Broad and deep model validation
- API for imbedded use

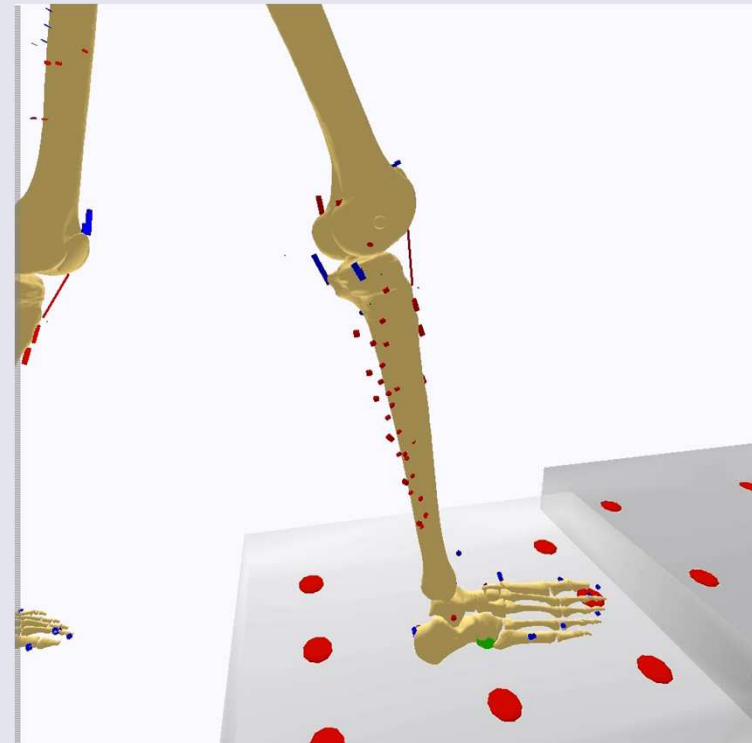


AnyBody Modeling System



Motion & ext Forces as Input:

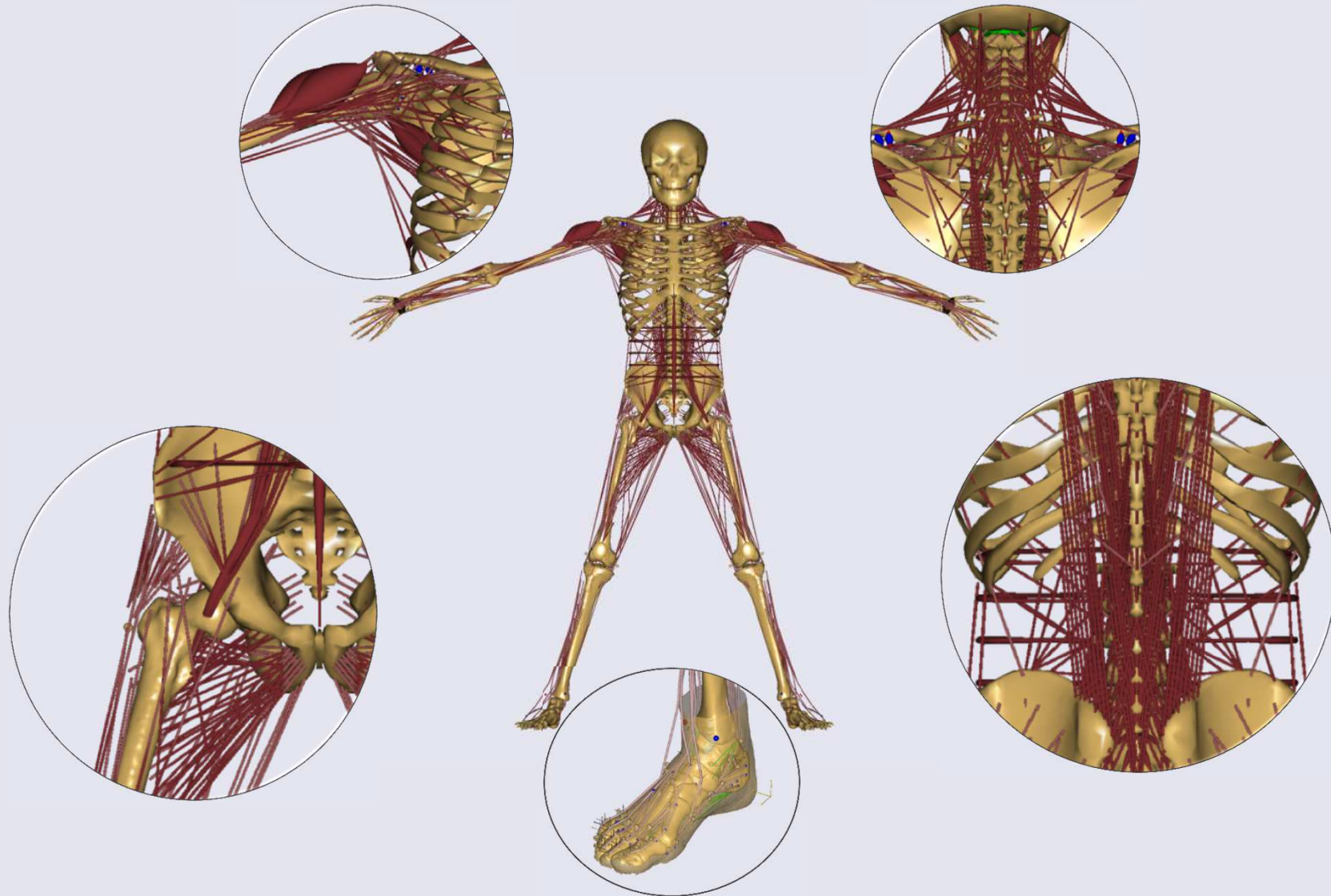
- Motion Capture (Vicon, Qualisys, ...)
- Joint Angle Input



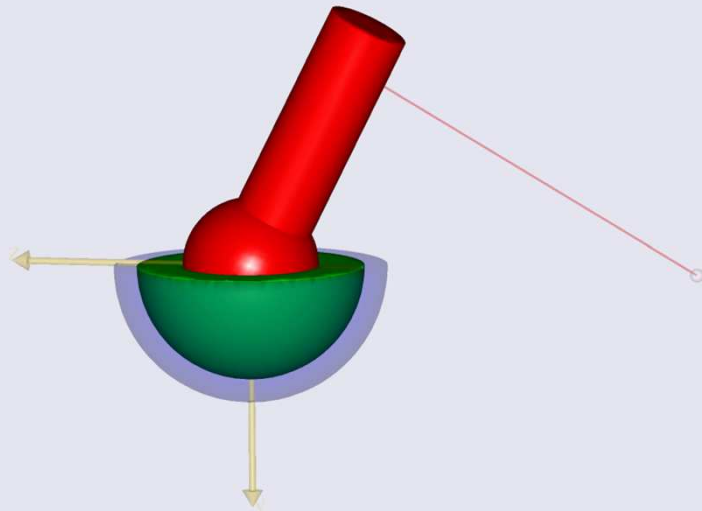
Forces as Output:

- Muscle Forces (activations)
- Joint Reaction Forces

Model Repository



Contact with Force Dependent Kinematics (FDK)



see previous Webcasts on FDK from:

- John Rasmussen
 - Michael S Andersen
 - Michael Damsgaard
- at www.anybodytech.com



Andersen et al., 2011

see previous Webcasts from:

- Michael S Andersen
- at www.anybodytech.com

Knee Implant from Grand Challenge 1

Validation

- Direct: In-vivo Forces
 - Magnitude + Phase

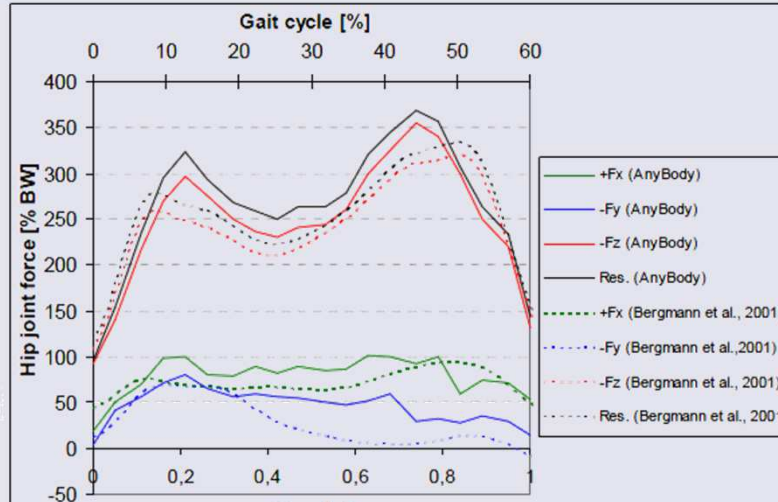
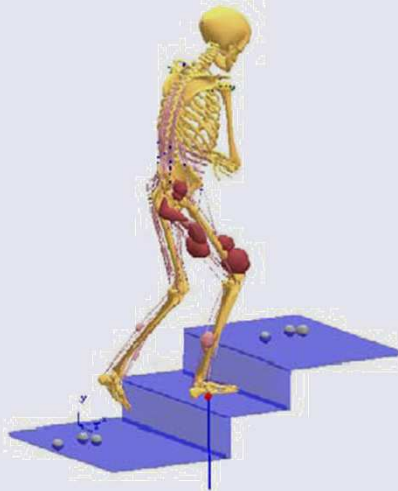
- Indirect: Muscle activations
 - Onset/Offset + Trend

- Clinical

- AnyBody vs. Other Model

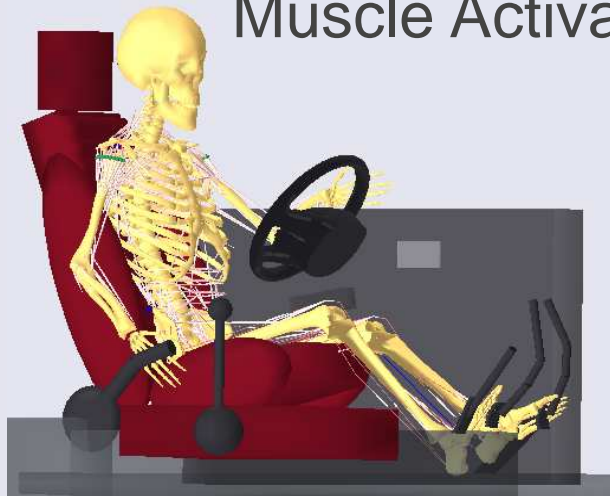
Direct Validation: *in vivo* Forces

Thielen et al., 2009

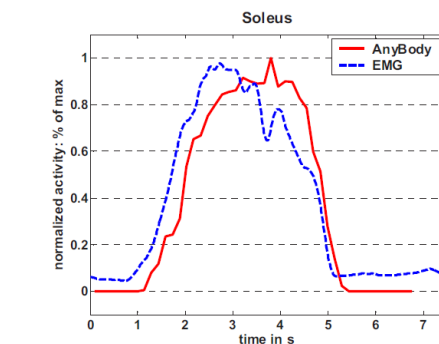
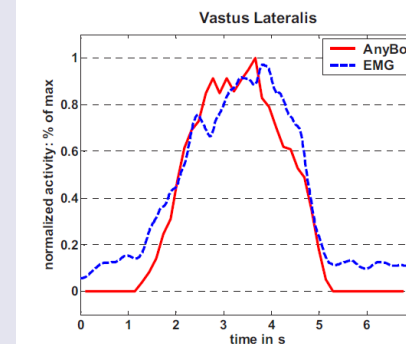
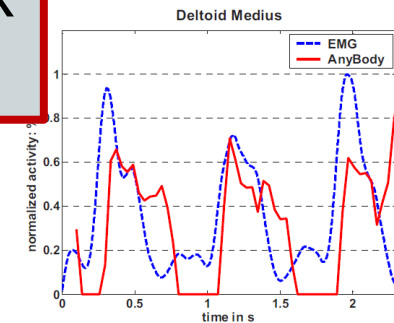
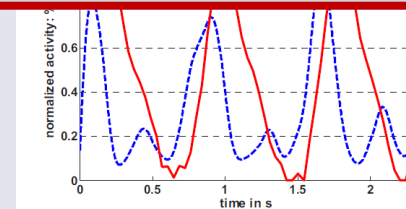


Reminder: please submit questions through the GoToMeeting “chat” box on the right side of your screen.

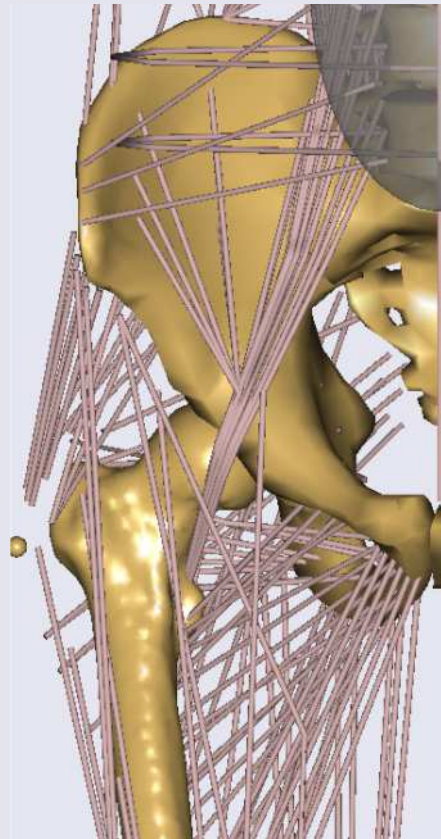
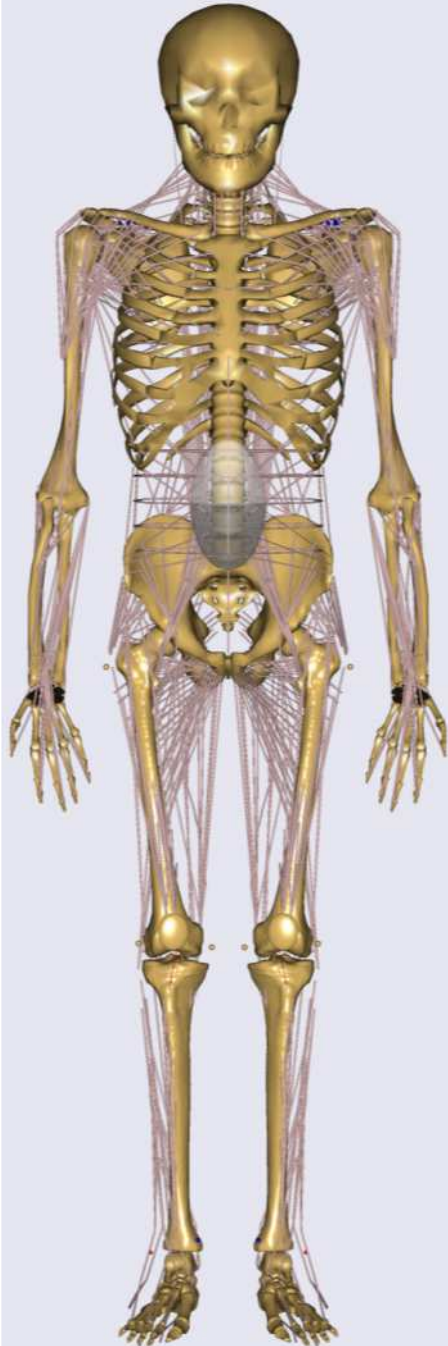
Indirect Muscle Activation - EMG



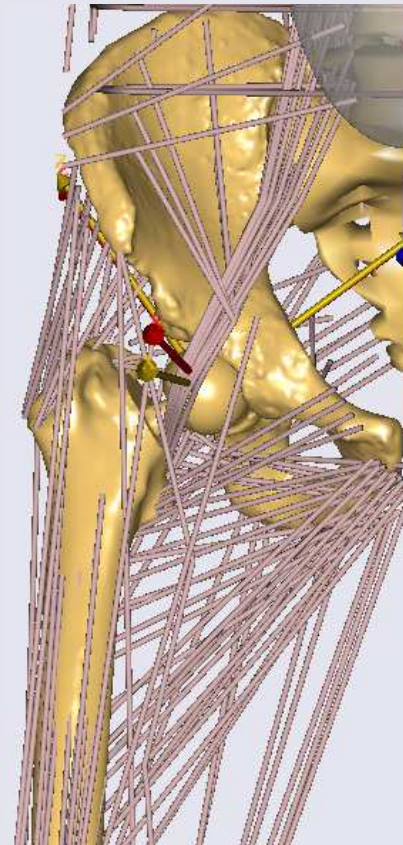
Rausch & Siebertz, 2008; FISITA 2008



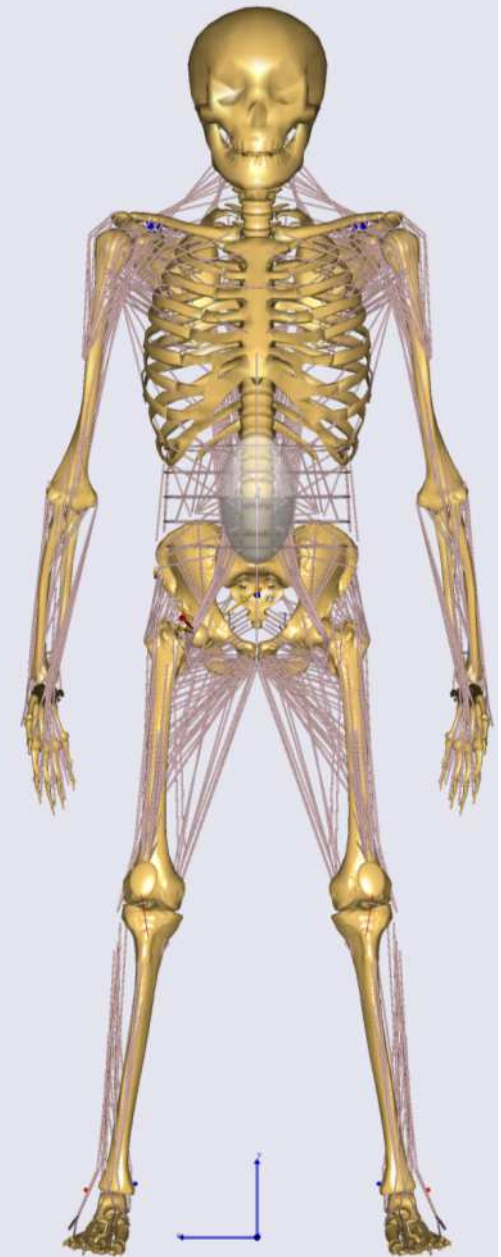
Subject-Specific Modeling



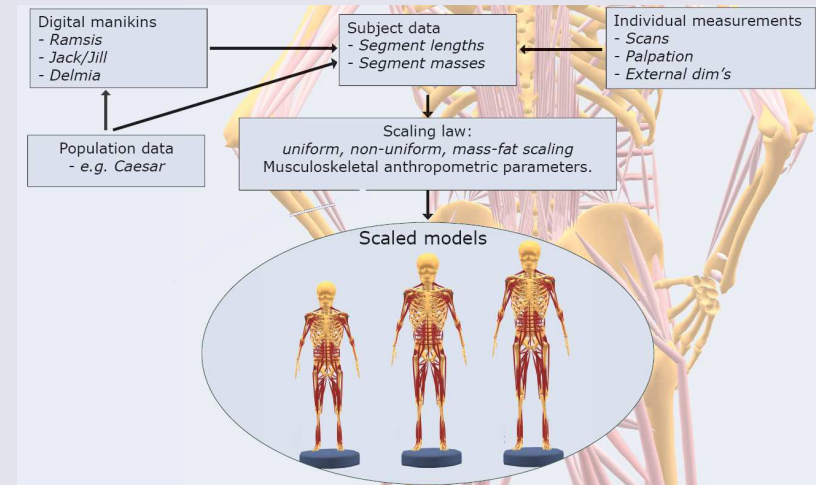
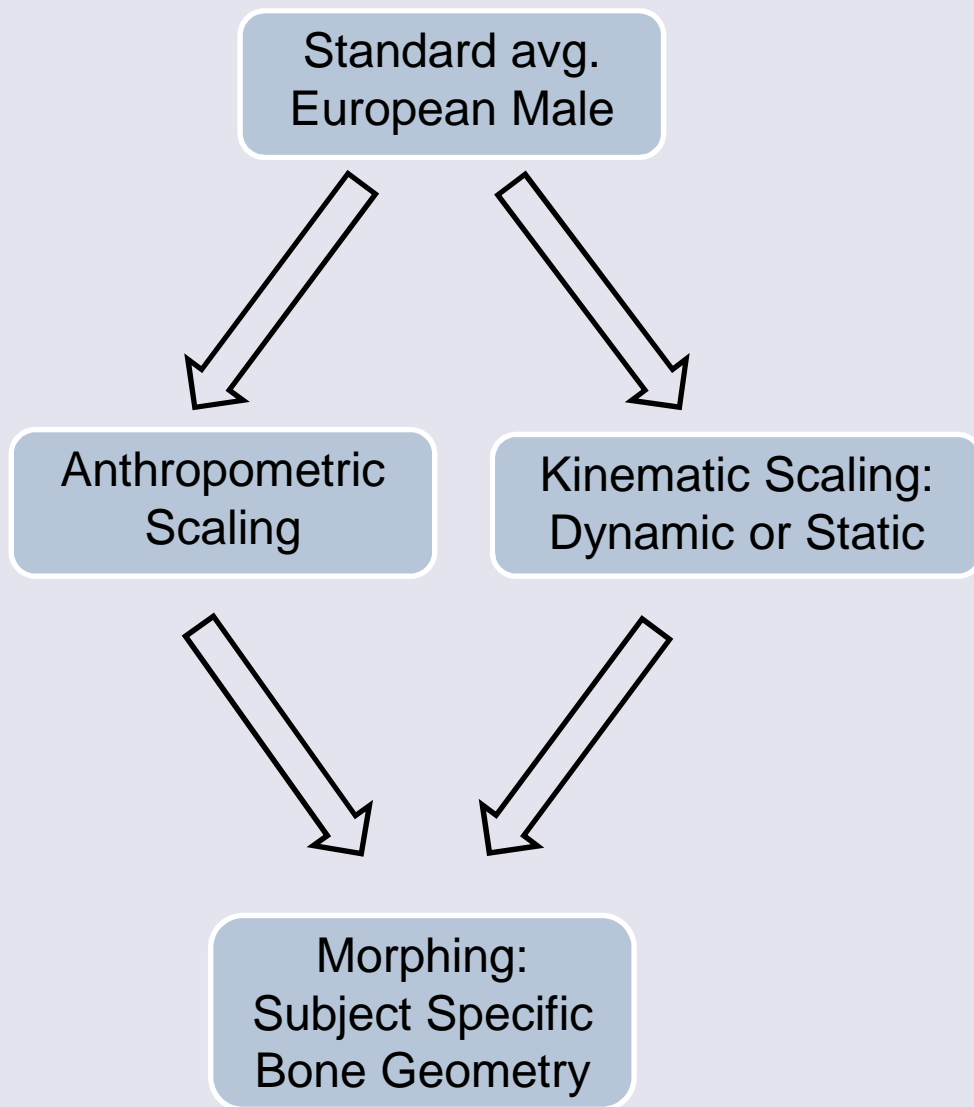
Generic



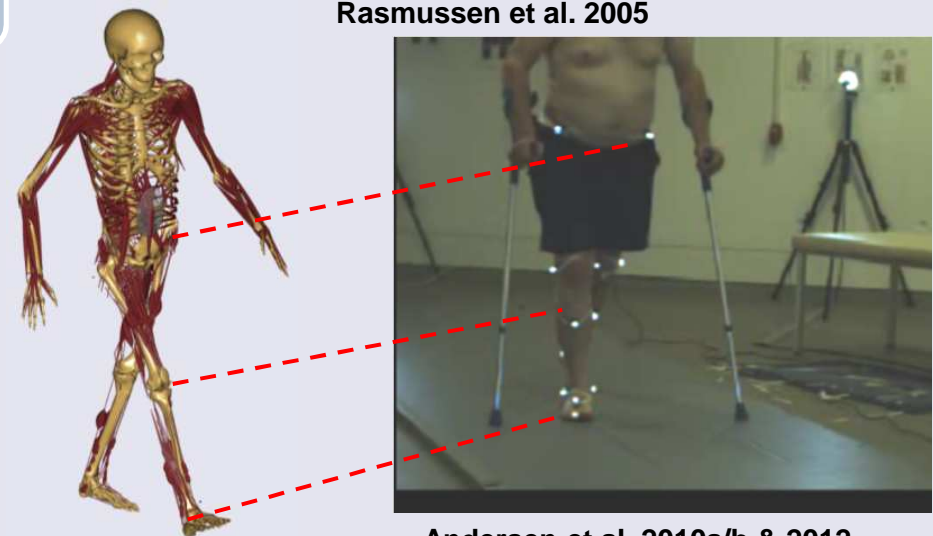
Subject-Specific



Subject - Specific Modeling



See previous Webcast on Anthro Scaling
Rasmussen et al. 2005



Traditional Scaling

ANYBODY
TECHNOLOGY



vs.

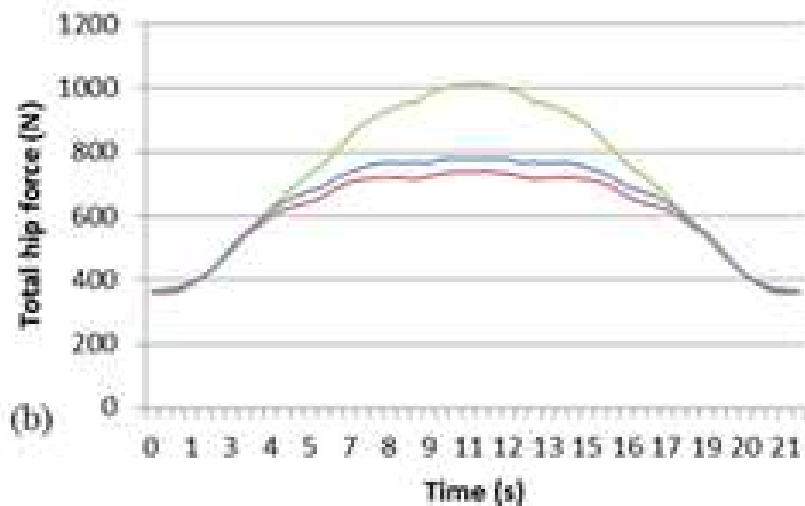


Subject-Specific Morphing

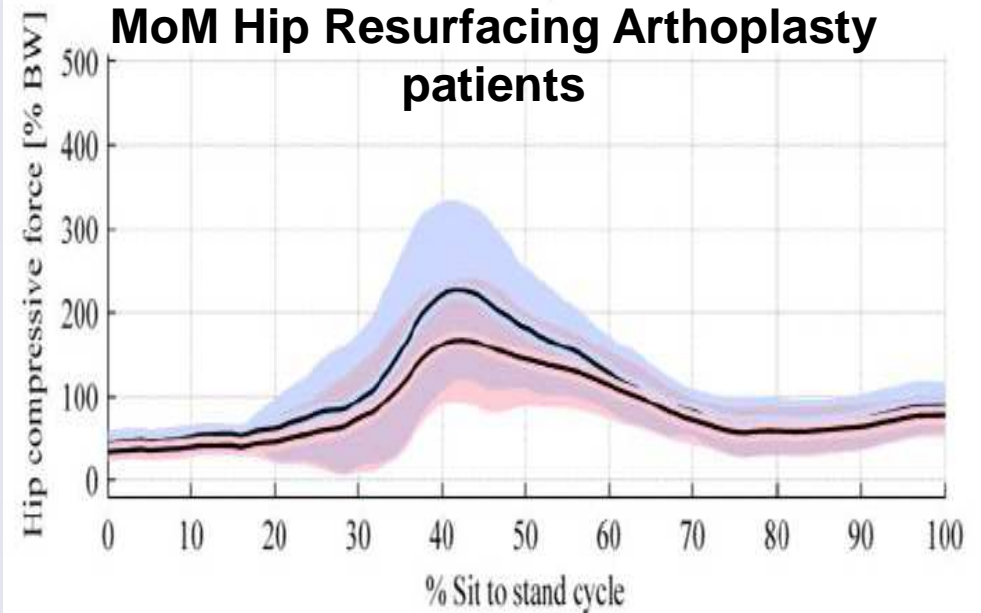
Deep Knee Bend

Sit-to-Stand Motion

Hip reaction forces



MoM Hip Resurfacing Arthroplasty patients



Model - Green=Standard; Red=Scaled; Blue=Manual fit to cadaver

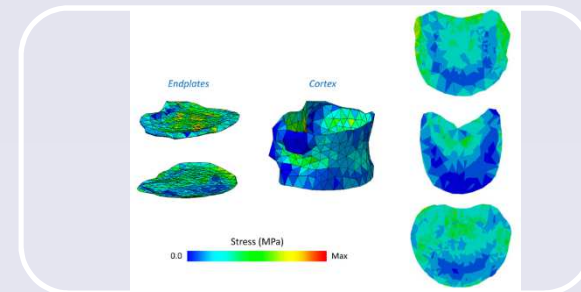
Method - Blue=Traditional; Pink=New. N=12

Subject-Specific Modeling Workflow

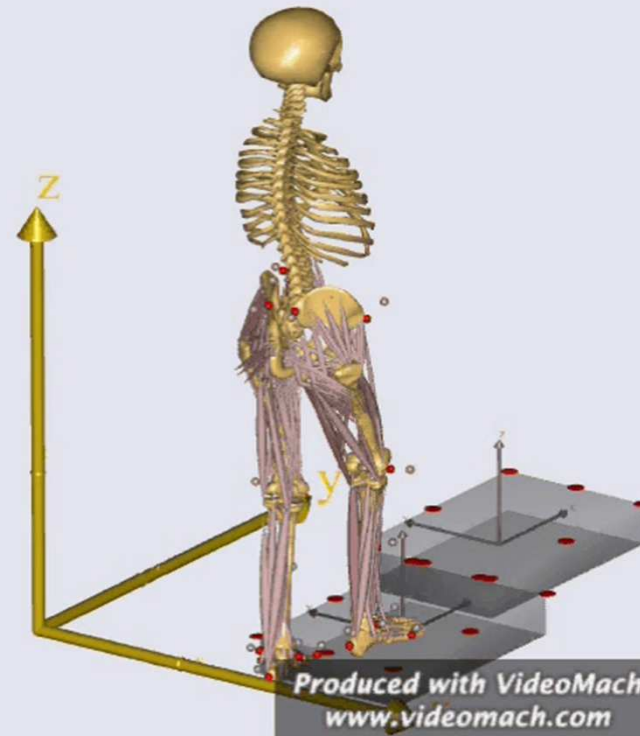
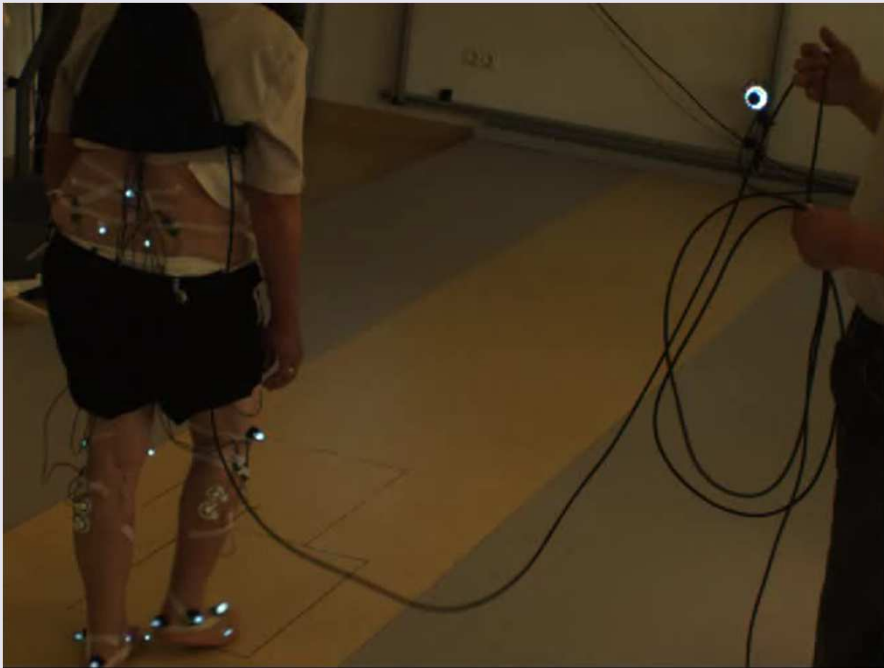
More information on subject-specific modeling is available in the archived webcast...

The New Release of the AnyBody Modeling System, version 5.2
28 June, 2012

at www.anybodytech.com



Total Hip Arthroplasty Design

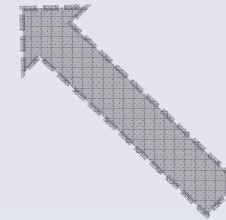
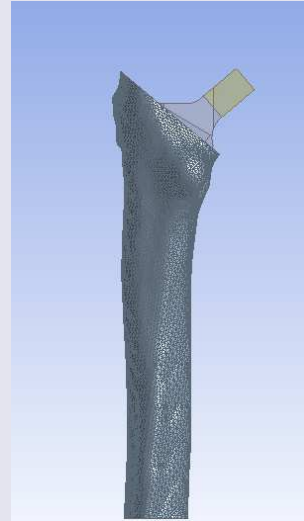
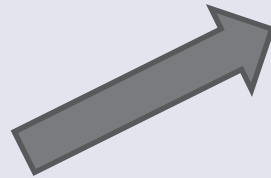
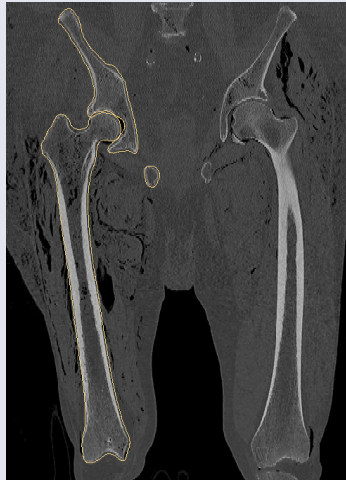


Weber et al. 2012

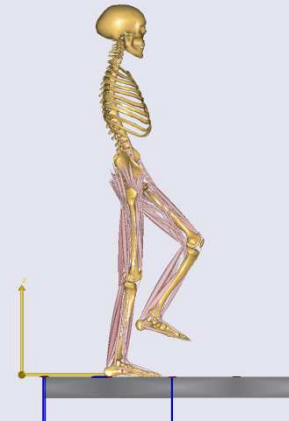
Putzer et al. 2011

Finite Elemente Modell

Bone Geometry from CT



Muscle Forces

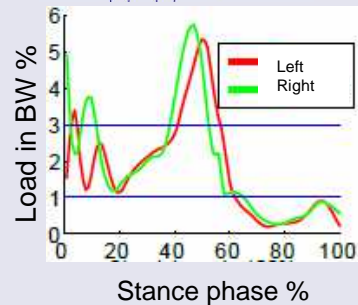
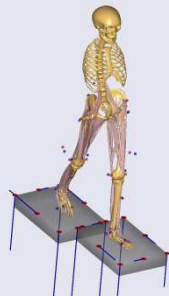


Weber et al. 2012

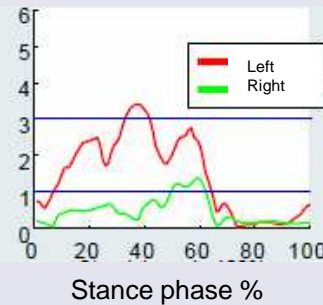
Putzer et al. 2011

THA during Daily Activities

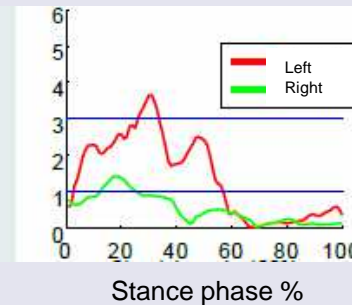
Walking:
Normal



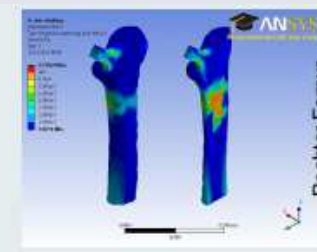
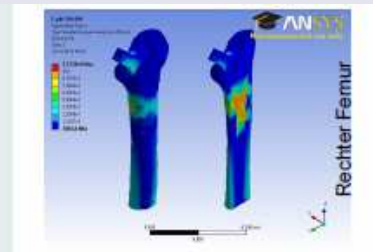
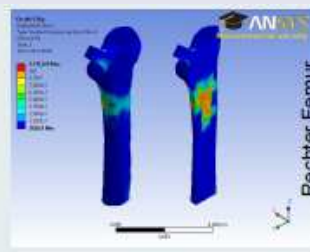
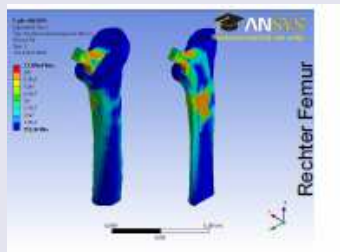
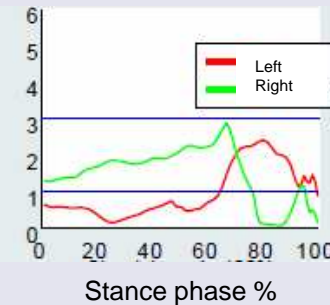
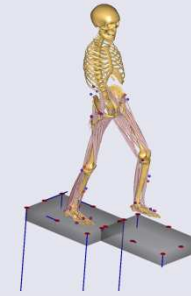
Walking:
20% loading



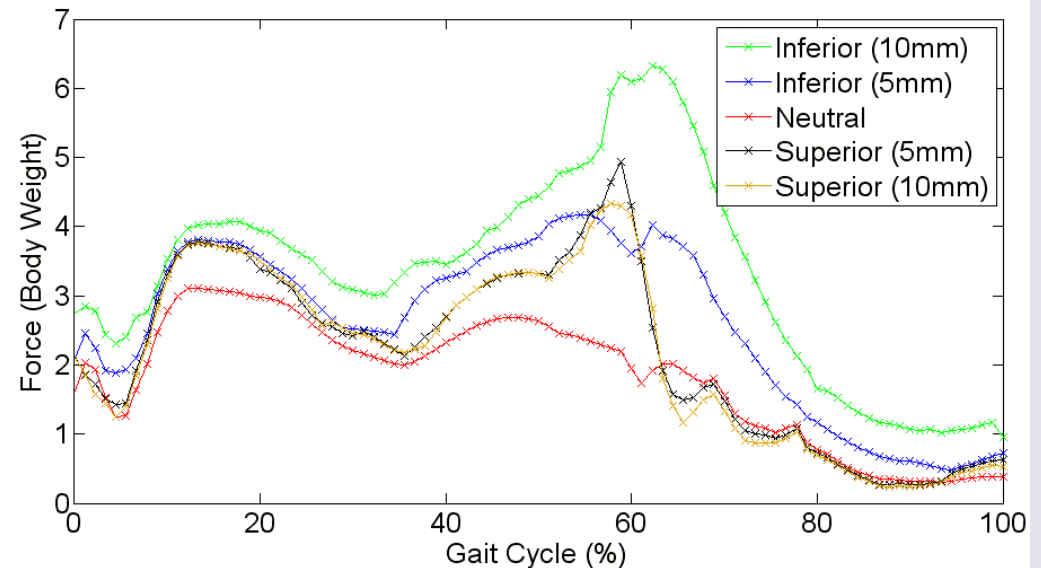
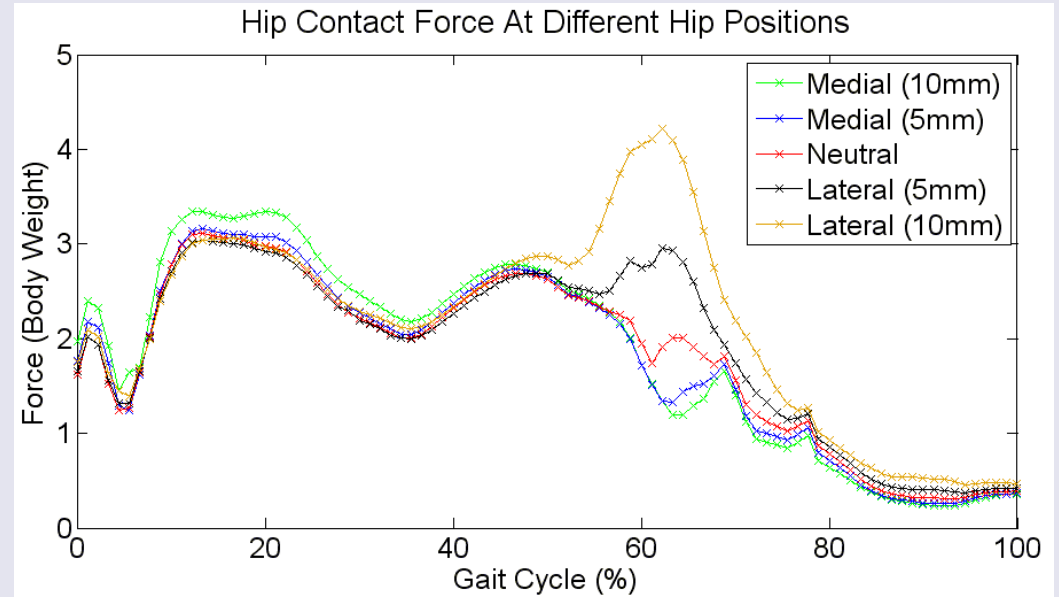
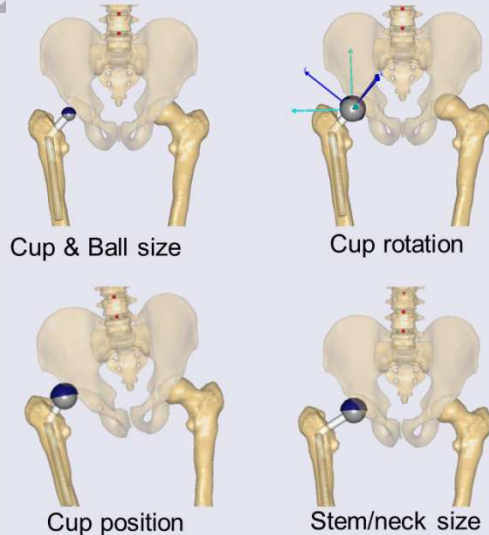
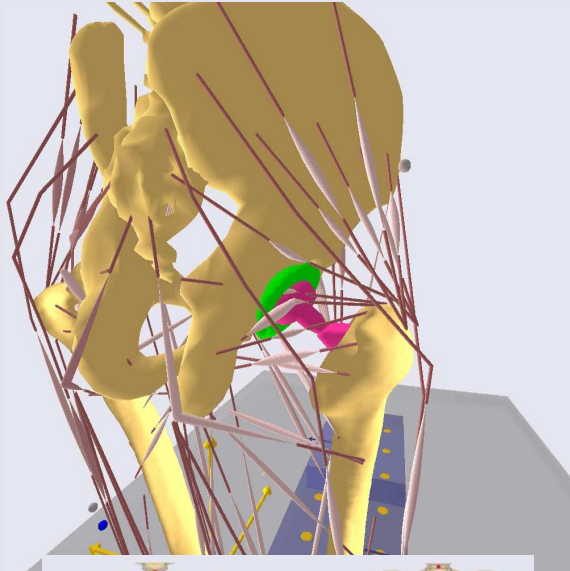
Walking:
50% loading



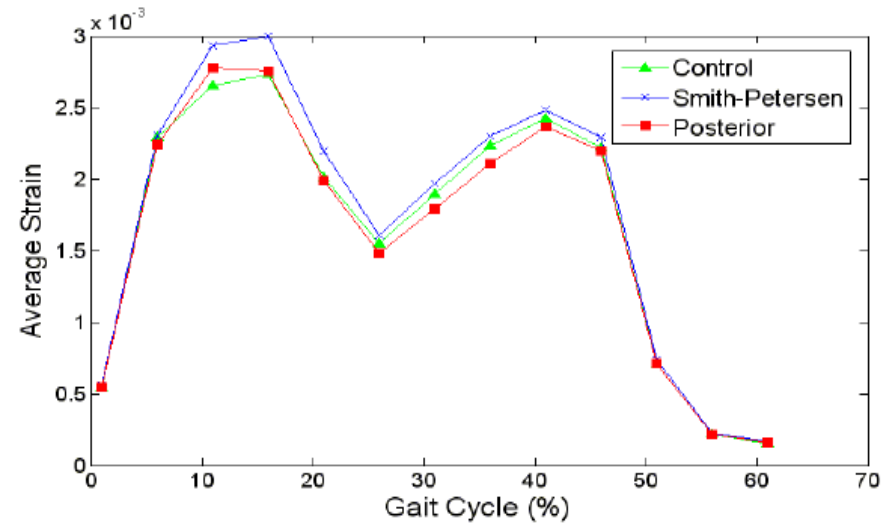
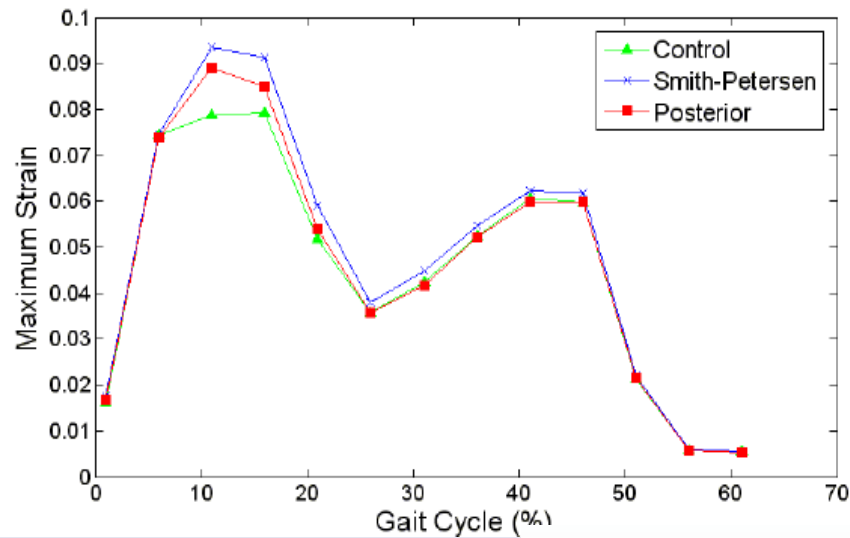
Stair Climbing



Hip Centre Relocation

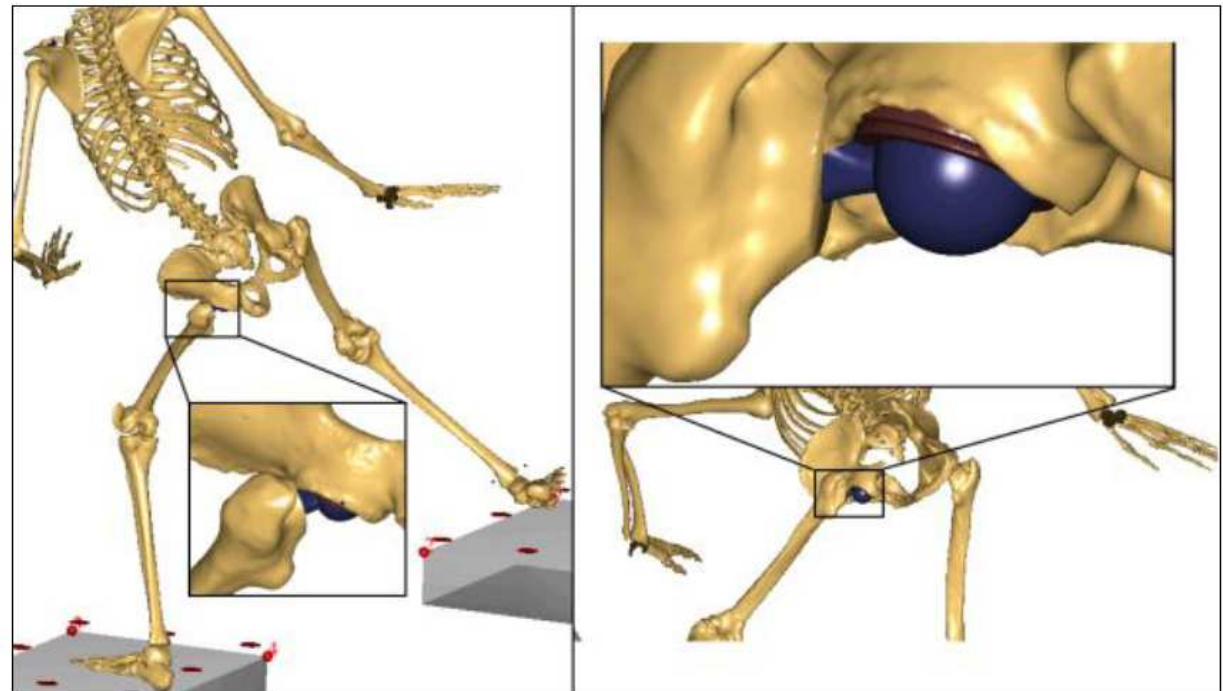
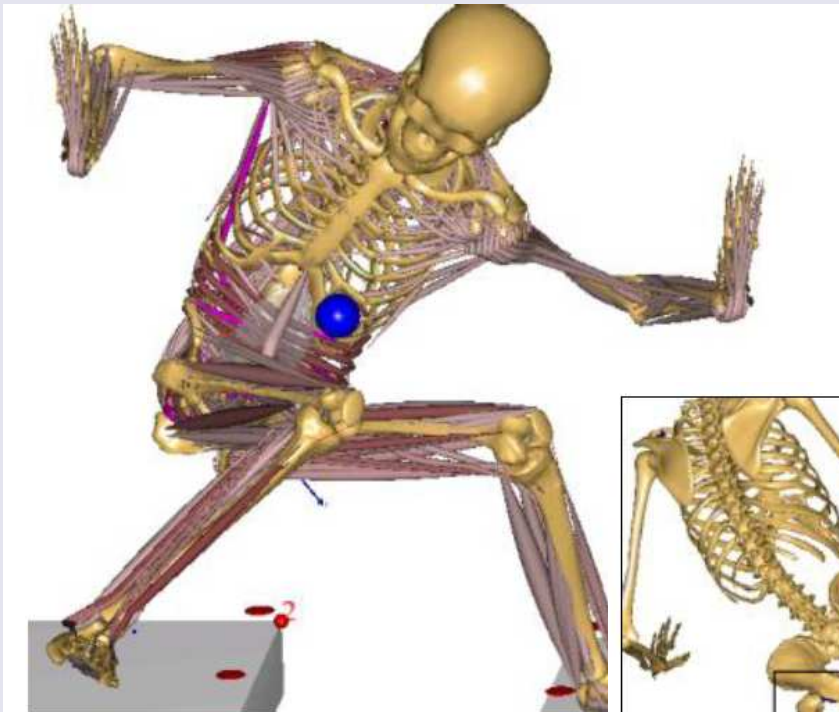


Surgical muscle damage increase proximal femur strain

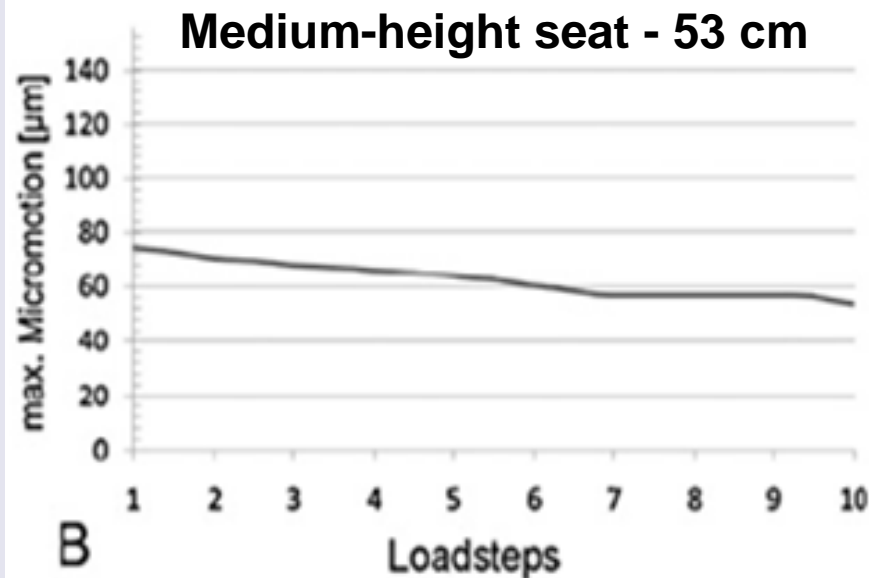
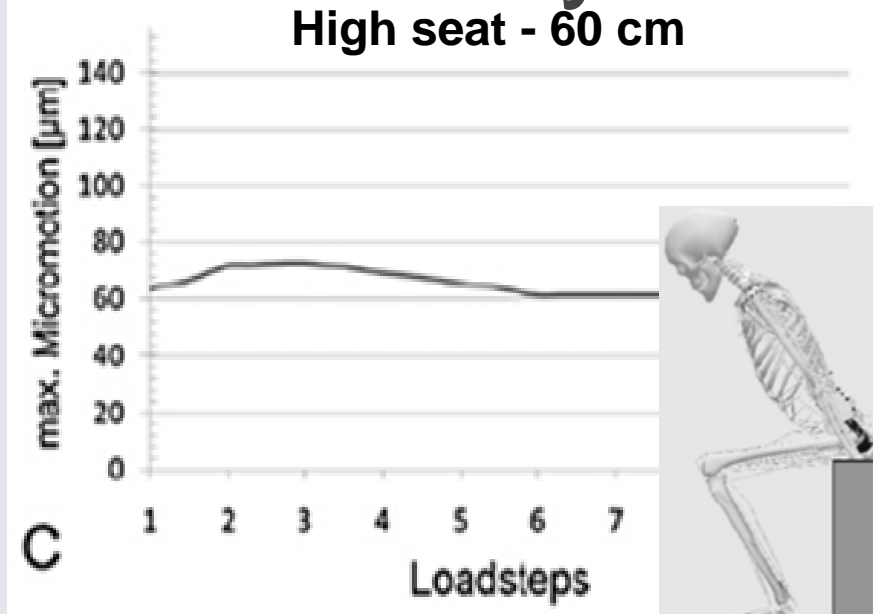
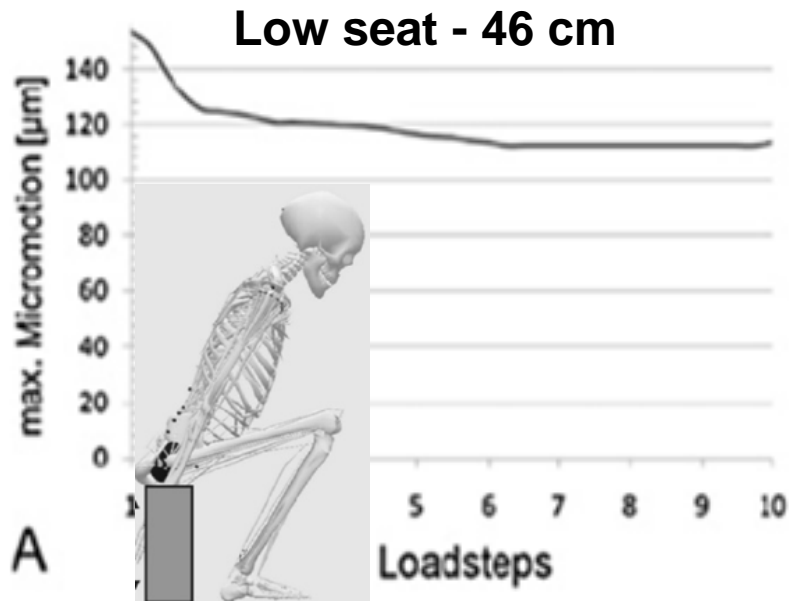


	Smith-Petersen	Posterior
Gluteus Medius	60%	60%
Gluteus Minimus	60%	60%
Piriformis	100%	60%
Tensor Fasciae Latae	60%	100%
Rectus Femoris	60%	100%

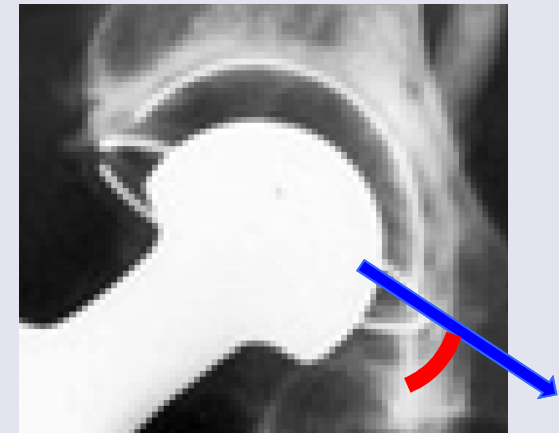
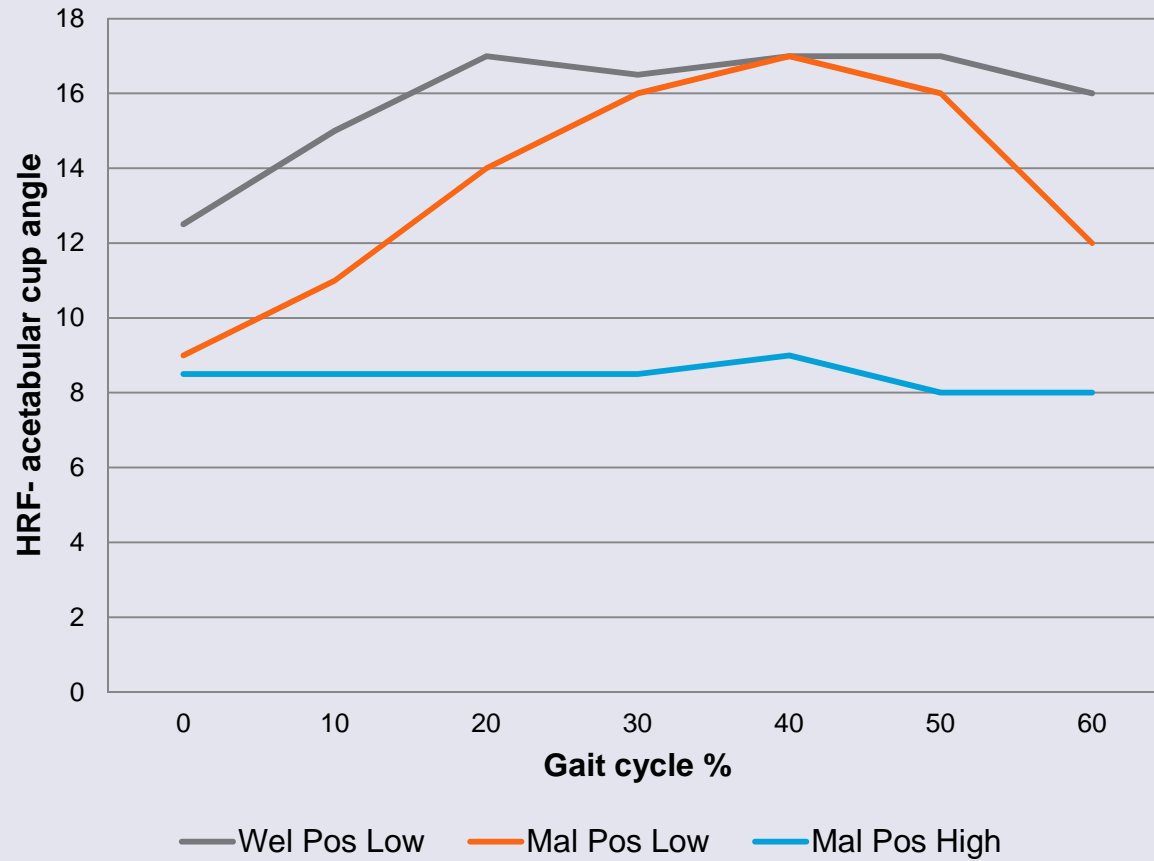
Subject-specific Musculoskeletal Simulation of Hip Dislocation Risk in Activities of Daily Living



Acetabular implant stability



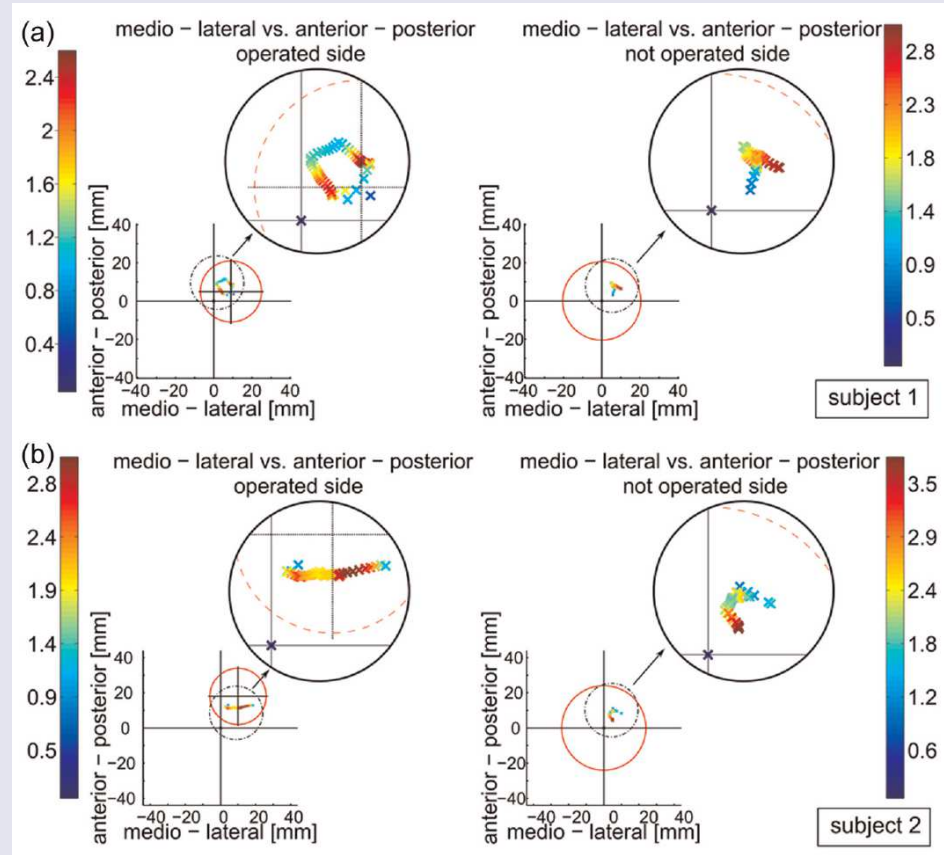
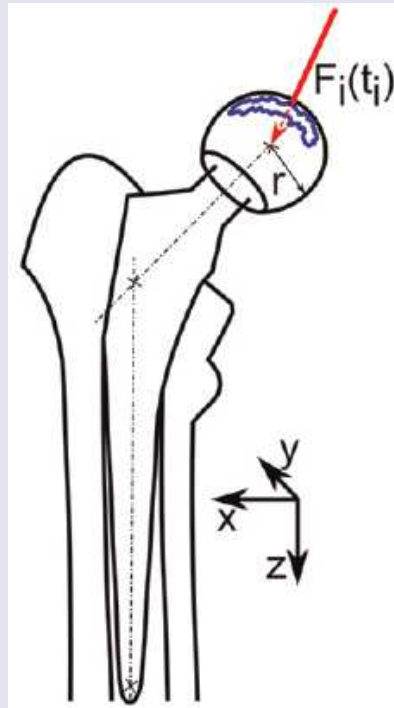
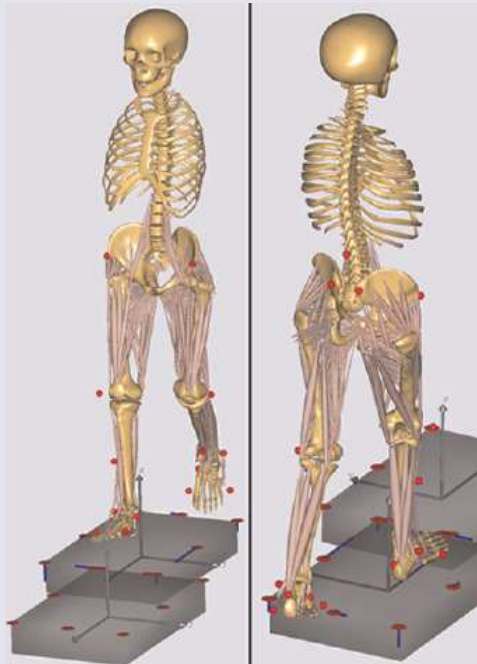
Patient-specific motion analysis



Measuring functional outcome after total hip replacement with subject-specific hip joint loading



Tim Weber^{1,2}, Sebastian Dendorfer², Silvia Dullien¹, Joachim Grifka¹, Gijbertus Jacob Verkerke^{3,4} and Tobias Renkawitz¹

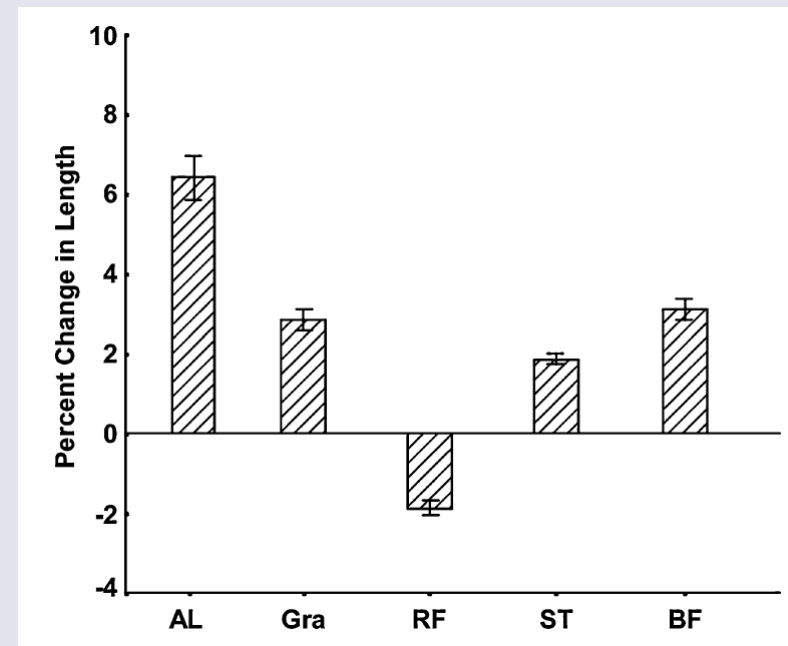
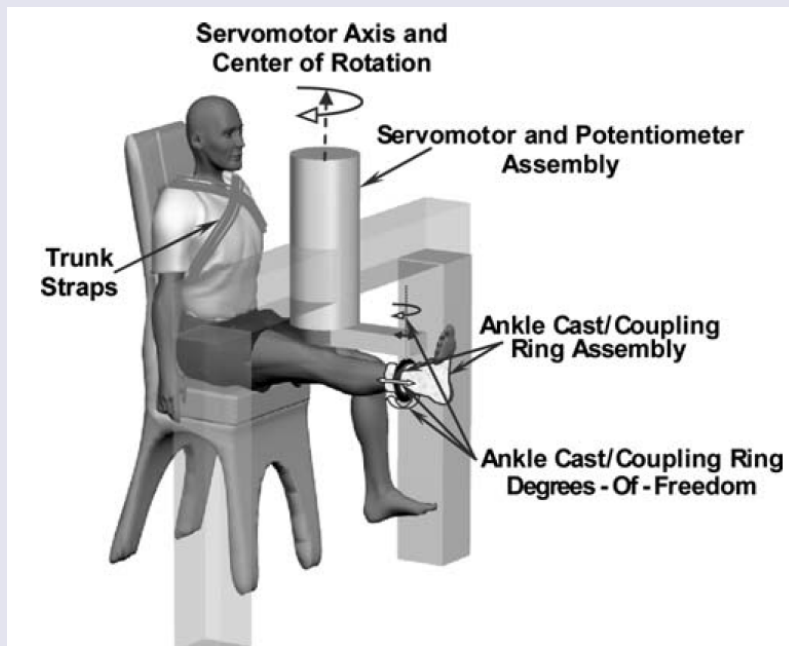


Exp Brain Res (2008) 188:529–540
DOI 10.1007/s00221-008-1383-z

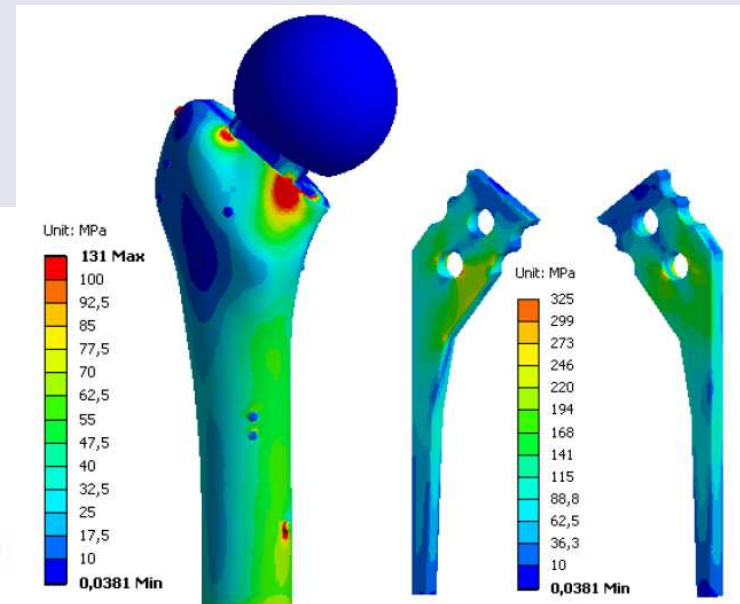
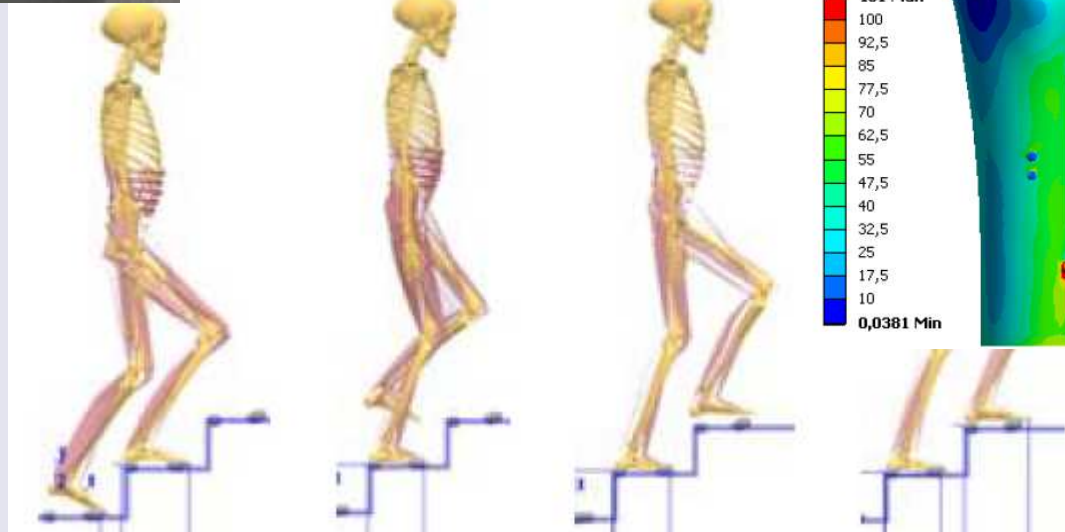
RESEARCH ARTICLE

Stretch reflex coupling between the hip and knee: implications for impaired gait following stroke

James M. Finley · Eric J. Perreault ·
Yasin Y. Dhaher



Clinical Application: Design of a Reinforced Antibiotic Hip Spacer



(in press)

Clinical implementation of finite element models in pelvic ring surgery for prediction of implant behavior: A case report

J. Böhme ^a, V. Shim ^{b,*}, A. Höch ^a, M. Mütze ^a, C. Müller ^c, C. Josten ^a

^a Department of Trauma, Plastic and Reconstructive Surgery, University of Leipzig, Liebigstr. 20, 04103 Leipzig, Germany

^b Auckland Bioengineering Institute, University of Auckland, 70 Symonds Street, Auckland, New Zealand

^c CADFEM GmbH, Marktplatz 2, 85567 Grafing, Germany



Table 3

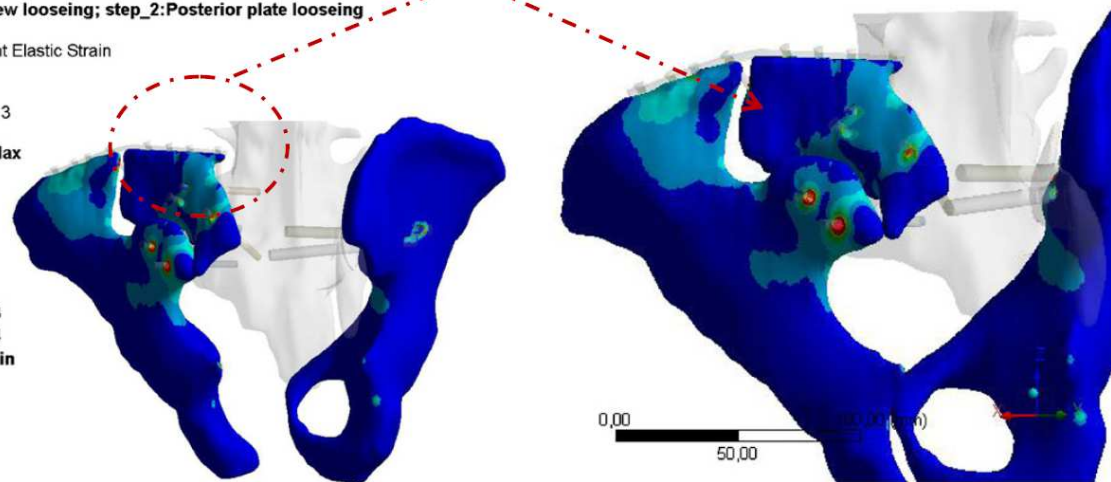
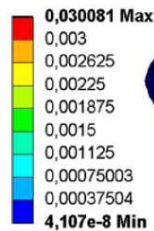
Hip forces used in the patient-specific FE model in an ISB recommended coordinate system, where the origin is at the centre of mass of the pelvis in the sagittal plane with X = anterior-posterior, Y = proximal-distal and Z = medial-lateral directions respectively.

	Forces [N]
Medial-lateral	-34.1
Proximal-distal	-253
Anterior-posterior	12.5

FE results based on AMS-derived hip loading (subject-specific model) agree well with clinical findings.

B: step_1: screw looseing; step_2:Posterior plate looseing

Figure
Type: Equivalent Elastic Strain
Unit: mm/mm
Time: 1
16.04.2012 15:13

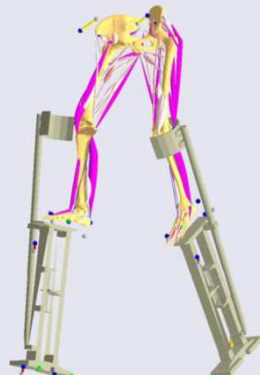


FE model showing a high-strain burden on the left-sided iliac plates. The magnified view of the situation is shown on the right (posterior view).

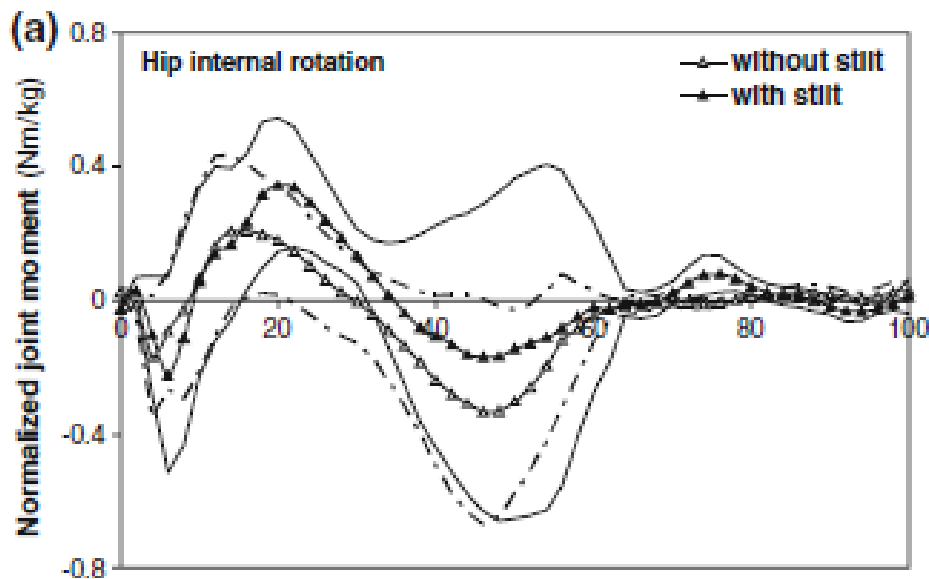
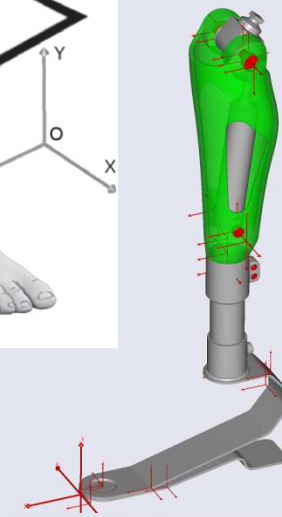
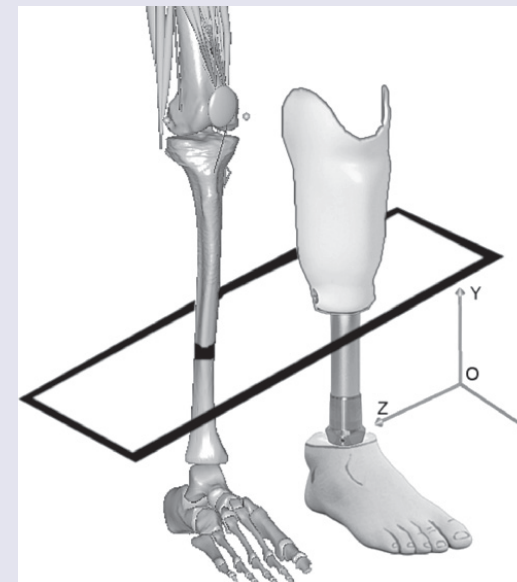
Analysis of Musculoskeletal Loadings in Lower Limbs During Stilts Walking in Occupational Activity

JOHN Z. WU, SHARON S. CHIOU, and CHRISTOPHER S. PAN

National Institute for Occupational Safety and Health, NIOSH, 1095 Willowdale Road, Morgantown, WV 26505, USA



Amputee Biomechanics (Voinescu, in press)



Summary

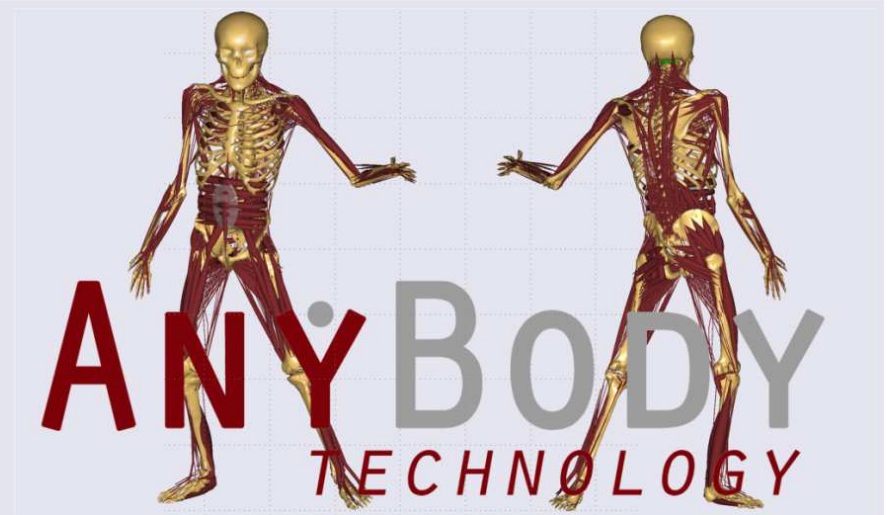
AnyBody Modeling System is used for:

- Patient Specific Models
- Implant Design
- Surgical Planning
- Outcome Assessment
- Implant Performance / Wear
- Clinical Impact
- Assistive Device

Please find full list of publications at
www.anybodytech.com

Q & A

- www.anybodytech.com
- www.anyscript.org



Webcast

- 20th Sept: The new Glasgow-Maastricht AnyBody foot model
- 7th Nov: Orthopedic Applications in the Spine

Meet AnyBuddies at:

- 13-15 Sep: ESMAC, Stockholm, Sweden
- 26-28 Sep: EORS, Amsterdam, Netherlands
- 2-4 Nov: AAHKS, Dallas, TX