Orthopaedic Biomechanics Research at the
VA RR&D Center of Excellence

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VA RR&D Center for Limb Loss Prevention and Prosthetic Engineering
Specific Areas of Expertise

- Mechanical testing
- Medical imaging analysis
- Motion analysis
- Cadaveric gait simulation
- Biplane fluoroscopy
Mechanical Testing

- MTS (15 kN)
- Enduratec 3400 (4.5 kN)
- Enduratec 3200 (0.45 kN)
- Biomomentum Mach-1 (0.05 kN)
- R2000 parallel axis robot (2kN)
- Vicon 8-camera motion analysis system
- Philips BV-Pulsera C-arm
- Custom acrylic/pneumatic jigs
- Dissection area, machine shop, freezers
Posterior Malleolar Fractures


VA RR&D Center for Limb Loss Prevention and Prosthetic Engineering
Iatrogenic Syndesmosis Malreduction via Clamp and Screw Placement


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Z-osteotomy vs. Evans Lateral Column Lengthening


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Medical Imaging Analysis

• US, CT and/or MRI
• New or existing data
  – CT scan database of 104 feet
    • Pes cavus (n=23)
    • Neutrally aligned (n=30)
    • Asymptomatic pes planus (n=28)
    • Symptomatic pes planus (n=23)
  – Ankle OA patients
    • Non-traumatic (n=~15)
    • Traumatic (n=~100)
Medical Imaging Analysis

- Segmentation
- Registration
- Fuse CT and MRI
- Custom CAD-based analysis
  - Ankle congruency
Custom CAD-based


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Custom CAD-based


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Custom CAD-based


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Motion Analysis Laboratory

- 12-camera Vicon motion analysis system
- 7 forces plates, 1 pressure plate
- Split belt instrumented treadmill
- Ground reaction forces, limb kinematics, joint moments/powers
Motion Analysis Laboratory

- Hahn ME, Wright E, Segal A, Orendurff M, Ledoux WR, Sangeorzan BJ. Foot and Ankle International 2012 Apr;33(4):282-9
Cadaveric gait simulation

Cadaveric gait simulation

Robotic Gait Simulator
Cadaveric gait simulation

- Weber JR, Aubin PM, Ledoux WR, Sangeorzan BJ. Second metatarsal length is positively correlated with increased pressure and medial deviation of the second toe in a robotic cadaveric simulation of gait. Foot and Ankle International 2012 Apr;33(4):312-9
Cadaveric gait simulation
Biplane fluoroscopy
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VA RR&D Center for Limb Loss Prevention and Prosthetic Engineering
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