MORE Foundation

MUSCULOSKELETAL ORTHOPEDIC RESEARCH AND EDUCATION

BIOMECHANICS RESEARCH LABORATORY

The MORE Foundation Biomechanics Research Laboratory houses research grade, motion tracking, materials testing and bio-robotic testing equipment. We undertake testing and investigations concerning effects of various orthopedic interventions and implantable devices on musculoskeletal biomechanics, implant strength and fracture fixation. The team is dedicated to developing innovative and rigorous testing strategies for evaluating orthopedic devices that result in overall improved quality of life with the least risk of potential injury for patients.

Research Areas & Experience:

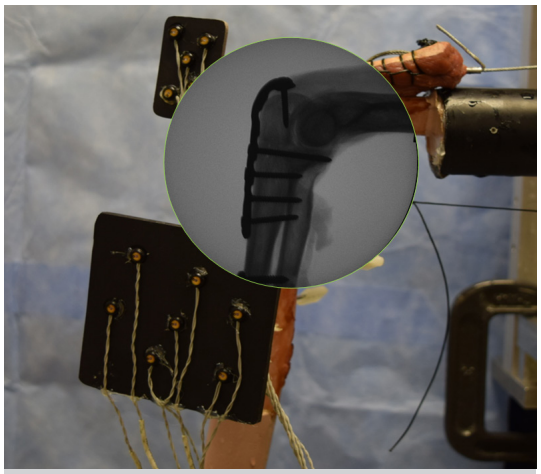
- Upper extremity (hand, shoulder, elbow, TSA, rTSA)
- Spine (lumbar/cervical)
- Lower extremity (hip, knee, foot & ankle)

Laboratory Capabilities & Services:

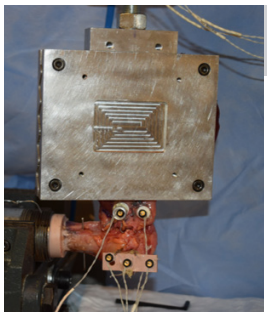
- Custom designed robotic equipment for purchase
- In-house and 3rd party contracted radiographic imaging (X-Ray, CT, MRI, DEXA)
- Servo-hydraulic test frames (uni- and bi-axial)
    - Load-to-failure/construct strength tests (cadaveric bones, synthetic bones)
    - Pull-out tests: screw pull-outs, tendon strain, suture strength
    - Long-term fatigue testing with or without fragment motion tracking
- Multi-axis, multi-segment range-of-motion (ROM) assessments with or without robotic control
- Multi-axis cadaveric loading tests using 6-DOF robotic arm
- Surgical training with audio-video conferencing within laboratory
- In-vitro musculoskeletal simulations:
    - Lower extremity (hip, knee, foot & ankle)
    - Upper extremity (hand, shoulder, elbow)
- 3D Printing (PLA, ABS) up to 12"x12" base
- 3D CAD, testing fixture design and fabrication
- Anatomical modeling & 3D printing using CT scans for pre-operative planning
- Bio-statistical analysis; preliminary, proof-of-concept testing
- Research protocol design, budgeting and grant submission

Over 35 Years of Combined Experience

- Biomechanics, mechanical design
- Bio-robotics, mechanical engineering & anthropology



Elbow musculoskeletal simulation with fracture gap tracking



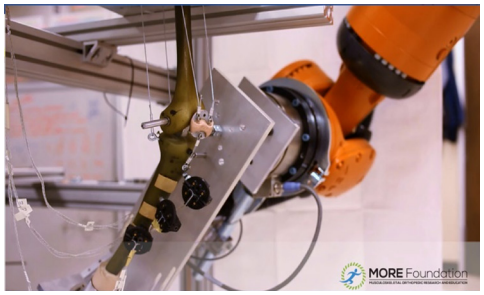
Tendon pull-out test

Fatigue loading of clavicle fracture plate

Robotic Musculoskeletal Joint Controllers

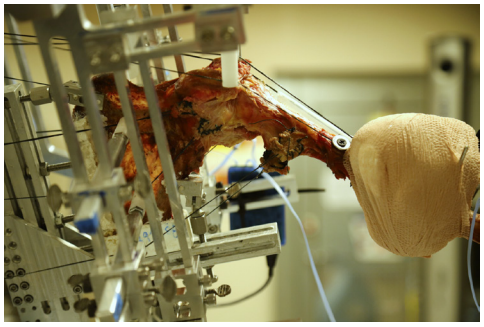
For over a decade, MORE Foundation engineers developed and perfected advanced multi-actuator musculoskeletal robotic testing platforms to mimic physiologic muscular response of independent muscles of the lower and upper extremity joints whilst simulating activities of daily living. Such simulations can also be performed in combination with a 6-DOF robotic arm (KUKA) for external loading simulations (upper body and arm weight, ground-reaction forces/torques etc).

Muscle force generation, joint loads, multi-joint kinematics, center of rotation, etc. are some of the primary outcomes of these test platforms. These outcomes allow clinicians and researchers to identify the limitations and advantages of different joint replacement devices, surgical procedures and therefore determine the ideal design, placement and biomechanical impacts of the same.



Lower Extremity Simulator

- 10 actuators with in-line single axis load cells
- Real-time, multi-axis joint position tracking and control
- Integration with 6-DOF robotic arm
- Import ADL kinematic/kinetic trajectories



Upper Extremity Simulator

- 12 actuators with in-line single axis load cell
- Custom scapula fixture allowing 3-DOF positioning
- Real-time, multi-axis joint position tracking and control
- Import ADL kinematic trajectories

Other Equipment:

- KR300 6-DOF robotic arm with 300kg payload capacity (KUKA Robotics)
- Optical rigid body tracking systems (Optotrak Certus (NDI, Waterloo, CA)

For further inquiries, questions or if you'd like to schedule a personal tour of our laboratory, please contact our staff below:

Ani Nayak, MS
Sr. Director, Biomechanics Research
623.241.8729
aniruddh.nayak@more-foundation.org

Marc Jacofsky, Ph.D.
Executive Director, Research and Education
623.537.5642
marc.jacofsky@more-foundation.org

For more information please visit **more-foundation.org/research/biomechanics-lab**