

DENNIS E. ANDERSON

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Education

- 2010 **Ph.D. in Engineering Mechanics**
Virginia Polytechnic Institute and State University
- 2009 **Graduate Certificate in Engineering Education**
Virginia Polytechnic Institute and State University
- 2005 **M.S. in Engineering Mechanics**
Virginia Polytechnic Institute and State University
- 2003 **B.S. in Mechanical Engineering**
Texas A&M University

Appointments

- 2015- Assistant Professor of Orthopedic Surgery, Harvard Medical School
- 2014- Staff Scientist, Center for Advanced Orthopaedic Studies, Beth Israel Deaconess Medical Center
- 2013-2015 Instructor in Orthopedic Surgery, Harvard Medical School
- 2013-2014 Research Associate, Center for Advanced Orthopaedic Studies, Beth Israel Deaconess Medical Center
- 2010-2013 Postdoctoral Research Fellow, Harvard Medical School and Center for Advanced Orthopaedic Studies, Beth Israel Deaconess Medical Center

Sponsored Research

Currently Funded

- 2015-2018 NIH-NIA R00AG042458 (Pathway to Independence Award – Independent Phase), “Age-Related Changes in Thoracic Spine Biomechanics”, Role: PI

Past Awards

- 2013-2015 NIH-NIA K99AG042458 (Pathway to Independence Award – Mentored Phase), “Age-Related Changes in Thoracic Spine Biomechanics”, Role: PI (\$165,380 direct costs)
- 2013-2015 American Society for Bone and Mineral Research Mentored Career Development Award, “Contribution of Age-Related Changes in the Rib Cage to Vertebral Loading”, Role: PI (\$75,000 direct costs)
- 2011-2012 Departmental Research Grant Award, Department of Orthopedics, Beth Israel Deaconess Medical Center, “Association of muscle density measured by QCT with trunk muscle strength and endurance”, Role: PI (\$18,300 direct costs)
- 2010-2012 NIH-NIA T32AG023480 (Translational Research in Aging Training Program; PI: Lewis A. Lipsitz), “The variation of trunk intramuscular fat with age, sex and activity level and its effect on muscle strength and vertebral loading”, Role: Post-Doctoral Fellow (\$102,168 direct costs)
- 2008-2010 NIH-NIA F31 AG030904 (NRSA Pre-doctoral Fellowship), “Implications of in vivo muscle loading for hip fracture etiology”, Roles: PI, Pre-Doctoral Fellow (\$57,560 total costs)

Peer-reviewed Publications

1. Anderson DE, Quinn E, Parker E, Allaire B, Muir JW, Rubin CT, Magaziner J, Hannan MT, Bouxsein ML and Kiel DP. Associations of computed tomography-based trunk muscle size and density with balance and falls in older adults. *Journal of Gerontology: Medical Sciences*, (accepted 24 September 2015).
2. Meng XJ, Bruno AG, Cheng B, Wang W, Bouxsein ML and Anderson DE. Incorporating six degree-of-freedom intervertebral joint stiffness in a lumbar spine musculoskeletal model – method and performance in flexed postures. *Journal of Biomechanical Engineering*, 137(10): 101008, 2015. doi: 10.1115/1.4031417
3. Bruno AG, Bouxsein ML, and Anderson DE. Development and validation of a musculoskeletal model of the fully articulated thoracolumbar spine and rib cage. *Journal of Biomechanical Engineering*, 137(8): 081003, 2015. doi: 10.1115/1.4030408
4. Meng XJ, Wang W, Anderson DE, Bruno AG, and Cheng B. [Effects of lumbar support on the driver's lumbar loadings]. *Qiche Gongcheng/Automotive Engineering*, 2015 (accepted). [in Chinese]
5. Meng XJ, Anderson DE, Wang W, Bruno AG, Tao X, Zhang C, and Cheng B. [Computational determination and validation of the driver lumbar loadings]. *Qiche Gongcheng/Automotive Engineering*, 2015 (accepted). [in Chinese]
6. Anderson DE, Franck, CT and Madigan ML. Age differences in the required coefficient of friction during level walking do not exist when experimentally-controlling speed and step length. *Journal of Applied Biomechanics* 30(4): 542-546, 2014. doi:10.1123/jab.2013-0275
7. Anderson DE and Madigan ML. Healthy older adults have insufficient hip range of motion and plantar flexor strength to walk like healthy young adults. *Journal of Biomechanics* 47(5): 1104-1109, 2014. doi:10.1016/j.jbiomech.2013.12.024
8. Anderson DE, Bean JF, Holt NE, Keel JC and Bouxsein ML. CT-based muscle attenuation and electrical impedance myography as indicators of trunk muscle strength independent of muscle size in older adults. *American Journal of Physical Medicine & Rehabilitation* 93(7): 553-561, 2014. doi:10.1097/PHM.0000000000000059
9. Anderson DE, Demissie S, Allaire BT, Bruno AG, Kopperdahl DL, Keaveny TM, Kiel DP and Bouxsein ML. The associations between QCT-based vertebral bone measurements and prevalent vertebral fractures depend on the spinal locations of both bone measurement and fracture. *Osteoporosis International* 25(2): 559-566, 2014. doi:10.1007/s00198-013-2452-0
10. Anderson DE and Madigan ML. Effects of age-related differences in femoral loading and bone mineral density on strains in the proximal femur during controlled walking. *Journal of Applied Biomechanics* 29(5): 505-516, 2013.
11. Anderson DE, D'Agostino JM, Bruno AG, Demissie S, Kiel DP and Bouxsein ML. Variations of CT-Based Trunk Muscle Attenuation by Age, Sex and Specific Muscle. *Journal of Gerontology: Medical Sciences* 68(3): 317-323, 2013. doi:10.1093/gerona/GLS168
12. Bruno AG, Anderson DE, D'Agostino JM and Bouxsein ML. The effect of thoracic kyphosis and sagittal plane alignment on vertebral compressive loading. *Journal of Bone and Mineral Research* 27(10): 2144-2151, 2012. doi:10.1002/jbmr.1658
13. Anderson DE, D'Agostino JM, Bruno AG, Manoharan RK and Bouxsein ML. Regressions for estimating muscle parameters in the thoracic and lumbar trunk for use in musculoskeletal modeling. *Journal of Biomechanics* 45: 66-75, 2012. doi:10.1016/j.jbiomech.2011.10.004

14. Anderson DE, Nussbaum MA and Madigan ML. A new method for gravity correction of dynamometer data and determining passive elastic moments at the joint. *Journal of Biomechanics* 43: 1220-1223, 2010.
15. Anderson DE, Madigan ML and Nussbaum MA. An algorithm for directly fitting a moment-angle-angular velocity model to maximum voluntary muscular moments measured with an isokinetic dynamometer. *Isokinetics and Exercise Science* 17: 51-56, 2009.
16. Bieryla KA, Anderson DE and Madigan ML. Estimations of relative effort during sit-to-stand increase when accounting for variations in maximum voluntary torque with joint angle and angular velocity. *Journal of Electromyography and Kinesiology*, 19(1): 139-144, 2009.
17. Anderson DE, Madigan ML and Nussbaum MA. Maximum voluntary joint torque as a function of joint angle and angular velocity: model development and application to the lower limb. *Journal of Biomechanics* 40: 3105-3113, 2007.
18. Anderson DE and Cotton JR. Mechanical analysis of percutaneous sacroplasty using CT image based finite element models. *Medical Engineering and Physics* 29:316-325, 2007.

Submitted Manuscripts

1. Bruno AG, Anderson DE, Allaire BT, Velie KR, De Paolis Kaluza C, and Boussein ML. Using computed tomography (CT)-based measurements of trunk anatomy to create patient-specific musculoskeletal models of the spine. Submitted to *Annals of Biomedical Engineering*, 1 June 2015.
2. Sis HL, Mannen EM, Cadel ES, Wong BM, Boussein ML, Anderson DE and Friis EA. Effect of follower load on thoracic spine motion and stiffness with intact rib cage. Submitted to *Spine*, 4 September 2015.
3. Anderson DE, Mannen EM, Sis HL, Wong BM, Cadel ES, Friis EA and Boussein ML. Effects of follower load and rib cage on intervertebral disc pressure and sagittal plane curvature in static tests of cadaveric thoracic spines. Submitted to *Journal of Biomechanics*, 18 September 2015.

Book Chapters

1. Anderson DE, Bruno AG and Boussein ML. Biomechanics of Hip and Vertebral Fractures. In: Marcus R, Feldman D, Dempster DW, Luckey M, and Cauley JA (eds). *Osteoporosis, Fourth Edition, Volume 1*, Academic Press, pp. 497-516, 2013
2. Anderson DE and Boussein ML. Factor of Risk for Fracture. In: Silva MJ and Guo XE (eds). *Skeletal Aging and Osteoporosis: Biomechanics and Mechanobiology*, Springer, Verlag, pp. 133-150, 2013

Fellowships, Honors and Awards

- Outstanding Researcher Award, National Center for Simulation in Rehabilitation Research, 2014
- Young Investigator Travel Grant, American Society for Bone and Mineral Research Annual Meeting, 2011 & 2013
- Young Investigator Award, American Society for Bone and Mineral Research Forum on Aging and Skeletal Health, 2011
- Beth Israel Deaconess Medical Center / Harvard Translational Research in Aging Training Program, Fellow, 2010-2012
- Ruth L. Kirschstein National Research Service Award for Individual Predoctoral Fellows, 2008-2010

Finalist (Honorable Mention), PhD Student Paper Competition, Podium Presentation, Solids, Design and Rehabilitation Engineering Category, ASME Summer Bioengineering Conference, 2010
Manual Stein Scholarship, Department of Engineering Science and Mechanics, Virginia Tech, 2008-2009
Graduate Research Development Program Grants, Virginia Tech, 2006 & 2008
Graduate Teaching Fellowship, Department of Engineering Science and Mechanics, Virginia Tech, 2007
Pratt Fellowship, Department of Engineering Science and Mechanics, Virginia Tech, 2006
Undergraduate Summer Research Grants Program, Texas A&M University, 2002
College of Engineering Distinguished Student Award, Texas A&M University, 2000

Selected Conference Abstracts (from 40 total)

1. Lorbergs AL, Zhou Y, Meng C-A, Brochin E, Kiel DP, Cupples LA, Murabito JM, Anderson DE, Allaire BA, Bouxsein ML, Trivison TG, Samelson EJ. "Prospective study of kyphosis and lower extremity function in women and men: The Framingham Study", *American Society for Bone and Mineral Research 2015 Annual Meeting*, Seattle, WA, October 9-12, 2015 (poster)
2. Anderson DE, Mannen EM, Sis HL, Wong BM, Cadel ES, Friis EA and Bouxsein ML. "Effects of follower load and rib cage on intervertebral disc pressures during static tests of cadaveric thoracic spines", *39th Annual Meeting of the American Society of Biomechanics*, Columbus, OH, August 5-8, 2015 (poster)
3. Koushyar H, Anderson DE, Nussbaum MA and Madigan ML. "Obesity is associated with increased joint torques and relative effort during gait: preliminary findings" *39th Annual Meeting of the American Society of Biomechanics*, Columbus, OH, August 5-8, 2015 (poster)
4. Bruno AG, Bouxsein ML and Anderson DE. "A biomechanical mechanism to explain high incidence of thoracolumbar vertebral fractures", *39th Annual Meeting of the American Society of Biomechanics*, Columbus, OH, August 5-8, 2015 (poster)
5. Anderson DE, Brooks DJ, Bruno AG, and Bouxsein ML. "Age-related calcification may increase the stiffness of costal cartilage", *American Society for Bone and Mineral Research 2014 Annual Meeting*, Houston, TX, September 12-15, 2014 (poster)
6. Bruno AG, Anderson DE, Meng X and Bouxsein ML. "A realistic model of the thoracolumbar spine and ribcage produces spinal loading patterns that may help explain the site-specific pattern of vertebral fractures along the spine", *American Society for Bone and Mineral Research 2014 Annual Meeting*, Houston, TX, September 12-15, 2014 (poster)
7. Anderson DE, Bruno AG, Bean JF and Bouxsein ML. "Development of subject-specific lumbar spine musculoskeletal models in OpenSim using CT-based muscle measurements and trunk extension strength", *7th World Congress of Biomechanics*, Boston, MA, July 6-11, 2014 (poster)
8. Allaire BT, Bruno AG, DePaolis MC, Anderson DE and Bouxsein ML. "Development and Testing of a New Method for Semi-automated Assessment of Intervertebral Disc Height from Lateral CT Scout Views", *7th World Congress of Biomechanics*, Boston, MA, July 6-11, 2014 (poster)
9. Anderson DE, Allaire BT, Bruno AG, Demissie S, Kiel DP and Bouxsein ML. "Low trunk muscle density is associated with prevalent vertebral fractures in older adults", *American Society for Bone and Mineral Research 2013 Annual Meeting*, Baltimore, MD, October 4-7, 2013 (plenary poster)

10. Anderson DE, Bruno AG, Allaire BT, Kim YM, Demissie S, Bouxsein ML and Samelson EJ. "Thoracic kyphosis is more strongly associated with the size and density of the thoracic spinal extensor muscles than lumbar spinal extensor muscles", *American Society for Bone and Mineral Research 2012 Annual Meeting*, Minneapolis, MN, October 12-15, 2012 (poster)
11. Anderson DE, Allaire BT and Bouxsein ML. "Associations of Costal Cartilage Calcification with Prevalent Vertebral Fractures in Older Adults", *2012 Meeting of the American Society of Biomechanics*, Gainesville, FL, August 15-18, 2012 (podium)
12. Anderson DE and Madigan ML. "Reduced Hip Extension Range of Motion and Plantar Flexion Strength are Functionally Significant Impairments that Affect Gait in Older Adults", *2012 Meeting of the American Society of Biomechanics*, Gainesville, FL, August 15-18, 2012 (podium)
13. Anderson DE, Bruno AG, Allaire BT and Bouxsein ML. "CT-Based Muscle Attenuation may be able to Account for Age- and Muscle-Specific Differences in Maximum Muscle Stress", *Proceedings of the ASME 2012 Summer Bioengineering Conference*, Fajardo, Puerto Rico, USA, June 20-23, 2012 (podium)
14. Anderson DE, D'Agostino JM, Bruno AG, Bouxsein ML, and Kiel DP. "Reduced QCT Attenuation Indicates Increased Trunk Intramuscular Fat in Women and Older Adults", *64th Annual Scientific Meeting of the Gerontological Society of America*, Boston, MA, November 18-22, 2011 (podium)
15. Anderson DE, D'Agostino JM, Bruno AG, Iyer S and Bouxsein ML. "Decreased muscle strength may increase vertebral compression forces in certain activities", *ASBMR Forum on Aging and Skeletal Health*, Bethesda, MD, March 21-22, 2011 (poster)
16. Anderson DE and Madigan ML. "Effects of age and speed on peak lower extremity joint torques when controlling speed and step length", *The ASME Summer Bioengineering Conference*, Naples, FL, June 16-19, 2010 (podium)

Invited Talks and Symposia

- 2015 College of Engineering, University of Wisconsin – Milwaukee, Milwaukee, WI
- 2015 Department of Biomedical Engineering, George Washington University, Washington D.C.
- 2015 Guest lecture, ME 5665 - Musculoskeletal Biomechanics class, Northeastern University, Boston, MA
- 2014 Department of Mechanical Engineering, Texas A&M University, College Station, TX
- 2014 Department of Mechanical Engineering, The University of Kansas, Lawrence, KS
- 2014 Graduate Biomechanics Seminar, Northeastern University, Boston, MA
- 2012 Aging and Gait Symposium, American Society of Biomechanics Annual Meeting, Gainesville, FL
- 2011 Institute for Aging Research, Hebrew SeniorLife, Boston, MA

Teaching Experience

Instructor

ESM 2204, Mechanics of Deformable Bodies, Virginia Tech, Spring 2009

- Students learned basic concepts of deformation, stress and strain, including stress-strain relationships, beam bending, stress transformations and calculating allowable loads.

ESM 3064, Mechanical Behavior of Materials Laboratory, Virginia Tech, Spring 2008

- Students took part in mechanical testing of engineering materials under static, dynamic, creep, and fatigue loads, and learned to analyze, interpret and report experimental data.

ESM 4105, Engineering Analysis of Physiologic Systems, Virginia Tech, Fall 2007

- Students were introduced to human physiology, and learned to describe physiologic systems using engineering concepts such as feedback control and heat and mass transfer.

Center for the Enhancement of Engineering Diversity ASPIRE Program - Introduction to Engineering Course, Virginia Tech, Summer 2004

- Academic course presenting basic engineering concepts and problem solving as part of a 5-week summer orientation program for incoming freshman engineering students.

Teaching Assistant

ESM 2074, Computational Methods, Virginia Tech, Spring 2004 and Spring 2005

ESM 2304, Dynamics, Virginia Tech, Fall 2003 and Fall 2004

ESM 2104, Statics, Virginia Tech, Summer 2003

Professional and Academic Affiliations

American Society for Bone and Mineral Research (ASBMR), 2011-present

American Society of Biomechanics (ASB), 2005-present

American Society of Mechanical Engineers (ASME), 2009-present

Gerontological Society of America (GSA), 2011-present

Kappa Theta Epsilon

Phi Kappa Phi

Professional and Academic Service

Journal peer reviewer: Archives of Gerontology and Geriatrics; BMC Musculoskeletal Diseases; Bone; Clinical Biomechanics; European Journal of Applied Physiology; Human Movement Science; International Journal of Solids and Structures; Journal of Biomechanics; Journal of Bone and Mineral Research; Journal of Electromyography & Kinesiology; Journal of Gerontology: Medical Sciences; Journal of Orthopedic Research; Medical Engineering & Physics; Osteoporosis International; Spine

Abstract reviewer for the American Society of Biomechanics Annual Meeting, 2012 & 2015.

Grant reviewer for the Swiss National Science Foundation, 2015

Grant reviewer for the American Society of Bone and Mineral Research Grants in Aid Program, 2014

Grant reviewer for the Smith Family Awards Program for Excellence in Biomedical Research, 2013

Abstract reviewer for the Gerontological Society of America Annual Scientific Meeting, 2013.

Session Co-Chair, *2012 Meeting of the American Society of Biomechanics*, August 15-18, 2012

Session Chair, *64th Annual Scientific Meeting of the Gerontological Society of America*, Boston, MA, November 18-22, 2011

Judicial Panelist in the Graduate Honor System, Virginia Tech, 2009-2010.

Coordinator - Biomechanics Journal Club, Virginia Tech Center for Applied Biomechanics, 2007-2008

Additional Training Activities and Courses Taken

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| 2014-2015 | Certificate in Applied Biostatistics, Harvard Catalyst –The Harvard Clinical and Translational Science Center (lectures and practicums in statistical analysis) |
| 2013 | HST-010, Human Functional Anatomy, Harvard Medical School (gross anatomy lectures and laboratory dissections) |
| 2012 | Responsible Conduct of Research, Harvard University (fulfills NIH and NSF requirements for Instruction in the Responsible Conduct of Research) |
| 2011-2012 | Young Investigators Initiative Workshops, US Bone and Joint Initiative (selective grant-writing mentoring program) |
| 2011 | EPI 254, Epidemiology of Aging, Harvard School of Public Health (lectures and discussions on methodological and clinical issues important to studies of older persons) |
| 2010-2012 | Advanced Aging Research Training Seminar Series, Hebrew SeniorLife Institute for Aging Research (monthly research training meetings for junior investigators conducting aging-related research across a variety of disciplines) |