

DOHERTY BIOMECHANICS

BRIAN J. DOHERTY, Ph.D.

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EDUCATIONAL EXPERIENCE

Duke University, Durham, NC. Ph.D., Biomedical Engineering, 1990.

Duke University, Durham, NC. M.S., Biomedical Engineering, 1986.

University of Pennsylvania, Philadelphia, PA. B.S.E., Bioengineering, 1984.

AWARDS AND HONORS

National Merit Scholarship, 1980 - 1984.

Duke University Research Fellowship, 1984-1990.

U. S. Air Force Summer Research Fellowship, 1986.

Siegel Research Award, 32nd Stapp Car Crash Conference, 1988.

Siegel Research Award, 35th Stapp Car Crash Conference, 1991.

Research Prize, 19th Annual Meeting of the Cervical Spine Research Society, 1991.

Best Paper, Annual Meeting of the Orthopedic Trauma Association, 1992.

WORK EXPERIENCE

2019 – present:

Principal Engineer, Doherty Biomechanics, Redwood City, CA.

Biomedical Engineer, specializing in biomechanics, impact injury and human tolerance, accident reconstruction and mechanical engineering. Experienced in head and spine injuries, implanted orthopedic devices, and bioengineering. Specific expertise in mechanical response to injury and traumatic failure of the cervical and lumbar spine.

1999 – 2019:

Principal Engineer, Applied BioMechanics, Alameda, CA.

Biomedical Engineer, specializing in biomechanics, impact injury and human tolerance, accident reconstruction and mechanical engineering.

January 1994 - February 2015:

Mathematical Statistician, Technology Manager & Informatics Chief, Cooperative Studies Program Coordinating Center, Veterans Administration Health Care System, Palo Alto, CA.

Participated in numerous large-scale medical research projects. Responsible for data system design, and managed a network of systems that receives patient and other medical data from over one hundred VA and private hospitals around the country.

June 1995-Dec 2000:

Assistant Professor, Department of Biomedical Engineering, University of Northern California, Petaluma, CA.

Responsibilities include teaching mechanical engineering and biomechanics to undergraduate and graduate students.

Research interests include investigations into injury mechanisms of the upper cervical spine (particularly in children and the elderly), quantitative anatomy for mathematical modeling of the spine, and the development of parametric models of spinal mechanics to better represent age- and gender-based variations.

September 1990 – September 1993:

Research Assistant Professor, Department of Orthopedic Surgery, Baylor College of Medicine, with joint appointment as Research Bioengineer, The Methodist Hospital, Houston, TX.

Research on fracture mechanisms of the upper cervical spine, mechanical stability of lumbar interbody fusion materials and effect of low bone mineral density on surgical approach to fracture treatment. Responsibilities included teaching biomechanics to residents and fellows and supervising all research activity in the Spine Section of the Department of Orthopedic Surgery.

September 1984 – September 1990:

Research Assistant, Department of Biomedical Engineering, Duke University, Durham, NC.

Investigated the mechanical response and traumatic failure modes of the human cervical and lumbar spines, in combined axial compression and flexion-extension bending. Conducted a study of the vibrational properties of the human head, using modal analysis techniques. Participated as a team member in the design of advanced concepts in automotive passive restraint devices for General Motors, using the Crash Victim Simulator algorithm to model occupant kinematics. The team's project was selected from among several universities to be presented to General Motors executives.

June 1986 – August 1986:

Graduate Research Fellow, Armstrong Aerospace Medical Research Laboratory, Modeling Division, Wright-Patterson Air Force Base, OH.

Performed mathematical modeling of manikin and human head-neck system kinematics during acceleration events, using Head-Spine Model and Articulated Total Body Model.

June 1983 – August 1984:

Research Assistant, University of Pennsylvania, Philadelphia, PA.

Designed, constructed, and implemented an optoelectronic device for measuring strain in a physical model of the brain. Assisted in set-up and operation of a primate head injury laboratory, including operation of the HYGE pneumatic actuator system and high-speed cinematography equipment.

GRANTS RECEIVED

“A Biomechanical Study of Odontoid Fracture”, funded by The Methodist Hospital Foundation; Jan - Dec 1992.

“The Effects of Bone Mineral Density on the Quality of Cervical Spine Plate Fixation.” (Co-PI with R. W. Lindsey), funded by AO/ASIF Research Commission; Jan - Dec 1993.

“The Variation in Segmental Bone Mineral Density in the Cervical Spine.” (Co-PI with R. W. Lindsey), funded by AO/ASIF Research Commission; Jan - Dec 1994.

“Bone Grafting of Osseous Defects: The Effect of Delayed Grafting on Bone Healing.” (Co-PI with R. W. Lindsey), funded by Dove Grant for Orthopedic Research, The Methodist Hospital; Jan - Dec 1994.

“The Use of Anatomic Landmarks in Intraoperative Radiography.” (Co-PI with R. W. Lindsey), funded by Ace Medical Company; Jun - Dec, 1993.

“Biochemical and Biomechanical Investigation of *Ligamentum Flavum* Properties in Adolescent Idiopathic Scoliosis Patients.” (Co-PI with N. A. Hadley), funded by the Shriner's Hospital Research Fund; Jan 1993 - Dec 1994.

TEACHING EXPERIENCE

University of Northern California, Department of Biomedical Engineering:

Taught classes in biomedical engineering and biomechanics to graduate students during their first year of study. Courses included biomedical engineering, and strength of materials.

Baylor College of Medicine, Department of Orthopedic Surgery:

Taught principles of orthopedic biomechanics to orthopedic surgery residents and fellows.

Duke University, Department of Biomedical Engineering:

Taught Dynamics, Statics, Electrical Engineering, and Strength of Materials. Taught a weekly recitation class and a weekly laboratory class to undergraduate students. In addition, served as a laboratory supervisor for a Biomedical Engineering laboratory class for three semesters.

PUBLICATIONS

PEER REVIEWED PAPERS

1. Doherty B.J. and Paver J.G. "A Computer Simulation of the Hybrid II Manikin Head-Neck System," SAFE Journal Vol 17 No 4, Winter 1987.
2. Stamato T., Weinstein R., Peters B., Hu J., Doherty B., Giaccia A. "Delayed Mutation in Chinese Hamster Cells," Somatic Cell and Molecular Genetics, Vol 13 No 1, 1987.
3. McElhaney J.H., Doherty B.J., Paver J.G., Myers B.S., Grey, L. "Combined Bending and Axial Loading Responses of the Human Cervical Spine," SAE Trans. No. 881709, 1988.
4. Doherty B.J. and Paver, J.G. "Mathematical Modeling of the Hybrid III Manikin Head-Neck Structure," Mathematical and Computer Modeling Vol 11 No 430, 1988.
5. McElhaney J.H., Doherty B.J., Paver J.G., Myers B.S., Grey L. "Flexion, Extension, and Lateral Bending Responses of The Cervical Spine," AGARD Meeting on Neck Injury in Advanced Military Aircraft Environments, Munich, 1989.
6. Myers B.S., McElhaney J.H., Doherty B.J., Grey, L. "Responses of the Human Cervical Spine to Torsion." SAE Technical Paper No 892437, 1989.
7. Myers B.S., McElhaney J.H., Doherty B.J. "The Viscoelastic Responses of the Human Cervical Spine in Torsion: Experimental Limitations of Quasi-Linear Theory, and a Method for Reducing These Effects," J. Biomech, Vol 24 No 9, 1991.
8. Myers B.S., McElhaney J.H., Doherty B.J., Paver J.G. and Gray, L. "The Role of Torsion in Cervical Spine Trauma," Spine Vol.16 No 8, 1991.
9. Myers B.S., McElhaney J.H., Nightingale R.W., Doherty, B.J. "The Influence of End Conditions on Human Cervical Spine Injury Mechanisms and the Use of a Single Cervical Injury Criterion," Proc. of the 35th Stapp Car Crash Conference, 1991.
10. Doherty B.J., Heggeness M.H., Esses S.I. "A Biomechanical Study of Odontoid Fractures and Fracture Fixation," Spine Vol 18 No 2, 1992.
11. Heggeness M.H. and Doherty B.J. "The Trabecular Anatomy of the Axis," Spine Vol 18 No 14, 1993.
12. Sasso R., Doherty B.J., Crawford M.J., Heggeness M.H. "Biomechanics of Odontoid Fracture Fixation; Comparison of One & Two Screw Technique," Spine Vol 18 No 14, 1993.

13. Leggon R., Lindsey R.W., Doherty B.J., Alexander J.W., Noble P.C. "The Holding Strength of Cannulated Screws Compared to Solid Core Screws in Cortical and Cancellous Bone," J. Orthop Trauma, Vol 7 No 5, 1993.
14. Kumar A., Kozak J.A., Doherty B.J. and Dickson J.H. "Interspace Distraction and Graft Subsidence Following Anterior Lumbar Fusion with Femoral Strut Allograft," Spine Vol 18 No 16, 1993.
15. Heggeness M.H. and Doherty B.J. "Discography Causes Endplate Deflection," Spine Vol 18 No 8, 1993.
16. Lindsey R.W., Diliberti T., Doherty B.J., Watson A.B. "Efficacy of Radiographic Evaluation of the Cervical Spine in Emergency Situations," South. Med. J., Vol 86 No 11, 1993.
17. Smith S.A., Lindsey R.W., Doherty B.J., Alexander J.W., Dickson J.H. "Cervical spine locking plate: in vitro biomechanical testing." Eur Spine J. Vol 1 No 4, 1993.
18. Smith S.A., Lindsey R.W., Doherty B.J., Dickson J.H. "In-Vitro Biomechanical Testing of the AO Cervical Spine Locking Plate." J. Orthop. Trauma Vol 7 No 2, 1993.
19. Lindsey RW, Fenison A, Doherty BJ, LeBlanc A "Long-Term Effects of Retained Diaphyseal Plates on Forearm Bone Density & Grip Strength." J. Orthop Trauma Vol 7 No 2, 1993.
20. Doherty BJ, Heggeness MH, "Quantitative Anatomy of Atlas", Spine Vol 19 No 22, 1994.
21. Lindsey RW, Fenison AT, Doherty BJ, Law P, LeBlanc A "Effects of Retained Diaphyseal Plates on Forearm Bone Density & Grip Strength," J Orthop Trauma, Vol 8 No 6, 1994.
22. Kip P.C, Esses S.I., Doherty B.J., Crawford M.J. "Biomechanical Testing of Pars Defect Repairs," Spine Vol 19 No 23, 1994.
23. Doherty B.J. and Heggeness M.H. "Quantitative Anatomy of the Second Cervical Vertebra." Spine Vol 20 No 5, 1995.
24. Smith S.A., Lindsey R.W., Doherty B.J., Dickson J.H. "An In Vitro Biomechanical Comparison of the Orosco and Cervical Spine Locking Plate," J. Spinal Dis Vol 8 No 3, 1995.
25. Curylo L., Lindsey, R.W., Doherty, B.J., LeBlanc A. "Segmental Variations of Bone Mineral Density in the Cervical Spine.", Spine Vol 21 No 2, 1996.
26. Esses SL., Doherty, B.J., Crawford M.J., Dreyzin V. "Kinematic Evaluation of Lumbar Fusion Techniques.", Spine Vol 21 No 6, 1996.

27. Doherty B.J., "Point of View: Anterior Instrumentation of the Thoracolumbar Spine." Spine Vol 22 No 7, April 1997.
28. Doherty B.J., "Point of View: The Quantitative Anatomy of the Thoracic Facet and the Posterior Projection of Its Inferior Facet." Spine Vol 22 No 16, August 1997.
29. Doherty B.J. and Heggeness M.H., "The Role of Facet Angle Asymmetry in Fractures of the First Cervical Vertebra." In Motor Vehicle Safety Design Innovations - SP-1226, SAE Publication No 970496, 1997.
30. Heggeness M.H. and Doherty B.J. "The Trabecular Anatomy of Thoracolumbar Vertebrae: Implications for Burst Fractures.", J. Anat Vol 121-2 No 2, 1997.
31. Beckner M.A., Heggeness M.H., Doherty B.J. "A Biomechanical Study of Jefferson Fractures.", Spine Vol 23 No 17, 1998.
32. Roberts D.A., Doherty B.J., Heggeness M.H. "Quantitative Anatomy of the Occiput and the Biomechanics of Occipital Screw Fixation." Spine Vol 15 No 10, 1998.
33. Breeze S.W., Doherty B.J., Noble P.S., LeBlanc A., Heggeness M.H. "A Biomechanical Study of Anterior Thoracolumbar Screw Fixation.", Spine Vol 23 No 17, 1998.
34. Heggeness M.H. and Doherty B.J. "Morphologic Study of Lumbar Vertebral Osteophytes." South Med J. Vol 91 No 2, 1998.

PRESENTATIONS – ABSTRACTS PUBLISHED

1. Doherty, B. J., McElhaney, J. H., and Myers, B. S. "Combined Bending and Axial Loading Responses of the Human Lumbar Spine," First World Congress on Biomechanics, 1990.
2. Pasipoularides, A., Kussmuall, W.G., Myers, B.S., Doherty, B. J., Stoughton, T. L., and Laskey, W. K. "Phasic Characteristics of Transaortic Pressure Gradients in Valvular Aortic Stenosis, J. Am Coll Cardiol, 17(2s1):A254, 1991.
3. Doherty, B. J. "A Biomechanical Basis of Evaluation of Cervical Spine Trauma," Orthopedic Trauma Association, 1991.
4. Doherty, B. J. and Heggeness, M. H. "The Quantitative Anatomy of the Atlas," Proc., Cervical Spine Research Society, 1992.
5. Heggeness, M. H. and Doherty, B. J. "Discography Causes End Plate Deflection," Proc., 7th Annual Meeting, North American Spine Society, 1992.

6. Kumar, A., Doherty, B. J., Kozak, J. A. and Dickson, J. H. "Interspace Behavior following Femoral Strut Allograft Anterior Lumbar Fusion," Proc., 7th Annual Meeting, NASS, 1992.
7. Smith, S. A., Lindsey, R. W., Doherty, B. J., Alexander, J. W., and Dickson, J. H. "In-Vitro Biomechanical Testing of the Cervical Spine Locking Plate," Proc., 7th Annual Meeting, North American Spine Society, 1992.
8. Lindsey, R. W., Diliberti, T., Babinski, C. Doherty, B. J., and Watson, A. B. "The Efficacy of Radiographic Evaluation of the Cervical Spine in the Emergency Setting," Proc., 7th Annual Meeting, North American Spine Society, 1992.
9. Doherty, B. J. "A Viscoelastic Model of Lumbar Spinal Responses to Complex Loads," Proc., Orthopedic Research Society, 1992.
10. Doherty, B. J. "A Mechanical Basis for Evaluation of Spine Trauma," Proc., Orthopedic Research Society, 1992.
11. Doherty, B. J., Heggeness, M. H., and Esses, S. I. "A Biomechanical Study of Odontoid Fractures and Fracture Fixation," Proc. 26th Annual Meeting, Canadian ORS, 1992.
12. Doherty, B. J., Heggeness, M. H., and Esses, S. I. "The Biomechanical Study of Occipital Cervical Fixation," Proc. 26th Annual Meeting, Canadian Orthopedic Research Society, 1992.
13. Kumar, A, Kozak, J. A., Doherty, B. J., and Dickson, J. H. "Interspace Distraction and Graft Subsidence Following Anterior Lumbar Fusion with Femoral Strut Allograft," Proc. 7th Annual Meeting of North American Spine Society, 1992.
14. Heggeness, M. H., and Doherty, B. J. "Discography Causes Endplate Deflection," Proc. 7th Annual Meeting of North American Spine Society, 1992.
15. Smith, S. A., Lindsey, R. W., Doherty, B. J., Alexander, J. W., and Dickson, J. H. "In Vitro Biomechanical Testing of the Cervical Spine Locking Plate," Proc. 7th Annual Meeting of North American Spine Society, 1992.
16. Lindsey, R. W., Curylo, L., Doherty, B. J., and LeBlanc, A. "Segmental Variations of Bone Mineral Density in the Cervical Spine," Proc., 10th Annual Meeting, NASS, 1995.
17. Doherty, B.J. and Heggeness, M.H. "The Role of Facet Angle Asymmetry in Fractures of the First Cervical Vertebra", SAE International Congress, Detroit MI, 1997.

TRAINING AND CERTIFICATIONS

- Excel Tribometers, Certified XL Tribometrist, 11/10/2011 (through present)
- Southwestern Association of Technical Accident Investigators (SATAI), Spring 2012 Training Conference, 3/10/2012
- Collision Safety Institute, Crash Data Retrieval Specialist certification, 10/5/2012
- Northwestern University Center for Public Safety, Pedestrian Vehicle Crash Reconstruction certification, 9/6/2013
- Engineering Dynamics Corporation, EDC Simulations training, 11/13/2015
- SATAI, Fall 2016 Training Conference, 10/8/2016:
 - Examination and Analysis of Motorcycle and Bicycle Helmets
 - The Hazards of Railroad Tracks for Bicyclists
 - Bicycle and Motorcycle Stability
 - Collision Reconstruction Techniques for Bicycle and Motorcycle Collisions
 - Documentation and Reconstruction of Night Time Accidents
 - Drug Toxicology and Impaired Driving
- SATAI, Winter 2020 Training Conference, Toyota Safety Sense, Performance Characteristics of Electric Scooters, 1/23/2020
- SATAI Winter 2020, Utilizing Video Evidence in Traffic Investigations, 1/23-25/2020
- National Association of Professional Accident Reconstruction Specialists (NAPARS), 2020 Joint Conference, Analyzing GPS Data for Reconstruction & Testing, 10/8/2020
- NAPARS, 2020 Joint Conference, PRT for Various Crash Types, 10/9/2020
- NAPARS, 2020 Joint Conference, Freightliner ECM Data for Reconstruction, 10/13/2020
- NAPARS, 2022 Training, Research and Information Sources, 10/20/2022
- NAPARS, 2022 Training, Linear Momentum, 10/28/2022
- NAPARS, 2022 Training, Bendix Pro, 11/04/2022
- NAPARS, 2022 Training, Vehicle Dynamics, 11/28/2022
- NAPARS, 2022 Training, Vehicle Spin Analysis, 11/18/2022
- NAPARS, 2023 Training, The EDR and the Trailer Hitch, 1/9/2023
- NAPARS, 2023 Training, EDR Update, 2/24/2023
- NAPARS, 2023 Training, Aerial Photogrammetry in Crash Reconstruction, 3/17/2023
- NAPARS, 2023 Training, Human Factors in Crash Reconstruction, 4/4/2023
- NAPARS, 2023 Training, Ignition Cyclopedia, 5/5/2023

PROFESSIONAL MEMBERSHIPS

- SAE (Society of Automotive Engineers)
- ASME (American Society of Mechanical Engineers)
- ASTM (American Society for Testing and Materials)
- SATAI (Southwestern Association of Technical Accident Investigators)
- NAPARS (National Association of Professional Accident Reconstruction Specialists)

PEER REVIEW ACTIVITIES

- Participated in the journal article review process for *Journal of Biomechanics* and *Spine*.
- Participated in the grant application review process for the Centers for Disease Control.
- Contributed several “Point of View” commentaries for *Spine*.

PATENTS GRANTED

- Prosthetic intervertebral devices (Michael H. Heggeness, Brian J. Doherty)
Patent number 5514180. May 7, 1996.
- Devices & methods for posterior spinal fixation (Michael H. Heggeness, Brian J. Doherty)
Patent number: 5558674. September 24, 1996. Assignee: Smith & Nephew Richards, Inc.
- Orthopedic fixation system (Brian J. Doherty)
Patent number 5643260. July 1, 1997. Assignee: Smith & Nephew, Inc.

Updated: May 2023