

Andrew Robert Karduna, PhD

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Assistant Professor
Department of Human Physiology
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EDUCATION

BS, Massachusetts Institute of Technology, Mechanical Engineering, 1989
Bachelor's Thesis: "Efficiency of the Quadriceps using Functional Electrical Stimulation"
Advisor: William F. Durfee, PhD

MSE, The Johns Hopkins University, Biomedical Engineering, 1991
Master's Thesis: "Transverse Stiffness and Constitutive Laws for Fiber Reinforced Elastomers"
Advisor: Frank C. P. Yin, MD, PhD

PhD, University of Pennsylvania, Bioengineering, 1995
Dissertation: "Translation at the Natural and Prosthetically Reconstructed Glenohumeral Joint"
Advisor: John L. Williams, PhD; Co-Advisor: Joseph P. Iannotti, MD, PhD

FACULTY APPOINTMENTS

Department of Bioengineering, University of Pennsylvania, Philadelphia, PA
Instructor, Fall 1995 – Spring 1996
Adjunct Assistant Professor, Spring 1999 – Fall 2000

School of Biomedical Engineering, Drexel University, Philadelphia, PA
Adjunct Assistant Professor, Spring 1999 – 2002

Department of Rehabilitation Sciences, MCP Hahnemann University (currently Drexel University), Philadelphia, PA
Assistant Professor, Summer 1996 – Spring 2000
Associate Professor, Summer 2000 – Summer 2002
Adjunct Associate Professor, Summer 2002 – 2005

Department of Human Physiology, University of Oregon, Eugene, OR
Assistant Professor, Fall 2002 – present

GRANTS

Present Grants

Principal Investigator, R01, *Centers for Disease Control and Prevention - National Institute of Occupational Safety and Health: A Biomechanical Study of Work-Related Shoulder Disorders*, March 2007 – February 2011, \$700,000 (direct costs).

Past Grants

Principal Investigator, *Oregon Medical Research Foundation: Biomechanics of Rotator Cuff Tears*, November 2003 – October 2006, \$24,000.

Principal Investigator, *Whitaker Foundation: Consequences of Altered Scapular Orientation Associated with Shoulder Impingement Syndrome*, September 2000 – June 2004, \$232,000.

Co-Investigator, *National Science Foundation: Functional Restoration of the Intervertebral Disc Using Novel Hydrogel Copolymers as Nucleus Pulposus Replacements*, October 2000 – September 2003, \$270,000.

Principal Investigator, R03, *Centers for Disease Control and Prevention - National Institute of Occupational Safety and Health: The Biomechanics of Occupational Shoulder Injuries*, August 2000 – July 2003, \$50,000.

Co-Investigator, *Drexel - MCP Hahnemann Intramural Synergies Program: Associating Hydrogels as Artificial Articular Cartilage*, July 2001 – June 2002, \$20,000.

Co-Investigator, *American Physical Therapy Association - Orthopaedic Section Classification of Low Back Pain Patients based on Trunk Electromyographic and Kinematic Patterns*, May 1999 – December 2001, \$5,000.

Co-Investigator, *Foundation for Physical Therapy: The Effects of Physical Rehabilitation in Patients with Impingement Syndrome*, September 1999 – September 2001, \$40,000.

Principal Investigator, *Drexel - MCP Hahnemann Intramural Synergies Program: Hydrogel Replacement of the Nucleus Pulposus for Degenerative Disc Disease*, May 1999 – May 2000, \$20,000.

Co-Investigator, *Arthritis Foundation: Mechanisms Associated with Shoulder Impingement Syndrome*, September 1998 – August 2000, \$50,000.

Co-Investigator, *American Physical Therapy Association - Orthopaedic Section Three-Dimensional Scapular Kinematics and Spinal Posture in Patients with Shoulder Impingement Syndrome*, May 1997 – May 1998, \$5,000.

Graduate Student, *DePuy, Inc.* Kinematics of the Glenohumeral Joint: Effects of Glenoid Prosthetic Component Design and Rotator Cuff Deficiency, June 1992 – June 1996, \$200,000.

PUBLICATIONS

Peer Reviewed Publications

1. **Karduna A**, Williams G, Williams J, Iannotti J: Kinematics of the glenohumeral joint: influences of muscle forces, ligamentous constraints and articular geometry, *Journal of Orthopaedic Research*, 14, 986-993, 1996.
2. **Karduna A**, Williams G, Williams J, Iannotti J: Glenohumeral joint translations before and after total shoulder arthroplasty: a study in cadavera. *Journal of Bone and Joint Surgery* 79A, 1166-1174, 1997.
3. **Karduna A**, Halperin H, Yin F: Experimental and numerical analysis in finite-sized isotropic and anisotropic rubber-like materials. *Annals of Biomedical Engineering* 25, 1009-1016, 1997
4. **Karduna A**, Williams G, Williams J, Iannotti J: Joint stability after total shoulder arthroplasty in a cadaver model. *Journal of Shoulder and Elbow Surgery* 6, 506-511, 1997.
5. Iannotti J, Williams J, **Karduna A**: Factors affecting the design of shoulder prosthesis, *Seminars in Arthroplasty*, 8, 260-267, 1997.
6. **Karduna A**, Williams G, Iannotti J, Williams J: Total shoulder arthroplasty biomechanics: a study of the forces and strains at the glenoid component, *Journal of Biomechanical Engineering*, 120, 92-99, 1998.
7. Klimkiewicz J, Williams G., Sher J, **Karduna A**, DesJardins J., Iannotti J: The acromioclavicular capsule as a restraint to posterior translation of the clavicle: a biomechanical analysis, *Journal of Shoulder and Elbow Surgery*, 8, 119-124, 1999.
8. **Karduna A**, McClure P, Michener L: Scapular kinematics: Effects of altering the Euler angle sequence of rotations, *Journal of Biomechanics*, 33, 1063-1068, 2000.
9. Williams GR, Naranja J, Klimkiewicz J, **Karduna A**, Iannotti JP, Ramsey M: The floating shoulder: a biomechanical basis for classification and management, *Journal of Bone and Joint Surgery*, 83A, 1182-7, 2001.
10. Williams GR, Jr., Wong KL, Pepe MD, Tan V, Silverberg D, Ramsey ML, **Karduna A**, Iannotti JP: The effect of articular malposition after total shoulder arthroplasty on glenohumeral translations, range of motion, and subacromial impingement. *Journal of Bone and Joint Surgery*, 10, 399-409, 2001.

11. **Karduna A**, McClure P, Michener L, Sennett B: Dynamic measurements of three-dimensional scapular kinematics: a validation study, *Journal of Biomechanical Engineering*, 123, 184-90, 2001.
12. Johnson M, McClure P, **Karduna A**: New method to assess scapular upward rotation in subjects with shoulder pathology, *Journal of Orthopaedic and Sports Physical Therapy*, 31, 81-89, 2001.
13. McClure P, Michener L, Sennett B, **Karduna A**: Direct three-dimensional measurement of scapular kinematics during dynamic movement in-vivo, *Journal of Shoulder and Elbow Surgery*, 10, 269-77, 2001.
14. Michener L, McClure P, **Karduna A**, Anatomical and biomechanical mechanisms of subacromial impingement syndrome, *Clinical Biomechanics*, 18, 369-379, 2003.
15. Tsai N-T, McClure P, **Karduna A**, Effects of muscle fatigue on 3-dimensional scapular kinematics, *Archives of Physical Medicine and Rehabilitation*, 84, 1000-1005, 2003.
16. McClure PW, Bialker J, Neff N, Williams G, **Karduna A**, Shoulder function and 3-dimensional kinematics in people with shoulder impingement syndrome before and after a 6-week exercise program, *Physical Therapy*, 84, 832-848, 2004
17. Su KP, Johnson MP, Gracely EJ, **Karduna A**, Scapular rotation in swimmers with and without impingement syndrome: practice effects, *Medicine and Science in Sports and Exercise*, 36, 1117-1123, 2004.
18. Silfies S, Squillante D, Maurer P, Westcott S, **Karduna A**: Trunk muscle recruitment patterns in specific chronic low back pain populations, *Clinical Biomechanics*, 20, 465-473, 2005.
19. Wu G, van der Helm, F, Veeger HEJ, Makhsouse M, Roy PV, Anglin C, Nagelsh J, **Karduna A**, McQuade K, Wang X, Werner F, Buchholz B: ISB recommendation on definitions of joint coordinate systems of various joints for the reporting of human joint motion—Part II: shoulder, elbow, wrist and hand, *Journal of Biomechanics*, 38, 981-992, 2005.
20. Dayanidhi S, Orlin M, Kozin S, Duff S, **Karduna A.**: Scapular kinematics during humeral elevation in adults and children. *Clinical Biomechanics*, 20, 600-606, 2005.
21. **Karduna A**, Kerner P, Lazarus M, Contact forces in the subacromial space: Effects of scapular orientation, *Journal of Shoulder and Elbow Surgery*, 14, 393-399, 2005..
22. Ebaugh D, McClure P, **Karduna A**: Three-dimensional scapulothoracic motion during active and passive arm elevation, *Clinical Biomechanics*, 20, 700-709, 2005.

23. McCully S, Kumar N, Lazarus M, **Karduna A**: Internal and external rotation of the shoulder: Effects of plane, end range determination, and scapular motion, *Journal of Shoulder and Elbow Surgery*, 14, 602-610, 2005.
24. Joshi A, Mehta S, Vresilovic E, **Karduna A**, Marcolongo M: Nucleus implant parameters significantly change the compressive stiffness of the human lumbar intervertebral disc, *Journal of Biomechanical Engineering*, 127, 536-540, 2005.
25. Joshi A, Fussel G, Thomas J, Hsuan A, Lowman, **Karduna A**, Vresilovic E, Marcolongo M: Functional compressive mechanics of a PVA/PVP nucleus pulposus replacement, *Biomaterials*, 27, 176-184, 2006.
26. Suprak D, Osternig L, van Donkelaar P, **Karduna A**: Shoulder joint position sense improves with elevation angle in a novel, unconstrained task, *Journal of Orthopaedic Research* 24:559-568, 2006.
27. McCully S, Suprak D, Kosek P, **Karduna A**: Suprascapular nerve block disrupts the normal pattern of scapular kinematics, *Clinical Biomechanics*, 21:545-53, 2006.
28. Ebaugh D, McClure P, **Karduna A**: Effects of shoulder muscle fatigue caused by repetitive overhead activities on scapulothoracic and glenohumeral kinematics, *Journal of Electromyography and Kinesiology*, 16:224-35, 2006.
29. Ebaugh DD McClure P, **Karduna A**: Scapulothoracic and glenohumeral kinematics following an external rotation fatigue protocol. *Journal of Orthopaedic and Sports Physical Therapy*, 36: 557-71, 2006.
29. McClure P, Michener L, **Karduna A**: Shoulder function and 3-dimensional scapular kinematics in people with and without shoulder impingement syndrome, *Physical Therapy*, 86: 1075-90, 2006.
30. McCully S, Suprak D, Kosek P, **Karduna A**: Suprascapular nerve block results in a compensatory increase in deltoid muscle activity, *Journal of Biomechanics*, Oct 9; [Epub ahead of print] 2006.
31. Suprak D, Osternig L, van Donkelaar P, **Karduna A**: Unconstrained shoulder joint position sense improves with external load, *Journal of Motor Behavior*, 2006 (accepted for publication).

Book Chapters

Marcolongo M, Kambin P, Lowman A, **Karduna A**: Experience with minimally invasive nucleus replacement. In *Arthroscopic and Endoscopic Spinal Surgery*, Edited by: P Kambin, Publisher: Humana Press, 2005.

Karduna A: Introduction to Biomechanical Analysis. In: *Kinesiology: Mechanics and Pathomechanics of Human Motion*, Edited by: Carol Oatis, Publisher: Lippincott Williams and Wilkins, 2003.

CONFERENCE PARTICIPATION

Presentations By Invitation

Karduna A, Williams G, Iannotti J, Williams J: Kinematics of the glenohumeral joint after shoulder arthroplasty, *ASME Winter Annual Meeting*, San Francisco, November 1995.

Karduna A, Williams G, Iannotti J, Williams J: An in-vitro study of glenoid component strains after total shoulder arthroplasty, *ASME Summer Bioengineering Conference*, Sun River, June 1997.

Karduna A, McClure P, Michener L: Scapular Kinematics: Effects of altering Euler angle sequence of rotations, *ASME Summer Bioengineering Conference*, Big Sky, June 1999.

Karduna A, McClure P: Moment arm calculations from in-vivo kinematic data: Application to the Trapezius, *ASME Winter Annual Meeting*, Orlando, November 2000.

Karduna A, Wu CY, Ebaugh D: Effects of low-load, high repetition motion on scapular kinematics, *IV World Congress of Biomechanics*, Calgary, August 2002.

Karduna A, Wu CY, Ebaugh D: The pattern of scapulohumeral motion – how stable is it?, *IV World Congress of Biomechanics*, Calgary, August 2002.

McCully S, Suprak D, Kosek P, **Karduna A:** Suprascapular nerve block disrupts the normal pattern of scapular kinematics, *International Society of Biomechanics*, Cleveland, August, 2005.

Presentations By Peer-Review

Karduna A, Williams G, Williams J, Iannotti J: A quantitative comparison of active and passive glenohumeral joint kinematics, *Orthopaedic Research Society*, New Orleans, February 1994.

Karduna A, Williams J, Williams G, Iannotti J: Active and passive glenohumeral joint kinematics, *Second World Congress of Biomechanics*, Amsterdam, July 1994.

Karduna A, Williams G, Iannotti J, Williams J: The effect of component conformity in total shoulder arthroplasty, *ASME Summer Bioengineering Conference*, Beaver Creek, June 1995.

Karduna A, Williams G, Williams J, Iannotti J: Kinematics of the glenohumeral joint before and after total shoulder arthroplasty, *Orthopaedic Research Society*, Atlanta, February 1996.

Karduna A, McClure P, Michener L: A new technique for non-invasive, three dimensional measurement of scapulohumeral kinematics, *Combined Sections Meeting of the American Physical Therapy Association*, Boston, February 1998.

Karduna A, McClure P, Michener L, Sennett B: Three-dimensional measurements of scapular kinematics: reliability and validity of a novel technique, *North American Congress on Biomechanics*, Waterloo, August 1998

Karduna A, McClure P, Michener L: The normal pattern of three-dimensional scapular kinematics, *Orthopaedic Research Society Meeting*, Anaheim, February 1999.

Karduna A, McClure P, Michener L: Scapular Kinematics, *International Shoulder Group Meeting*, Calgary, August 1999.

Karduna A, Kerner P, Lazarus M: Effects of scapular orientation on subacromial contact forces, *International Shoulder Group Meeting*, Cleveland, June 2002.

Ebaugh D, McClure P, **Karduna A**,: Effects of task intensity on changes in scapular kinematics, *American Society of Biomechanics*, Toledo, September 2003.

Karduna A, Kerner P, Lazarus M: Effects of scapular orientation on subacromial contact forces, *American Society of Biomechanics*, Toledo, September 2003.

McCully S, Kumar N, Lazarus M, **Karduna A**: Internal and external rotation of the shoulder: Effects of plane, end range determination, and scapular motion, *American Society of Biomechanics*, Portland, September, 2004.

Session Chairing

ASME Winter Annual Meeting, Kinematic Analysis, Orlando, November 2000.

American Society of Biomechanics, Orthopaedics I: Basic Science, Portland, September, 2004.

Northwest Biomechanics Symposium, Upper Extremity, Seattle, May, 2005.

International Society of Biomechanics, Motor Control – Upper Extremity, Cleveland, September, 2005.

American Society of Biomechanics, Shoulder, Blacksburg, September, 2006

Abstract Reviewing

American Society of Biomechanics

2004 – Reviewed top 10% of submitted abstracts for consideration for society awards

2006 – Reviewed abstracts in the area of musculoskeletal modeling of the upper extremity

Conference Organization

Local Organization Committee, *American Society of Biomechanics*, Portland, September, 2004.

Co-Chair, *Northwest Biomechanics Symposium*, Seattle, May, 2005.

HONOR AND AWARDS

Finalist, Clinical Biomechanics Award, American Society of Biomechanics, 1998, 1999

Research Award, Pennsylvania Physical Therapy Association, 1998

Alpha Eta, Health Care Educator Honor Society, 2000

MANUSCRIPT REVIEWER

Regular Reviewer

Clinical Biomechanics, 2002 – present

Clinical Orthopaedics and Related Research, 1997 – present

Journal of Orthopaedic and Sports Physical Therapy, 1997 – present

Journal of Shoulder and Elbow Surgery, 1997 – present

Ad-hoc Reviewer

American Journal of Sports Medicine, 2005, 2007

Annals of Biomedical Engineering, 2005

Archives of Physical Medicine and Rehabilitation, 2001

Biomechanics and Modeling in Mechanobiology, 2006

Clinical Anatomy, 2005

Human Movement Science, 2003, 2007

Journal of Applied Biomechanics, 2001

Journal of Biomechanical Engineering, 1998, 2003, 2005, 2006

Journal of Biomechanics, 1996, 2001, 2004, 2005, 2006

Journal of Orthopaedic Research, 1995, 2000, 2005, 2006

Journal of Sports Science and Medicine, 2004

Medicine & Science in Sports & Exercise, 2005, 2006

GRANT REVIEWING

Drexel University, Synergy Program, 2000
Department of Veterans Affairs, 2001
Swiss National Science Foundation, 2003
U.S. Army Medical Research, 2005, 2006
National Athletic Trainers' Association, 2006

PROFESSIONAL SOCIETIES

American Society of Mechanical Engineering, 1989 – present
International Society of Biomechanics, 2001 – present
American Society of Biomechanics, 1988 – present
 Newsletter editor and executive board member, 2003 – 2006
 Communications chair and executive board member, presently
International Shoulder Research Group, 1995 – present
 Committee on standardization of shoulder motion, 2001 – 2005
 Board members, 2005 - present

UNIVERSITY SERVICE

MCP Hahnemann University (Drexel University)

Student/Resources Task Force, 1997
Graduate Admissions and Standards Committee, 1998 – 2000
Appointments and Promotions Committee, 2000 – 2002
Research Committee, 2002

University of Oregon

Search Committee for Head of TSA Machine Shop, Spring 2003
Operations Committee for TSA, Summer 2003 – present
Scholastic Review Committee, Spring 2005 – present
Search Committee for Faculty Position, Fall 2006 – Winter 2007

GRADUATE STUDENTS

Doctoral Students

Lori Michener (co-advisor with Phil McClure), Relationships Between Impairments, Three-Dimensional Kinematics, Functional Limitation, and Disability in Patients with Subacromial Impingement Syndrome, MCP Hahnemann University, 2001

Sheri Silfies, Trunk Muscle and Motor Control Impairments in Patients with Lumbar Instability, MCP Hahnemann University, 2002

David Ebaugh (co-advisor with Phil McClure), The Effects of Muscle Activity and Fatigue on Three-Dimensional Scapulothoracic and Glenohumeral Kinematics, MCP Hahnemann University, 2004

Abhijeet Joshi (co-advisor with Michele Marcolongo), Mechanical Behavior of the Human Lumbar Intervertebral Disc with Polymeric Hydrogel Nucleus Implant: An Experimental and Finite Element Study, Drexel University, 2004

David Suprak, Unconstrained Joint Position Sense in Healthy and Unstable Shoulder, University of Oregon, 2006

Bernardo San Juan, University of Oregon, current student

Tal Amasay, University of Oregon, current student

Masters Students

Michael Johnson, Reliability and Validity of a New Method to Assess Scapular Upward Rotation in Subjects with and without Shoulder Pathology, MCP Hahnemann University, 1999

Nian-Tuen Tsai, The Effect of Muscle Fatigue of the Infraspinatus and Teres Minor Muscles on Scapular Kinematics, MCP Hahnemann University, 1999

Eva Su, Changes in Scapular Rotation after Practice in Swimmers with and without Shoulder Impingement Syndrome, MCP Hahnemann University, 2000

Bessie Wu, Work Related Biomechanics of the Shoulder, MCP Hahnemann University, 2000

Sudarshan Dayanishi, Scapular Kinematics During Humeral Elevation in Adults and Children, MCP Hahnemann University, 2003

Sean McCully, Internal and External Rotation of the Shoulder: Effects of Plane, End Range Determination, and Scapular Motion, University of Oregon, 2003

Jason Chapman, Unconstrained Shoulder Joint Position Sense Does Not Change With Body Orientation, University of Oregon, 2006

Current Undergraduate Thesis Students

Linden Lee
Keely Zodrow
Simon Yang

Past UO Undergraduate Thesis Students

Brian Fedor
Annie Fetcher

Dissertation/Thesis Committees

Kelley Fitzgerald, PhD Student, MCP Hahnemann University, 1998
David Hutchinson, MS Student, MCP Hahnemann University, 1997
Yi-Liang Kuo, MS Student, MCP Hahnemann University, 1997
Saipin Prasersukdee, PhD Student, MCP Hahnemann University, 2001
Maiko Sakamoto, MS Student, MCP Hahnemann University, 2001
Wen-Yu Liu, PhD Student, MCP Hahnemann University, 2001
Renee Crossman, MS Student, MCP Hahnemann University, 2003
Margaret Finley, PhD Student, University of Maryland, 2003
Nuanlaor Thawinchai, MS/PhD Student, MCP Hahnemann University, 2004
Jeanne Langan, PhD Student, University of Oregon, 2006
Heng-Ju Lee, PhD Student, University of Oregon, 2006
Robert Catena, PhD Student, University of Oregon, present
Sandy Saavedra, PhD Student, University of Oregon, present
Harpa Helgadóttir, PhD Student, Iceland University, present