SAMUEL C. WORDEMAN, Ph.D.

PROFESSIONAL BIOGRAPHICAL OUTLINE

BACKGROUND

Dr. Wordeman earned a Bachelor of Science degree in Biomedical Engineering with a focus in Biomechanics from Washington University in St. Louis, and continued on to earn degrees of Master of Science and Doctorate of Philosophy in Biomedical Engineering from The Ohio State University, Columbus, Ohio. Dr. Wordeman also held the position of Post-Doctoral Research Associate at The Ohio State University. During his dissertation, Dr. Wordeman studied the neuromuscular and biomechanical effects of injury prevention training protocols, on kinematic and kinetic patterns associated with knee injury mechanisms in sport. Dr. Wordeman's graduate and undergraduate studies included extensive formal training on the quantitative and qualitiative mechanical properties and response of bone, muscle, tendon, ligament, cartilage, and non-musculoskeletal soft tissues. During his graduate and post-doctoral research, Dr. Wordeman contributed to the development and publication of advanced and physiologically relevant methodologies for the simulation of lower extremity sports injury mechanisms in post-mortem human subjects. Dr. Wordeman further developed advanced algorithms for the prediction of second ACL injury risk based on individual anatomy and biomechanical risk factors associated with non-contact ACL injury mechanism.

Dr. Wordeman has experience with three-dimensional motion capture, radiographic and magnetic-resonance-based image analysis, advanced statistical and mathematical modeling of mechanical systems, kinematic and kinetic analysis of the human body, biomechanical testing of live and post-mortem human subjects in laboratory and clinical settings, stress-strain analyses of biological and non-biological materials, and computational biomechanics. Dr. Wordeman has completed and/or instructed advanced coursework in device design, orthopaedic hard- and soft-tissue biomechanics, engineering biomaterials, human movement analysis, experimental biomechanics, mechanobiology, and tissue engineering.

Dr. Wordeman's academic background, and his experience with experimental research and modeling of the human body, provides a thorough understanding of human physiology, mechanics, biomechanical failure mechanisms, and interaction of the human anatomy with its environment. Currently, he specializes in biomechanics, injury tolerance, and biomechanical failure mechanisms.

SUMMARY OF EXPERIENCE

- Designed and conducted biomechanical research regarding the efficacy of clinically-implemented neuromuscular training protocols for prevention of primary and secondary ACL injury.
- Designed and implemented impact-based methodology for evaluation of lower extremity injury mechanisms and tolerance in isolated post-mortem human lower extremities.
- Performed randomized controlled trials to evaluate efficacy of neuromuscular training protocols and commercial electromechanical muscle stimulation units for lower extremity injury risk mitigation.
- Designed and executed federally-funded studies for investigation of non-contact anterior cruciate ligament injury mechanism.
- Designed and built device for *in vitro* measurement of contractility of engineered muscle constructs.

AREAS OF EXPERTISE

- Biomechanical Consulting
- Human Injury Tolerance and Failure Mechanisms
- Orthopaedic Biomechanics
- Biomaterials and Implant Design
- Accident Reconstruction
- Kinematic and Kinetic Analysis
- Experimental and Computational Testing

EDUCATION

- Ph.D., Biomedical Engineering, The Ohio State University, 2014
- M.S., Biomedical Engineering, The Ohio State University, 2014
- Ph.D. student, Biomedical Engineering, University of Cincinnati (transferred to The Ohio State University), 2007-2011
- BS, Biomedical Engineering (Biomechanics Track), Washington University, St. Louis, 2007

PROFESSIONAL EXPERIENCE

May 2015 – Present | ARCCA, Incorporated | Senior Biomechanist

- Practices biomechanics to identify and evaluate injury mechanisms and severity.
- Utilizes medical records, testing, computer modeling, and knowledge of human injury tolerance to determine whether an injury is consistent with a specific set of actions or exposure to a specific incident environment.
- Investigates and reconstructs motor vehicle collisions, incident sites, and equipment failures.

December 2014 – May 2015 | The Ohio State University | Post-Doctoral Researcher

- Implemented peer-reviewed, NIH-funded protocols to identify subject-specific risk factors for lower-extremity ligament injury in live human subjects, computational models, and post-mortem human subjects.
- Utilized advanced computational magnetic resonance image (MRI) processing tools to identify non-modifiable risk factors for ACL injury.
- Established protocols and performed data processing from experimental studies.
- Performed biomechanical analyses of injury mechanisms and tolerance in cadavers and live human subjects using passive and active three-dimensional motion analysis systems, force, pressure, and displacement transducers, as well as clinician-friendly methodologies.
- Oversaw and coordinated clinical and scientific laboratory personnel for numerous multidisciplinary, federally- and privately-funded research projects.
- Designed and built post-mortem human subjects biomechanics laboratory.

July 2011 – December 2014 | The Ohio State University | Graduate Research Associate

- Utilized reliable biomechanical methodologies to quantify the biomechanical effects of neuromuscular training on factors associated with noncontact ACL injury mechanisms in sport.
- Implemented and evaluated neuromuscular training programs aimed at reduction of risk for second injury subsequent to ACL-reconstruction in athletes.
- Conducted randomized biomechanical evaluation of commercially-available electromechanical muscle stimulation units for improvement of quadriceps function after ACL-reconstruction.
- Designed and implemented custom dynamic test device and protocol for simulation of lower extremity injury mechanisms in post-mortem human subjects.

July 2007 – June 2011 | University of Cincinnati | Graduate Research and Teaching Assistant

- Performed cross-validation of optical and pneumatic bioreactor mechanical stimuli for tissue-engineered ligament constructs in a rabbit model.
- Developed protocol for evaluation of *in vivo* relationship between left ventricular pressure-volume relationship and fractional flow reserve during open heart surgery in a pig model.
- Served as teaching assistant for undergraduate and graduate courses in Medical Device Dissection, Musculoskeletal Biomechanics, and Tissue Biomechanics.
- Performed data collections and analysis in human biomechanics using dynamic and quasistatic techniques for assessment of ligament injury risk.

SCIENTIFIC PEER-REVIEWER:

American Journal of Sports Medicine: 2014-Present

Clinical Biomechanics: 2014-Present

CURRENT PROFESSIONAL MEMBERSHIPS:

American Society of Biomechanics, 2014-Present

SELECTED AWARDS AND HONORS:

- American College of Sports Medicine Biomechanics Interest Group Student Research Award, 2011
- American Journal of Sports Medicine Systematic Review Award, 2012
- 1st Place Ohio Orthopaedic Society Resident Paper Contest, 2012
- Midwest Graduate Research Symposium Sigma Xi Oral Presentation Award, 2012
- Orthopaedic Research Society Best Scored Knee Poster, 2012
- American Orthopaedic Society for Sports Medicine Herodicus Award, 2013
- American Society of Biomechanics Journal of Biomechanics Award, 2014

PEER-REVIEWED PUBLICATIONS:

Magnussen, RA, Pottkotter, K., Di Stasi SD, Paterno, MV, **Wordeman, SC,** Schmitt, LC., Flanigan, DC, Kaeding CC, Hewett TE. (2016). Femoral Nerve Block after Anterior Cruciate Ligament Reconstruction. *J Knee Surg*. In press.

Kiapour AM, Demetropoulos CK, Kiapour A, Quatman CE, **Wordeman SC**, Goel VK, Hewett TE. (2016). Strain Response of the Anterior Cruciate Ligament to Uniplanar and Multiplanar Loads During Simulated Landings: Implications for Injury Mechanism. *Am J Sports Med*. Aug;44(8):2087-96.

Panos, JA, Hoffman JT, **Wordeman SC**, Hewett TE. (2016). Medio-lateral Knee Fluency in Anterior Cruciate Ligament-Injured Athletes During Dynamic Movement Trials. *Clin Biomech*. Mar;33:7-12.

Hoffman, JT., McNally, MP, **Wordeman, SC**, Hewett, TE. (2015). Validation of a Method to Accurately Correct Anterior Superior Iliac Spine Marker Occlusion. *J Biomech*. Apr 13;48(6):1224-8.

Wordeman SC, Hewett TE.. Research-Based and Clinical Considerations for Effective Neuromuscular Training to Prevent Second Anterior Cruciate Ligament Injury. *Operative Techniques in Sports Medicine*. In Press as of December, 2015.

Kiapour AM, Kiapour A, Goel VK, Quatman CE, **Wordeman SC**, Hewett TE, Demetropoulos CK. (2015) Uni-directional Couplgin Between Tibiofemoral Frontal and Axial Plane Rotation Supports Valgus Collapse Mechanism of ACL Injury. *J Biomech*. 48(10):1745-51

Hoffman JT, McNally MP, **Wordeman SC**, Hewett TE.. (2015) Validation of a Method to Accurately Correct Anterior Superior Iliac Spine Marker Occlusion. *J Biomech*. 48(6):1224-8

Myer GD, Bates NA, DiCesare CA, Barber Foss KD, Thomas SM, **Wordeman SC**, Sugimoto D, Roewer BD, Medina McKeon JM, Di Stasi SL, Noehren BW, McNally M, Ford KR, Kiefer AW, Hewett TE.. (2015) Reliability of 3-Dimensional Measures of Single-Leg Drop Landing Across 3 Institutions: Implications for Multicenter Research for Secondary ACL-Injury Prevention. *J Sport Rehabil*. 24(2):198-209.

Myer GD, **Wordeman SC**, Sugimoto D, Bates NA, Roewer BD, Medina McKeon JM, DiCesare CA, Di Stasi SL, Barber Foss KD, Thomas SM, Hewett TE. (2014) Consistency of Clinical Biomechanical Measures Between Three Different Institutions: Implications for Multi-Center Biomechanical and Epidemiological Research. *Int J Sports Phys Ther*. 9(3):289-301

Kiapour A, Kiapour AM, Kaul V, Quatman CE, **Wordeman SC**, Hewett TE, Demetropoulos CK, Goel VK. (2014) Finite Element Model of the Knee for Investigation of Injury Mechanisms: Development and Validation. *J Biomech Eng*. 136(1):011002

Kiapour AM, Quatman CE, Goel VK, **Wordeman SC**, Hewett TE, Demetropoulos CK. (2013) Timing Sequence of Multi-Planar Knee Kinematics Revealed by Physiologic Cadaveric Simulation of Landing: Implications for ACL Injury Mechanism. *Clinical Biomechanics*. 29(1):75-82.

Kiapour AM, **Wordeman SC**, Paterno MV, Quatman CE, Levine JW, Goel VK, Demetropoulos CK, Hewett TE. (2013) Diagnostic Value of Knee Arthrometry in the Prediction of Anterior Cruciate Ligament Strain During Landing. *Am J Sports Med*. 42(2):312-9.

Patel SA, Hageman J, Quatman CE, **Wordeman SC**, Hewett TE. (2013) Prevalence and Location of Bone Bruises Associated with Anterior Cruciate Ligament Injury and Implications for Mechanisms of Injury: A Systematic Review. *Sports Med*. 44(2):281-93

Quatman CE, Kiapour AM, Demetropoulos CK, Kiapour A, **Wordeman SC**, Levine JW, Goel VK, Hewett TE. (2014) Preferential Loading of the ACL Compared with the MCL During Landing: A Novel In Sim Approach Yields the Multiplanar Mechanism of Dynamic Valgus During ACL Injuries. *Am J Sports Med*. 42(1):177-86

Kiapour AM, Kaul V, Kiapour A, Quatman CE, **Wordeman SC**, Hewett TE, Demetropoulos CK, Goel VK. (2013) The Effect of Ligament Modeling Technique on Knee Joint Kinematics: A Finite Element Study. *Applied Mathematics*. 4:91-97.

Levine JW, Kiapour AM, Quatman CE, **Wordeman SC**, Goel VK, Hewett TE, Demetropoulos CK. (2013) Clinically Relevant Injury Patterns Following ACL Injury Provide Insight to Define ACL Injury Mechanisms. *Am J Sports Med*. 41(2):385-95

Wordeman SC, Paterno MV, Quatman CE, Bates NA, Hewett, TE. (2012). Arthrometric Curve-Shape Variables to Assess Anterior Cruciate Ligament Integrity. *Clin Biomech*. 27(8):830-6

Quatman CE, Paterno MV, **Wordeman SC**, Kaeding CC. (2011). Longitudinal Anterior Knee Laxity Related to Substantial Tibial Tunnel Enlargement after Anterior Cruciate Ligament Revision. *J Arthroscopic and Related Surgery*. 27(8):1160-3

Wordeman SC, Quatman CE, Kaeding CC, Hewett TE. (2012) In Vivo Evidence for Tibial Plateau Slope as a Risk Factor for Anterior Cruciate Ligament Injury: A Systematic Review and Meta-Analysis. *Am J Sports Med*. 40(7):1673-81