STEVE RUNDELL

PhD, PE

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Biomechanics | Forensic Visualization | Traffic Accident Reconstruction | Mechanical Failure Analysis

Education

DREXEL UNIVERSITY

PhD	Biomedical Engineering	2010

MICHIGAN STATE UNIVERSITY

MSE	Mechanical Engineering	2005
BSE	Mechanical Engineering	2003

Licenses & Certifications

Professional Engineer	MI
Professional Engineer	FL

Affiliations

Society of Automotive Engineers
American Society of Biomechanics

Professional Profile

Dr. Steve Rundell's major practice area involves the scientific investigation of accidents resulting in traumatic injury as well as forensic visualization. He has over 15 years of experience performing forensic investigations and reconstructions of real-world accidents. He also has extensive experience in product development and mechanical design consulting for the medical devices industry. He holds a B.S. and M.S. in Mechanical Engineering from Michigan State University and a Ph.D. in Biomedical Engineering from Drexel University.

Dr. Steve Rundell is a licensed Professional Engineer and has published numerous peer-reviewed journal articles and abstracts. He has presented scientific findings at both medical and engineering conferences. Most recently, Dr. Rundell has performed research related to skull fracture mechanics, pediatric head and neck injury, virtual reality in forensic investigations, subject-specific computational modeling of real-world automobile collisions, the mechanical causation of spinal disc herniations, lower extremity forces generated during rear-end automobile collisions, and the likelihood of sustaining closed-head injury during a rear-end collision.

Areas of Expertise

Biomechanical Engineering
Mechanical Engineering
Forensic Visualization
Accident Reconstruction

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Experience

Explico
2014 - Present *Principal Engineer*

Drexel University
2023 - Present *Visiting Assistant Professor*

Armstrong Forensic Engineering
2011 - 2014 *Senior Consultant*

Exponent Failure Analysis Associates, Inc.
Injury Biomechanics and Medical Devices Group
2010 - 2011 *Managing Engineer*
2007 - 2010 *Senior Engineer*
2005 - 2007 *Engineer*

Michigan State University's Orthopedic Biomechanics Laboratories
2001 - 2005 *Graduate Research and Teaching Assistant*

Awards and Honors

Paper Competition Winner, ASTM International Annual Meeting, 2010
Paper Competition Winner, ASME Summer Bio Engineering Conference, 2010
TRS Foundation Grant Recipient, 2003
Design News Magazine Award Recipient, 2003
Graduate Fellowship, 2003

Presentations and Published Abstracts

Kurtz S., Rundell S.A., Spece H., Yarbrough R.V. Strength of a Lumbar Total Joint Replacement Under Aggressive Worst-Case Loading Conditions: Finite Element Simulation of a Spine Wear Simulator. A Society in Motion International Society for the Advancement of Spine Surgery The Innovation Society, 2025.

Demma D., Rossman S., Johns N., Rundell S. Validation of Steering Wheel Forces and Upper Extremity Loading During Rear-End Collisions using MADYMO. Summer Biomechanics, Bioengineering and Biotransport Conference, 2023.

Jeffs S., Demma D., Petroskey K., Bland M., Rundell S. Computational Simulation of Sideswipe Collisions to Predict Head Injury Metrics. XXVIII Congress of the International Society of Biomechanics, 2021.

Rossman, S., Meyer, E., Isaza, J., Rundell, S. Physiological Loading Conditions to Simulate Standing. Summer Biomechanics, Bioengineering, and Biotransport Conference, 2021.

Demma, D., Button, K., Kappler, E., Rossman, S., Rundell, S. A Strategy for Validating the Kinematics of a Vehicle-Specific MADYMO Model of a Low-Speed Rear-End Collision. Summer Biomechanics, Bioengineering, and Biotransport Conference, 2021.

Snyder, P., Watts, D., Sproule, D., Rossman, S., Button, K., Weaver, B., Rundell S. Out-of-Position Analysis of Low Speed Rear-End Collision Using a Subject-Specific MADYMO Simulation. Biomedical Engineering Society Annual Meeting, Oral Presentation, 2019.

Sproule, D., Figueroa, R., Rundell, S., Williams J., Perlmutter, S. Characterization of Visual Acuity and Contrast Sensitivity Using Head-Mounted Displays in a Virtual Environment: A Pilot Study. Human Factors and Ergonomics Society Annual Meeting, 2019.

Figueroa, R., Sproule, D., Williams, J., Perlmutter, S., Arndt, S., Rundell, S. Application of Stereoscopic Head-Mounted Displays and Interactive Virtual Reality Environments to an "Optical Illusion" Misstep and Fall Case. Human Factors and Ergonomics Society Annual Meeting, 2019.

Snyder P., Rundell, S., Fenton, T., Haut, R., Wei, F. The Importance of Skull Morphology in Remote Blunt Impact Induced Fracture Initiation. Summer Biomechanics, Bioengineering, and Biotransport Conference, 2019.

Sproule, D., Rossman, S., Snyder P., Button, K., Weaver B., Rundell, S. Subject-Specific MADYMO Analysis of a Low Speed Rear-End Collision. Summer Biomechanics, Bioengineering, and Biotransport Conference, 2019.

Snyder, P., Rundell, S., Fenton, T., Haut, R., Wei, F. Importance of Skull Morphology and Blunt Impact Location in Remote Fracture Initiation. XXVII Congress of the International Society of Biomechanics held in conjunction with the 43rd Annual Meeting of the American Society of Biomechanics, 2019.

Sproule, D., Rossman, S., Snyder, P., Button, K., Weaver, B., Rundell, S. Biomechanical Analysis of a Low Speed Rear-End Collision Using a Subject-Specific MADYMO Simulation. XXVII Congress of the International Society of Biomechanics held in conjunction with the 43rd Annual Meeting of the American Society of Biomechanics, 2019.

Rossman, S., Meyer, E., Rundell, S. Development of a Finite Element Lumbar Spine Model to Predict Intervertebral Disc Herniation Risk. XXVII Congress of the International Society of Biomechanics held in conjunction with the 43rd Annual Meeting of the American Society of Biomechanics, 2019.

Button K, Davison M, Weaver B, Rundell S. Inertial Loading of the Pediatric Head Exceeds Neck Injury Tolerance Prior to Head Injury Tolerance. American Society of Biomechanics Annual Meeting, Poster Presentation, 2018.

Button K, Davison M, Weaver B, Rundell S. Inertial Loading of the Pediatric Head Exceeds Neck Injury Tolerance Prior to Head Injury Tolerance. World Congress of Biomechanics, Poster Presentation, 2018.

Snyder P, Rundell S, Fenton T, Haut R, Wei F. Local Thickness of the Human Skull Affects Patterns of Cranial Fracture. American Society of Biomechanics Annual Meeting, Poster Presentation, 2018.

Sproule D, Rossman S, Button K, Weaver B, Rundell S. Simulation of Occupant Kinematics in Low-Speed Lateral Collisions using Articulated Total Body. World Congress of Biomechanics, Poster Presentation, 2018.

Rossman S, Sproule D, Button K, Weaver B, Rundell S. Intervertebral Disc Herniation Risk During Low-Speed Lateral Collisions. World Congress of Biomechanics, Poster Presentation, 2018.

Snyder P, Rundell S, Fenton T, Haut R, Wei F. Effects of local thickness distribution on skull fracture due to focal and diffuse parietal impacts. World Congress of Biomechanics, Poster Presentation, 2018.

Button KD, Rossman SM, Weaver BT, Rundell SA. Cervical Spine Forces and Disc Herniation Risk During Standardized Rear-End Impact Testing. Summer Biomechanics, Bioengineering and Biotransport Conference, Poster Presentation, 2016.

Weaver BT, Davison MA, Rundell SA, Meyer EG. An Investigation of Human Long Bone Fracture Patterns During Traumatic Amputations from Moving Railroad Equipment. Summer Biomechanics, Bioengineering and Biotransport Conference, Poster Presentation 2016.

Davison MA, Weaver BT, Rundell SA. Investigation of Neck and Head Injury Potential during Inertial Loading of the Pediatric Head: Implications to Shaken Baby Syndrome Characterization, American Society of Biomechanics Annual Meeting, Poster Presentation, 2015.

Rundell SA, Guiang A. Evaluation of Head Loading and Injury Risk During Moderately Severe Rear-end Collisions. World Congress of Biomechanics, Poster Presentation, 2014.

Rundell SA, Weaver BT. Forward Bending with Increased Erector Spinae Force Helps Reduce Disk Herniation Risk. American Society of Biomechanics Annual Meeting, Podium Presentation, 2012.

Rundell SA, Day JS, Isaza J, Siskey R, MacDonald D, Kurtz SM. Determining the biomechanical environment of lumbar mobile total disc replacements using case-specific finite element modeling related to retrieved implants. FDA Workshop on Computer Methods for Medical Devices, 2011.

Siskey, SD, Siskey, RL, Kurtz SM, Rundell, SA. Sensitivity of cervical total disc replacement articulation to device lordosis and disc height distraction. FDA Workshop on Computer Methods for Medical Devices, 2011.

Auerbach JD, Hanulewicz P, Rundell SA. Novel, semi-rigid lumbar spinal stabilization lowers pedicle screw pull-out risk in an osteoporotic spine when compared with titanium and PEEK rods. ePoster, 18th International Meeting on Advanced Spine Techniques (IMAST), 2011.

Auerbach JD, Parry J, Rundell SA. Dynamic cervical stabilization: A novel, motion-preserving alternative to fusion and articulating total disc replacement. ePoster, 18th International Meeting on Advanced Spine Techniques (IMAST), 2011.

Auerbach JD, Rundell SA. Dynamic cervical stabilization: A novel, motion-preserving alternative to fusion and articulating total disc replacement. Poster Presentation, 11th Annual Meeting of the Spinal Arthroplasty Society, 2011.

Auerbach JD, Hanulewicz P, Rundell SA. Semi-rigid lumbar spinal stabilization lowers screwbone interface force and cancellous bone strain when compared with PEEK and titanium rod systems in a healthy and osteoporotic spine. Poster Presentation, 11th Annual Meeting of the Spinal Arthoplasty Society, 2011.

Rundell SA, Day JS, Isaza J, Siskey R, MacDonald D, Kurtz SM. Derivation of clinically relevant boundary conditions suitable for evaluation of chronic impingement of lumbar total disc replacement: Application to standard development. Podium Presentation, ASTM International Meeting 2010, San Antonio, TX. (Paper competition winner)

Siskey SD, Cordaro NM, Siskey RL, Rundell SA. Characterization of adjacent level loading in the cervical spine for fusion and motion preserving alternatives. Eur Spine J 2010; 19 (Suppl 3):S233-364.

Rundell SA, Isaza J, Day JS, Guillory S, Newberry WN, Kurtz SM. The importance of posterior muscle strength and facet contact in preventing lumbar disc herniation during forward bending. Proceedings, ASME 2010 Summer Bioengineering Conference (SBC2010), Naples FL, June 16-19, 2010.

Rundell SA, Isaza J, Day JS, Guillory S, Newberry WN, Kurtz SM. The importance of posterior muscle strength and facet contact in preventing lumbar disc herniation during forward bending. Proceedings, ASME 2010 Summer Bioengineering Conference (SBC2010), Naples FL, June 16-19, 2010.

Rundell SA, Isaza J, Guillory S, Day JS, Kurtz SM. Posterior muscle activation in the lumbar spine engages facet contact and reduces shear force in the intervertebral disc during simulated standing. Poster Presentation, 56th Annual Meeting of the Orthopaedic Research Society, 2010.

Rundell SA, Isaza J, Guillory S, Day JS, Kurtz SM. The role of facet contact in reducing intervertebral shear during simulated standing. Oral Poster Presentation, 10th Annual Meeting of the Spinal Arthoplasty Society, 2010.

Rundell SA, Siskey R, Isaza J, Kurtz SM. Disc height distraction increases range of motion and impingement risk in fixed and mobile bearing total disc replacements. Oral Poster Presentation, 10th Annual Meeting of the Spinal Arthoplasty Society, 2010.

Rundell SA, Guerin HL, Yim J. The development of a model for use in evaluating degenerative disc disease. Poster Presentation, 10th Annual Meeting of the Spinal Arthroplasty Society, 2010.

Angibaud LD, Steffens J, Rundell SA, Hayes A, Weisenburger JN, Haider H. Effects of tibial insert slope on polyethylene wear and stress. 54th Annual Meeting of the Orthopaedic Research Society, 2008.

Rundell SA, Guerin HL, Auerbach JD, Kurtz SM. Nucleus pulposus replacement material stiffness properties affect vertebral body strains and remodeling response. Podium Presentation, 8th Annual Meeting of the Spine Arthroplasty Society, 2008.

Rundell SA, Auerbach JD, Balderston RA, Kurtz SM. Evaluation of the influence of TDR positioning on subsidence and facet arthrosis. Podium Presentation, 8th Annual Meeting of the Spine Arthroplasty Society, 2008.

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Yim J, Bowman B, Paganelli J, Rundell S, Jahng T, Watson R. A finite element analysis to predict peak bending and shear stresses on the Nflex dynamic stabilization device and comparison to empirically derived fatigue data. Poster Presentation, 8th Annual Meeting of the Spine Arthroplasty Society, 2008.

Rundell S, Gimbel J. Evaluation of pedicle screw loosening in a combined facet and total disc replacement system. Poster Presentation, 8th Annual Meeting of the Spine Arthroplasty Society, 2008.

Rundell SA, Auerbach JD, Balderston RA, Kurtz SM. Effects of TDR implantation and positioning on adjacent level facet forces and disc pressures. Poster Presentation, 8th Annual Meeting of the Spine Arthroplasty Society, 2008.

Coleman JC, Bowden A, Rundell S, Nockels RP, Foley KT. Effect of semi-rigid posterior rods on kinematic stability and load distribution in the lumbar spine. Poster Presentation, Congress of Neurological Surgeons, 2008.

Ong K, Rundell S, Liepins I, Lauren R, Markel D, Kurtz S. Biomechanical evaluation of acetabular component polyethylene stresses, fracture risk, and wear rate during press-fit implantation. Poster No. P10, 2nd Joint Meeting of the Bone Research Society and the British Orthopaedic Research Society, Manchester, UK, June 23-25, 2008.

Rundell SA, Auerbach Jd, Balderston RA, Kurtz SM. Total disc replacement positioning affects facet contact forces and vertebral body strains. Poster Presentation 54th Annual Meeting of the Orthopaedic Research Society, 2008.

Ong K, Rundell SA, Markel D, Kurtz SM. Biomechanical evaluation of acetabular component polyethylene stresses, fracture risk, and wear rate during press-fit implantation. 54th Annual Meeting of the Orthopaedic Research Society, 2008.

Coleman, JC, Bowden AE, Rundell S, Nockels RP, and Foley KT. Effect of semi-rigid posterior rods on kinematic stability and load distribution in the lumbar spine. Proc AANS/CNS, Chicago, IL, April 26-May 1, 2008.

Ong K, Rundell S, Markel D, Kurtz S. Biomechanical evaluation of acetabular component polyethylene stresses, fracture risk, and wear rate during press-fit implantation. Poster P22, 20th Annual Symposium of the International Society for Technology in Arthroplasty, Paris, October 4-6, 2007.

Bowden AE, Rundell S, Auerbach J, Balderston R. Total disc replacement changes facet contact stresses in extension, lateral bending, and axial rotation. Spine Arthroplasty Summit 7, Berlin, Germany, May 1-4, 2007.

Coleman J, Bowden AE, Rundell SA, Nockels RP and Foley KT. Effect of a semi-rigid posterior implant on range of motion and load distribution in the lumbar spine: A finite element study. Spine Arthroplasty Summit 7, Berlin, Germany, May 1-4, 2007.

Rundell S, Bowden AE, Auerbach J and Balderston R. Effects of Prodisc positioning on lumbar kinematics as determined using a specimen-specific finite element model. Spine Arthroplasty Summit 7, Berlin, Germany, May 1-4, 2007.

Baars DC, Rundell SA, Haut RC. Acute repair of chondrocyte membranes can help prevent DNA fragmentation. 52nd Annual Meeting of the Orthropaedic Research Society, 2006.

Rundell S, Bowden AE, Villarraga ML, Zhu Q and Krypton P. Validation of experimental implant-bone interface load measurement for a facet replacement device using finite element analysis. Spine Arthroplasty Summit 6, Montreal, Quebec, Canada, May 10-13, 2006.

Rundell SA, Haut RC. Tissue equilibration alters the response of cartilage explants to unconfined compression. 51st Annual Meeting of the Orthopaedic Research Society, 2005.

Rundell SA, McPhilamy A, Orth M, Haut RC. Glucosamine supplementation can help limit matrix damage and adjacent cell death in traumatized explants. 51st Annual Meeting of the Orthopaedic Research Society, 2005.

Peer-Reviewed Articles and Dissertations

Rundell SA, Kurtz SM, Spece H, Goldstein JA, Hodges SD, Yarbrough RV. Sensitivity of Lumbar Total Joint Replacement to Axial and Coronal Plane Misalignment: An *In Silico* Study. International Journal of Spine Surgery. *In Press*.

Kurtz SM, Rundell SA, Spece H, Yarbrough RV. Sensitivity of Lumbar Total Joint Replacement Contact Stresses Under Misalignment Conditions—Finite Element Analysis of a Spine Wear Simulator. Bioengineering. 2025; 12(3):229. https://doi.org/10.3390/bioengineering12030229

Davison MA, Button KD, Benzel EC, Weaver BT, Rundell SA. (2021) A biomechanical assessment of shaken baby syndrome: what about the spine? World Neurosurgery. DOI: 10.1016/j.wneu.2022.03.104.

Stephanie Rossman, Eric Meyer & Steve Rundell (2021) Development of a finite element lumbar spine model to predict intervertebral disc herniation risk factors, Computer Methods in Biomechanics and Biomedical Engineering, DOI: 10.1080/10255842.2021.1922677

Rundell SA, Weaver BT, Guiang A. Characterization of Occupant Lower Extremity Behavior During Moderate-to-High Speed Rear Impacts. Society of Automotive Engineers, SAE #2013-01-0222, January 2013.

Rundell SA, Day JS, Isaza J, Guillory S, Kurtz SM. Lumbar total disc replacement impingement sensitivity to disc height distraction, spinal sagittal orientation, implant position, and implant lordosis. Spine 2011; 37(10): E590-E598.

Rundell SA, Day JA, Isaza J, Siskey R, MacDonald D, Kurtz SM. Derivation of clinically relevant boundary conditions suitable for evaluation of chronic impingement of lumbar total disc replacement: Application to standard development. Int J ASTM 2011; 8(5): 1-14. J AI103556.

Rundell SA, The biomechanics of lumbar total disc replacement impingement: In silica investigations of polyethylene damage modes of lumbar total disc replacement. Ph.D. Dissertation, Drexel University, 2011.

Ong KL, Rundell S, Liepins I, Laurent R, Markel D, Kurtz S. Biomechanical modeling of acetabular component polyethylene stresses, fracture risk, and wear rate during press-fit implantation. J Orthop Res 2009; 27(11):1467-1472.

Rundell SA, Guerin HL, Auerbach JD, Kurtz SM. Total disc replacement device properties on lumbar spine mechanics. Spine 2009; 34(19): 2022-2032.

Rundell SA, Auerbach JD, Balderston RA, Kurtz SM. Total disc replacement positioning affects facet contact forces and vertebral body strains. Spine 2008; 33(23):2510-2517.

Baars DC, Rundell SA, Haut RC. Treatment with non-ionic surfactant poloxamer P188 reduces tunnel positive cells in bovine chondral explants exposed to injurious unconfined compression. Biotech Model Mechanoboil 2006; 5(2-3): 133-139.

Jex CT, Wan CJ, Rundell S, Haut RC, MacDonald B, Wertheimer SJ. Analysis of three types of fixation of the Weil osteotomy. Foot Ankle Surgery 2006; 45(1): 13-19, 2006.

Rundell SA, Haut RC. Exposure to a standard culture medium alters the response of cartilage explants to injurious unconfined compression. J Biomech 2005; 26, July.

Rundell SA, Baars DC, Phillips DM, Haut RC. The limitation of acute necrosis in retro-patellar cartilage after a severe blunt impact to the in vivo habit patella-femoral joint. J Orthopaedic Res 2005; 23(6):1363-1369.

Rundell SA. Investigation of the acute injury response of articular cartilage in vitro and in vivo: Analysis of various therapeutic treatments. M.S. Thesis, Michigan State University, 2005.

Professional Development

Society of Automotive Engineers

Photography for Accident Reconstruction, Product Liability, and Testing, 2019

Vehicle Crash Reconstruction: Principles and Technology, 2018

Photogrammetry and Analysis of Digital Media, 2017

Applying Automotive EDR Data to Traffic Crash Reconstruction, 2016

Northwestern University Center for Public Education

Advanced Crash Reconstruction Utilizing Human Factors, 2014