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Engineering & Scientific Consulting

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Professional Profile

Dr. Cutcliffe's area of expertise is injury and tissue biomechanics, focusing on the mechanical differences between healthy and injured tissue and the kinematics contributing to injury. Dr. Cutcliffe's research experience includes human volunteer testing, cadaveric testing, testing using anthropomorphic test devices (ATDs), animal testing, and computational modeling. Dr. Cutcliffe has conducted a variety of research involving head, neck, and knee injuries resulting from sports and motor vehicle accidents, which she has published in peer-reviewed journals and presented at various professional conferences.

Prior to joining Exponent, Dr. Cutcliffe was a Postdoctoral Associate and Graduate Research Assistant in the Orthopaedic Research Laboratory at Duke University. Her research investigated cartilage biomechanics using magnetic resonance imaging and mechanical testing, both in vivo and ex vivo, to develop earlier diagnostic techniques for osteoarthritis. She was also a Graduate Research Assistant in the Injury Biomechanics Laboratory at Duke University. Her work evaluated head impact and acceleration using cadaveric studies and assessed ATD head and neck response through both physical and computational experiments.

Academic Credentials & Professional Honors

Ph.D., Biomedical Engineering, Duke University, 2019

M.S., Biomedical Engineering, Duke University, 2015

B.S.E., Biomedical Engineering, Duke University, 2011

National Science Foundation Research Fellowship Honorable Mention, 2013

Whitaker International Summer Grant Awardee, 2013

Prior Experience

Postdoctoral Associate, Orthopaedic Research Laboratory, Department of Orthopaedic Surgery, Duke University, 2020

Graduate Research Assistant, Orthopaedic Research Laboratory, Department of Orthopaedic Surgery, Duke University, 2016 – 2019

Graduate Research Assistant, Injury Biomechanics Laboratory, Department of Biomedical Engineering, Duke University, 2011 – 2016

Professional Affiliations

Society of Automotive Engineers – SAE

The Orthopaedic Research Society – ORS

Publications

Cutcliffe HC, Kottamasu PK, McNulty AL, Goode AP, Spritzer CE, DeFrate LE. Mechanical metrics may show improved ability to predict osteoarthritis compared to T1rho mapping. *Journal of Biomechanics* 2021; 129. DOI: 10.1016/j.jbiomech.2021.110771.

Andress B, Kim JH, Cutcliffe HC, Amendola A, Goode AP, Varghese S, DeFrate LE, McNulty AL. Meniscus cell regional phenotypes: Dedifferentiation and reversal by biomaterial embedding. *Journal of Orthopaedic Research* 2021; 39(10): 2177-2186.

Cutcliffe HC, Davis KM, Spritzer CE, DeFrate LE. The characteristic recovery time as a novel, noninvasive metric for assessing in vivo cartilage mechanical function. *Annals of Biomedical Engineering* 2020; 48(12): 2901-2910.

Cutcliffe HC, DeFrate LE. Comparison of cartilage mechanical properties measured during creep and recovery. *Nature Scientific Reports* 2020; 10:1547. DOI: 10.1038/s41598-020-58220-2.

Cutcliffe HC*, Paranjape CS* (*co-first authors), Grambow SC, Utturkar GM, Collins AT, Garrett WE, Spritzer CE, DeFrate LE. A new stress test for knee joint cartilage. *Nature Scientific Reports* 2019; 9:2283. DOI: 10.1038/s41598-018-38104-2.

Englander ZA, Cutcliffe HC, Utturkar GM, Taylor KA, Spritzer CE, Garrett WE, DeFrate LE. In vivo assessment of the interaction of patellar tendon tibial shaft angle and anterior cruciate ligament elongation during flexion. *Journal of Biomechanics* 2019; 90:123-127.

Englander ZA, Cutcliffe HC, Utturkar GM, Garrett WE, Spritzer CE, DeFrate LE. A comparison of knee abduction angles measured by a 3D anatomic coordinate system versus videographic analysis. *The Orthopaedic Journal of Sports Medicine* 2019; 7(1). DOI: 10.1177/2325967118819831.

Lloyd AM, Nightingale RW, Luck JF, Bass CR, Cutcliffe HC, Myers BS. The response of the pediatric head to impacts onto a rigid surface. *Journal of Biomechanics* 2019; 93:167-176.

Kwak YH, Barrientos T, Furman B, Zhang H, Puvindran V, Cutcliffe HC, Herfarth J, Nwankwo E, Alman BA. Pharmacologic targeting of beta-catenin improves fracture healing in old mice. *Nature Scientific Reports* 2019; 9:9005. DOI 10.1038/s41598-019-45339-0.

Sutter EG, Liu B, Utturkar GM, Widmyer MR, Spritzer CE, Cutcliffe HC, Englander ZA, Goode AP, Garrett WE, DeFrate LE. Effects of anterior cruciate ligament deficiency on tibiofemoral cartilage thickness and strains in response to hopping. *The American Journal of Sports Medicine* 2019; 47(1):96-103.

Collins AT, Kulvaranon ML, Cutcliffe HC, Utturkar GM, Smith WAR, Spritzer CE, Guilak F, DeFrate LE. Obesity alters the in vivo mechanical response and biochemical properties of cartilage as measured by MRI. *Arthritis Research & Therapy* 2018; 20(1):232. DOI: 10.1186/s13075-018-1727-4.

Eckersley CP, White TR, Cutcliffe HC, Shridharani JK, Wood GW, Bass CR. Foul tip impact attenuation of baseball catcher masks using head impact metrics. *PLOS One* 2018; 13(6):e0198316.

Owusu-Akyaw KA, Heckelman LN, Cutcliffe HC, Sutter EG, Englander ZA, Spritzer CE, Garrett WE, DeFrate LE. A comparison of patellofemoral cartilage morphology and deformation in anterior cruciate

ligament deficient versus uninjured knees. *Journal of Biomechanics* 2018; 67:78-83.

Nightingale RW, Sganga J, Cutcliffe HC, Bass CR. Impact responses of the cervical spine: A computational study of the effects of muscle activity, torso constraint, and pre-flexion. *Journal of Biomechanics* 2016; 49(4):558-564.

Kuo C, Wu LC, Hammor BT, Luck JF, Cutcliffe HC, Lynall RC, Kait JR, Campbell KR, Mihalik JP, Bass CR, Camarillo DB. Effect of the mandible on mouthguard measurements of head kinematics. *Journal of Biomechanics* 2016; 49(9):1845-1853.

Lloyd AM, Nightingale RW, Luck JF, Song Y, Fronheiser L, Cutcliffe HC, Myers BS, Bass CR. The compressive stiffness of human pediatric heads. *Journal of Biomechanics* 2015; 48(14):3766-3775.

Rafaels KA, Cutcliffe HC, Salzar RS, Davis M, Boggess B, Bush B, Harris R, Rountree MS, Sanderson TE, Campman S, Koch S, Bass CR. Injuries of the head from backface deformation of ballistic protective helmets under ballistic impact. *Journal of Forensic Sciences* 2015; 60(1):219-225.

Dibb AT, Cutcliffe HC, Luck JF, Cox CA, Myers BS, Bass CR, Arbogast KB, Seacrist T, Nightingale RW. Pediatric head and neck dynamics in frontal impact: Analysis of important mechanical factors and proposed neck performance corridors for six and ten year old ATDs. *Traffic Injury Prevention* 2014; 15(4):386-394.

Lloyd AM, Nightingale RW, Song Y, Luck JF, Cutcliffe HC, Myers BS, Bass CR. The response of the adult and ATD heads to impacts onto a rigid surface. *Accident Analysis & Prevention* 2014; 72:219-229.

Taylor KA, Cutcliffe HC, Queen RM, Utturkar GM, Spritzer CE, Garrett WE, DeFrate LE. In vivo measurement of ACL length and relative strain during walking. *Journal of Biomechanics* 2013; 46(3):478-483.

Dibb AT, Cox CA, Nightingale RW, Luck JF, Cutcliffe HC, Myers BS, Arbogast KB, Seacrist T, Bass CR. Importance of muscle activation for biofidelic pediatric neck response. *Traffic Injury Prevention* 2013; 14(Sup 1):S116-S127.

Cutcliffe HC, Schmidt AL, Lucas JE, Bass CR. How few? Bayesian statistics in injury biomechanics. *Stapp Car Crash Journal* 2012; 56:349-386.

Presentations

Cutcliffe HC, Paranjape C, Davis K, Spritzer CE, DeFrate LE. In vivo cartilage creep and recovery as a stress test for cartilage degeneration. Poster presentation, Annual Meeting of the Orthopaedic Research Society (ORS), Austin, TX, 2019.

Cutcliffe HC, Ólafsdóttir JM, Östh J, Davidsson J, Brolin K. Gender differences in occupant posture during driving and riding. Podium presentation, International Research Council on Biomechanics of Injury (IRCOBI), Antwerp, Belgium, 2017.

Cutcliffe HC, Luck JF, Kait JR, Kuo C, Wu L, Lynall RC, Campbell KR, Capehart B, Camarillo DB, Mihalik JP, Bass CB. Validation of an ear-based measurement system for head impact. Podium presentation, 25th Annual Meeting of the Biomedical Engineering Society (BMES), Tampa, FL, 2015.

Cutcliffe HC, Brolin K, Östh J, Ólafsdóttir JM, Davidsson J. Gender differences in occupant posture and muscle activity with motorized seat belts. Podium presentation, 24th International Technical Conference on the Enhanced Safety of Vehicles (ESV), Gothenburg, Sweden, 2015.

Chancey VC, Nightingale RW, Cutcliffe HC, Myers BS. Isometric bending strength of the cervical spine

estimated from moments generated by optimized active muscles in flexion, extension, and lateral bending. Poster presentation, 10th Annual Injury Biomechanics Symposium of The Ohio State University, Columbus, OH, 2014.

Dibb AT, Cutcliffe HC, Luck JF, Cox CA, Myers BS, Bass CR, Arbogast KB, Seacrist T, Nightingale RW. Proposed neck performance corridors for six and ten year old ATDs in frontal impact. Podium presentation, 23rd International Technical Conference on the Enhanced Safety of Vehicles (ESV), Seoul, South Korea, 2013.

Cutcliffe HC, Schmidt AL, Lucas JE, Bass CR. How few? Bayesian statistics in injury biomechanics. Podium presentation, Stapp Car Crash Conference, Savannah, GA, 2012.

Peer Reviewer

Journal of Biomechanics

Traffic Injury Prevention