



**Exponent®**  
Engineering & Scientific Consulting

## Megan Toney-Bolger, Ph.D., P.E.

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### Professional Profile

Dr. Toney-Bolger's areas of expertise include kinematics, dynamics, neuromechanics, motor control of human motion, and human injury mechanics. Her work experience includes the analysis of a variety of injuries involving motor vehicles, recreational activities and equipment, pedestrians, occupational accidents, and slip-and-fall accidents as well as conducting sled tests and full-scale vehicle-to-vehicle crash tests.

Dr. Toney-Bolger's research has focused on occupant motion and loading in response to variety of crash modalities as well as the biomechanics of human walking and running, amputee locomotion, neural control of locomotion, gait rehabilitation technology, and motor learning responses in gait before and after injury or impairment.

Dr. Toney-Bolger also has technical knowledge and training in the areas of gait analysis techniques and use of the 3D Static Strength Prediction Program. She is a certified forklift operator and certified XL tribometrist. She has also completed training in traffic crash reconstruction through the Northwestern University Center for Public Safety.

Prior to joining Exponent, Dr. Toney-Bolger was a Graduate Research Assistant in the Comparative Neuromechanics Laboratory at Georgia Institute of Technology where she completed a National Institutes of Health Fellowship for Prosthetics and Orthotics Research Training. Her research evaluated the effect of amputation on a patient's control strategies, their ability to walk, and their adaptation to altered walking environments. Dr. Toney-Bolger has experience collecting and analyzing kinematic, kinetic, and electromyography (EMG) data using high-speed motion capture systems (VICON) and advanced computational software (Matlab and LabVIEW). Dr. Toney-Bolger also served as a Graduate Teaching Assistant at Georgia Tech for a graduate-level course in clinical gait analysis. In addition, Dr. Toney-Bolger conducted research in the Orthopaedic Biomechanics Laboratory at Duke University where she studied responses to air blast at both the cellular and organismal level.

### Academic Credentials & Professional Honors

Ph.D., Applied Physiology, Georgia Institute of Technology, 2014

B.S.E., Biomedical Engineering, Duke University, 2009

NIH Fellow for Prosthetics and Orthotics Research Training, 2009-2012

Finalist for P.E.O. Scholar Award from Georgia Institute of Technology

## Professional Affiliations

American Society of Biomechanics

Society of Automotive Engineers

## Publications

Sharpe S, Grijalva S, Allin L, Courtney A, Toney-Bolger M, et al. Evaluation of Occupant Kinematics and Kinetics during Moderate Severity Simulated Frontal Impacts with and without Frontal Airbag Deployment. SAE Technical paper, 2023-01-0559.

Toney-Bolger ME, Chang YH. The motor and the brake of the trailing leg in human walking: transtibial amputation limits ankle-knee torque covariation. *Experimental Brain Research* 2023; 241(1): 161-174.

Toney-Bolger M, Isaacs JL, Rapp van Roden E, Croteau J, et al. Seat Belt Latch Plate Design and Pretensioner Deployment Strategies Have Limited Effect on In- and Out-of-Position Occupants in High-Severity Rear-End Collisions. SAE Technical Paper 2022-01-0849.

Croteau J, Toney-Bolger M, Isaacs JL, Shurtz B, et al. Seatback Strength and Its Effect on In-Position and Out-of-Position ATD Loading in High-Speed Rear Impact Sled Tests. SAE Technical Paper, 2022-01-0856.

Isaacs JL, Campbell IC, Watson H, Toney-Bolger M. Head and Neck Loading Trends in IIHS Side Impact Testing. Proceedings of the FISITA World Congress, Prague, 13-17 September 2021. Outstanding Paper Award

Toney-Bolger ME, Croteau J, Dibb A, Weber P, et al. The Role of Seat Belt Restraint System Components in Rear-End Collisions. SAE Technical Paper, 2021-01-0912.

Toney-Bolger ME, Sherman S, Isaacs J, Garman T, et al. An Evaluation of Near- and Far-side Occupant Responses to Low- to Moderate-Speed Side Impacts. SAE Technical Paper, 2020-01-1218.

Toney-Bolger ME, Campbell IC, Miller BD, Davis MS, et al. Evaluation of Occupant Loading in Low- to Moderate-Speed Frontal and Rear-End Motor Vehicle Collisions. SAE Technical Paper, 2019-01-1220.

Bruno A, Toney-Bolger M, George J, Koller J, et al. Evaluation of Occupant Kinematics in Low- to Moderate-Speed Frontal and Rear-End Motor Vehicle Collisions. SAE Technical Paper, 2019-01-1226.

Selgrade B, Toney ME, Chang YH. Two biomechanical strategies for locomotor adaptation to split-belt treadmill walking in subjects with and without transtibial amputation. *Journal of Biomechanics* 2017; 53(28):136-143.

Hashish R, Toney-Bolger ME, Sharpe SS, Lester BD, et al. Texting during stair negotiation and implications for fall risk. *Gait & Posture* 2017; 58:409-414.

Selgrade B, Thajchayapong M, Lee GE, Toney ME, et al. Changes in mechanical work during neural adaptation to asymmetric locomotion. *Journal of Experimental Biology* 2017; 220:2993-3000.

Toney M, Chang YH. The motor and the brake of the trailing leg in human walking: leg force control through ankle modulation and knee covariance. *Experimental Brain Research* 2016; 234(10):3011-3023.

Toney M, Chang YH. Humans robustly adhere to dynamic walking principles by harnessing motor abundance to stabilize forces. *Experimental Brain Research* 2013; 231(4):433-443.

## Invited Presentations

Isaacs JL, Toney Bolger ME, Campbell IC. Cervical Spine Loading During Asymmetrical Non-Injurious Physical Activities. Podium Presentation, XXVII Congress of the International Society of Biomechanics (ISB) /43rd Annual Meeting of the American Society of Biomechanics (ASB), Calgary, Canada, August 2019.

Thajchayapong M, Cho G, Toney M, Chang YH. Changes in total mechanical work explain why metabolic cost tracks locomotor adaptation during split-belt treadmill walking. Poster No. T272, 7th World Congress of Biomechanics, Boston, MA, July 6-11, 2014.

Toney M, Chang YH. Consistent power production during walking is maintained by structuring joint torque variance to modulate trailing leg forces. Poster No. T267, 7th World Congress of Biomechanics, Boston, MA, July 6-11, 2014.

Toney M, Chang YH. Amputees use less joint torque covariation than able-bodied subjects to generate leg force during walking. Podium Presentation, XXIV Congress of the International Society of Biomechanics, Natal, Rio Grande Do Norte, Brazil, August 4-9, 2013.

Toney M, Chang YH. Identifying implicit neuromechanical control targets in human gait. Poster No. 274.05/JJ3, 42nd Society for Neuroscience Annual Meeting, New Orleans, LA, October 13-17, 2012.

Toney M, Chang YH. Limb force variance is structured to stabilize the step-to-step transitions of dynamic walking. Abstract No. 285, 36th American Society of Biomechanics Annual Meeting. Gainesville, FL, August 15-18, 2012.

Norman T, Toney M, Chang YH. The Gait Deviation Index for analysis of amputee walking at different speeds. 38th American Academy of Orthotists and Prosthetists Annual Meeting and Scientific Symposium, Atlanta, GA, March 21-24, 2012.

Herrin K, Toney M, Chang YH. Use of neuromechanical redundancy for locomotor compensation in able-bodied and transtibial amputee subjects. Abstract No. 400, 34th American Society of Biomechanics Annual Meeting. Providence, RI, August 18-21, 2010.

## Additional Education & Training

Northwestern University Center for Public Safety - Traffic Crash Reconstruction

English XL Tribometry

3D Static Strength Prediction Program