

Exponent®
Engineering & Scientific Consulting

Abby Niesen, Ph.D., P.E.

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Professional Profile

Dr. Niesen offers biomechanical engineering expertise in evaluating injury mechanisms, injury potential, and the kinematics of human movement under injurious versus non-injurious loading conditions. Dr. Niesen has experience evaluating acute injuries and chronic pathologies of the head, spine, shoulder, and knee in various contexts, including motor vehicle, occupational, and recreational accidents. Her research experience includes biomechanical testing using human volunteers, cadaveric specimens, anthropomorphic test devices (ATDs) (“crash test dummies”), and computational models. Dr. Niesen’s research has been published in peer-reviewed journals and presented at various conferences.

Prior to joining Exponent, Dr. Niesen was a graduate researcher in the Orthopedic Biomechanics Laboratory at the University of California, Davis where she led a research initiative to evaluate a novel implant design in total knee replacement patients. In this role, she developed a custom radiographic imaging system and protocols that improved the accuracy of measuring knee implant stability and movement.

Dr. Niesen also has experience developing advanced biomechanical computer models and simulations in Research and Development at Stryker. Within Stryker’s Joint Replacement division, she worked in close collaboration with surgeons to enhance the design of innovative concepts and conducted cadaveric research pertaining to the human knee.

Academic Credentials & Professional Honors

Ph.D., Biomedical Engineering, University of California, Davis, 2023

M.S., Biomedical Engineering, University of California, Davis, 2021

B.S., Civil Engineering, Tufts University, 2014

Achievement Rewards for College Scientists (ARCS) Scholar

Tau Beta Pi – Engineering Honor Society

Licenses and Certifications

Professional Engineer Mechanical, California, #42571

Certified English XL Tribometrist (CXLT)

Northwestern University Center for Public Safety, Traffic Crash Reconstruction for Engineers

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Prior Experience

Advanced Technology - R&D Engineering Intern, Stryker, 2023

Graduate Researcher, University of California Davis, 2018-2023

Staff Professional I/II, GEI Consultants, 2014-2018

Professional Affiliations

International Radiostereometry Society

International Women in Biomechanics

Orthopedic Research Society

Publications

Niesen AE, Tirumalai PA, Howell SM, and Hull ML. A new tibial insert design with ball-in-socket medial conformity and posterior cruciate ligament retention has low tibial baseplate migration after unrestricted kinematically aligned total knee arthroplasty: a cohort study using radiostereometric analysis. Acta Orthopaedica. 2024; 95:758-764. doi: 10.2340/17453674.2024.42489.

Niesen AE, Tirumalai PA, Howell SM, and Hull ML. Risk of tibial baseplate loosening is low in patients following unrestricted kinematic alignment total knee arthroplasty using a cruciate-retaining medial conforming insert: A study using radiostereometric analysis at 2 years. Knee Surgery, Sports Traumatology, Arthroscopy. 2024; 32:693-703. doi: 10.1002/ksa.12089.

Kaptein BL, Pijls B, Koster L, Kärrholm J, Hull M, Niesen A, Heesterbeek P, Callary S, Teeter M, Gascoyne T, Röhrl SM, Flivik G, Bragonzoni L, Laende E, Sandberg O, Solomon LB, Nelissen R, Stilling M. Guideline for RSA and CT-RSA implant migration measurements: an update of standardizations and recommendations. Acta Orthopaedica. 2024; 95:256-267. doi: 10.2340/17453674.2024.40709.

Howell SM, Sappey-Marinier E, Niesen AE, Nedopil A, and Hull ML. Better forgotten joint scores when the angle of the prosthetic trochlea is lateral to the quadriceps vector in kinematically aligned total knee arthroplasty. Knee Surgery, Sports Traumatology, Arthroscopy. 2023; 31:5438-5445. doi: 10.1007/s00167-023-07598-3.

Niesen AE and Hull ML. State of the art in radiostereometric analysis for tibial baseplate migration and future research directions. Journal of Biomechanical Engineering. 2023; 145:1-30. doi:10.1115/1.4063626.

Niesen AE, Kaptein BL, Hull ML. Conditions for use and implementation of globally-aligned versus local baseplate coordinate systems when computing migration using radiostereometric analysis. Journal of Biomechanical Engineering. 2023;145(6):061010. doi:10.1115/1.4056802

Niesen AE, Garverick AL, Howell SM, Hull ML. Low tibial baseplate migration 1 year after unrestricted kinematically aligned total knee arthroplasty. Knee Surgery, Sports Traumatology, Arthroscopy. 2022;31(4):1433-1442. doi:10.1007/s00167-022-07171-4

Niesen AE, Garverick AL, Howell SM, Hull ML. Error in maximum total point motion of a tibial baseplate is lower with a reverse-engineered model versus a CAD model using model-based radiostereometric analysis. Journal of Biomechanics. 2022;143:111267. doi:10.1016/j.jbiomech.2022.111267

Niesen AE and Hull ML. Measurement error versus repeated measurements: a guide describing two

methods for computing bias and precision of migration measurements from double examinations using radiostereometric analysis. Journal of Biomechanical Engineering. 2022;144(6):061011. doi:10.1115/1.4054375

Niesen AE and Hull ML. Previously unrecognized source of error in the change in maximum total point motion to determine continuous migration of unstable tibial baseplates. Journal of Biomechanical Engineering. 2022;144(2):024504. doi:10.1115/1.4052743

Niesen AE and Hull ML. Propagation of registration error into maximum total point motion to analyze tibial baseplate stability at six months using marker-based and model-based RSA. Journal of Biomechanics. 2021;127:110651. doi:10.1016/j.jbiomech.2021.110651

Niesen AE, Garverick AL, Hull ML. Maximum total point motion of five points versus all points in assessing tibial baseplate stability. Journal of Biomechanical Engineering. 2021;143(11):114502. doi:10.1115/1.4051347

Niesen AE and Hull ML. Propagation of registration errors into change in maximum total point motion for determining stability of tibial baseplates. Computer Methods in Biomechanics and Biomedical Engineering. 2021;24(9):1019-1025. doi:10.1080/10255842.2020.1865324

Niesen AE, Garverick AL, Howell SM, Hull ML. Reorienting the tibial baseplate improves the registration accuracy of model-based radiostereometric analysis. Journal of Biomechanics. 2020;113:110078. doi:10.1016/j.jbiomech.2020.110078

Presentations

Niesen AE and Hull ML. Measurement error versus repeated measurements: two methods for computing bias and precision of migration measurements from double examinations using radiostereometric analysis. Podium presentation. International Radiostereometry Meeting. Nijmegen, The Netherlands, April 2023

Niesen AE, Kaptein BL, Hull ML. Differences in globally-aligned versus local baseplate coordinate systems when computing migration using model-based radiostereometric analysis. Podium presentation. International Radiostereometry Meeting. Nijmegen, The Netherlands, April 2023

Niesen AE, Tirumalai PA, Howell SM, Hull ML. Increasing medial conformity of a tibial insert from intermediate to ball-in-socket does not increase tibial baseplate migration. Podium presentation. International Radiostereometry Meeting. Nijmegen, The Netherlands, April 2023

Niesen AE, Howell SM, Hull ML. Increasing medial conformity of tibial insert does not increase tibial baseplate migration. E-poster. American Association of Hip and Knee Surgeons. Dallas, TX, November 2022

Niesen AE. Low tibial baseplate migration 1 year after unrestricted kinematically aligned total knee arthroplasty. Podium presentation. International Society for Technology in Arthroplasty. Maui, HI, August 2022

Niesen AE, Error in maximum total point motion of a tibial baseplate is lower with a reverse-engineered model versus a CAD model using model-based radiostereometric analyses. Presentation. International Society for Technology in Arthroplasty. Maui, HI, August 2022

Niesen AE, Garverick AL, Howell SM, Hull ML. Reverse-engineered models reduce registration error of an asymmetric tibial baseplate design in model-based radiostereometric analyses. Poster. Orthopaedic Research Society. Tampa, FL, February 2022.

Niesen AE and Hull ML. Propagation of registration errors into the change in maximum total point motion

to analyze tibial baseplate stability at two years using marker-based and model-based RSA. Presentation. International Radiostereometry Meeting. Oslo, Norway, May 2021

Niesen AE and Hull ML. Propagation of registration error into maximum total point motion to analyze tibial baseplate stability at six months using marker-based and model-based RSA. Presentation. International Radiostereometry Meeting. Oslo, Norway, May 2021

Niesen AE, Garverick AL, Howell SM, Hull ML. Determining the optimal orientation of a tibial baseplate to improve registration accuracy of model-based radiostereometric analysis. Presentation. International Radiostereometry Meeting. Oslo, Norway, May 2021

Niesen AE, Garverick AL, Howell SM, Hull ML. Determining the optimal orientation of a tibial baseplate to improve registration accuracy of model-based radiostereometric analysis. Poster. Orthopaedic Research Society. February 2021

Niesen AE, Garverick AL, Howell SM, Hull ML. Determining the optimal orientation of a tibial baseplate to improve registration accuracy of model-based radiostereometric analysis. Presentation. International Society for Technology in Arthroplasty. November 2020

Peer Reviews

Clinical Biomechanics

Journal of Orthopaedic Surgery and Research