

Exponent®
Engineering & Scientific Consulting

Shady Elmasry, Ph.D., P.E.

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Professional Profile

Dr. Elmasry specializes in injury and orthopedic biomechanics, with particular expertise in human kinematics and mechanisms associated with disc degeneration, traumatic spine fractures, and knee joint instability, which he has investigated through physical testing and computational modeling. He has extensive experience developing full human body models using multibody dynamics and finite elements numerical methods to assess injury risk arising from human interactions across various modalities, including automotive and industrial accidents, wearable devices, robotics, and footwear. Dr. Elmasry is also proficient in both physical and computational testing of the head kinematics using anthropometric test dummies (ATD) and MADYMO software, as well as evaluation of helmets and protective gear. Additionally, he has experience in performing cadaveric studies to evaluate joint function and soft tissue engagement following injuries and surgical interventions.

Dr. Elmasry has extensive experience quantifying internal loads on soft tissue and skeletal structures with an emphasis on the spine and lower extremities. He received intensive training in conducting translational research to unravel biomechanical reasons associated with surgical failures due to joint instability and to identify biomechanical risk factors associated with injuries and negative clinical outcomes. Dr. Elmasry also has experience in conducting in vivo experiments to study human movement using high- speed cameras, force plates, and inertial measurement units (IMUs).

Prior to joining Exponent, Dr. Elmasry worked within teams of arthroplasty surgeons and biomechanical scientists at the Hospital for Special Surgery to leverage simulation of knee mechanics in healthy and diseased knees and following surgical intervention. He developed a multibody dynamics model of the knee to understand the interaction between ligament properties and implant design towards achieving knee stability following total knee replacement. He also used a six-degrees of freedom robot arm to conduct physical experiments on cadaveric knees to understand ligament engagement patterns under different loading conditions. During his Ph.D. in the Biomechanics Research lab at the University of Miami, he developed finite element models and conducted physical experiments using MTS machines to study the biomechanics of the lumbar spine following various fixation procedures and investigated failure modes of implant hardware. He further developed computer models to analyze various mechanisms that lead to intervertebral disc degeneration such as smoking and aging. Dr. Elmasry also worked in a gait lab where he conducted in vivo experiments to evaluate human movement and body performance.

Academic Credentials & Professional Honors

M.S., Clinical and Translational Investigation, Weill Cornell Medicine, 2021

Ph.D., Industrial Engineering, University of Miami, 2017

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M.Sc., Mechanical Design and Production, Cairo University, 2012

B.Sc., Mechanical Design and Production, Cairo University, 2007

TL1 Training Award, Center for Advancing Translational Science, NIH, 2019

Adele Boskey Prize for Innovative Research in Orthopedic Surgery and Rheumatology, Hospital for Special Surgery, 2019

Spine section award, Orthopedic Research Society, 2016

Licenses and Certifications

Professional Engineer Mechanical, Arizona, #82799

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

Prior Experience

Postdoctoral Fellow, Orthopedic Biomechanics, Hospital for Special Surgery, 2017–2021

Research Assistant, Orthopedic Biomechanics, University of Miami, 2013-2017

Research Assistant, Industrial Engineering, Cairo University, 2009-2013

Professional Affiliations

Orthopedic Research Society (ORS)

International Society for Technology in Arthroplasty (ISTA)

Association for Clinical and Translational Science (ACTS)

Biomedical Engineering Society (BMES)

Languages

Arabic

Patents

Elmasry S., Imhauser C., Sculco P., Westrich G., Kahlenberg C., inventors (2025). New York Society for Relief of Ruptured, Crippled, assignee. “System and method for quantifying gap assessment examination”, US Patent Number. 12376973.

Publications

Elmasry SS. LaValva S., Kahlenberg CA., Mayman DJ., Cross MB., Pearle AD., Wright TM., Westrich GH., Imhauser CW., Sculco PK. (2026) “How accurate are arthroplasty surgeons in visually estimating extension and flexion gaps in total knee arthroplasty?” Bone & Joint Open. 7(3): 1–7.

Nazem M., Andreassen TE., Kim N., Moyle K., Besier TF., Halloran JP., Imhauser CW., Chokhandre S., Schneider MTY., Elmasry S., Zaylor W., Shelburne KB., Erdemir A., Laz. PJ., (2026) “Deciphering the

“Art” in Modeling and Simulation of the Knee Joint: Model Benchmarking” Journal of Biomechanical Engineering. 148(5): 051004.

Andreassen E., Laz J., Erdemir A., Besier T., Halloran J., Imhauser C., Chokhandre S., Schwartz A., Nohouji N., Rooks N., Schneider M., Elmasry S., Zaylor W., Hume D., Shelburne K., (2023) “Deciphering the “Art” in Modeling and Simulation of the Knee Joint: Assessing Model Calibration Workflows and Outcomes” Journal of Biomechanical Engineering. 145(12): 121008.

Imhauser C., Baumann A., Liu X, Bischoff J., Verdonschot N., Fregly B., Elmasry S., Abdollahi N., Hume D., Rooks N., Schneider M., Zaylor W., Besier T., Halloran J., Shelburne K., Erdemir A., (2023). “Reproducibility in Modeling and Simulation of the Knee: Academic, Industry, and Regulatory Perspectives”. Journal of Orthopaedic Research. 41(12): 2569-2578.

Halloran J., Abdollahi N., Hafez M., Besier T., Chokhandre S., Elmasry S., Hume D., Imhauser C., Rooks N., Schneider M., Schwartz A., Shelburne K., Zaylor W., Erdemir A., (2023) “Assessment of reporting practices and reproducibility potential of a cohort of published studies in computational knee biomechanics”. Journal of Orthopaedic Research. 41(2):325-34.

Elmasry S., Sculco P., Kahlenberg C., Mayman D., Cross M., Pearle A., Wright T., Westrich G., Imhauser C. (2022) “Arthroplasty surgeons differ in their intraoperative soft tissue assessments: a study in human cadavers to quantify surgical decision-making in TKA”. Clinical Orthopaedics and Related Research®. 480(8):1604-15

Elmasry S., Kahlenberg C., Mayman D., Wright T., Westrich G., Cross M., Imhauser C., Sculco P., Chalmers B. (2022) “A mid-level constrained insert reduces coupled axial rotation but not coronal mid-flexion laxity induced by joint line elevation in posterior-stabilized total knee arthroplasty: a computational study”. The Journal of Arthroplasty. 37(6):S364-70

Volz M., Elmasry S., Jackson A., Travascio F. (2022) "Computational modeling intervertebral disc pathophysiology: A review." Frontiers in physiology 12: 2467

Elmasry, S., Chalmer, B., Sculco, P., Kahlenberg, C., Cross, M., Mayman, D., Wright, T., Westrich, G., Imhauser, C. (2021). “Simulation of Preoperative Flexion Contracture in a Computational Model of Total Knee Arthroplasty: Development and Evaluation”. Journal of Biomechanics. 120: 110367

Rooks, N., Schneider, M., Erdemir, A., Elmasry, S., Halloran, J., Laz, P., Shelburne, K., Hume, D., Imhauser, C., Zaylor W., Hafez, A., Schwartz, A., Chokhandre, S., Abdollahi, N., Besier, T. (2021). “A Method to Compare Heterogeneous Types of Bone and Cartilage Meshes”. Journal of Biomechanical Engineering, 143(11): 111002.

Chalmers, B., Elmasry, S., Sculco, P., Kahlenberg, C., Mayman, D., Wright, T., Westrich, G., Imhauser, C, Cross, M (2021). “Additional Distal Femoral Resection Increases Mid-Flexion Laxity in Posterior Stabilized TKA: A Computational Model of a Flexion Contracture”. The Bone & Joint Journal. 103: 87-93.

Rooks, N., Schneider, M., Erdemir, A., Halloran, J., Laz, P., Shelburne, K., Hume, D., Imhauser, C., Zaylor W., Hafez, A., Elmasry, S., Schwartz, A., Chokhandre, S., Abdollahi, N., Besier, T. (2021). “Deciphering the “Art” in Modeling and Simulation of the Knee Joint: Variations in Model Development”. Journal of Biomechanical Engineering, 143(6): 061002.

Elmasry, S., Sculco, P., Kia, M., Kahlenberg, C., Cross, M., Pearle, A., Mayman, D., Wright, T., Westrich, G., Imhauser, C. (2020). “A New Geometric Ratio for Ligament Balancing in measured resection TKA”. Journal of Orthopaedic Research (Special issue: Recent Advances in Total Joint Replacement), 38:1637-45.

Elmasry, S., Imhauser, C., Wright, T., Cross, M., Mayman, D., Pearls, A., Westrich, G., Sculco, P. (2019). “Neither Anterior nor Posterior Referencing Consistently Balances the Flexion Gap in Measured

Resection TKA: A Computational Analysis". Journal of Arthroplasty, 34: 981-86.

Khalenberg, C., Elmasry, S., Imhauser, C., Wright, T., Cross, M., Westrich, G., Sculco, P. (2019). "Posterior Condylar Bone Resection and Femoral implant Thickness Varies Between Implant Systems: Implications for Flexion Gap Balancing". Knee Surgery, Sports Traumatology, Arthroscopy, 27:2140-44.

Elmasry, S., Asfour, S., Travascio, F. (2018). "Finite Element Study to Evaluate the Biomechanical Performance of the Spine After Augmenting Percutaneous Pedicle Screw Fixation With Kyphoplasty in the Treatment of Burst Fractures". Journal of Biomechanical Engineering, 140(6): 061005.

Elmasry, S., Asfour, S., & Travascio, F. (2017). "Effectiveness of Pedicle Screw Inclusion at the Fracture Level in Short-Segment Fixation Constructs for the Treatment of Thoracolumbar Burst Fractures: A Computational Biomechanics Analysis". Journal of Computer Methods in Biomechanics and Biomedical Engineering 20: 1412-20.

Elmasry, S., Asfour, S., de Rivero Vaccari, Juan Pablo, Travascio, F. (2016). "A computational model for investigating the effects of changes in bioavailability of insulin-like growth factor-1 on the homeostasis of the intervertebral disc". Computers in Biology and Medicine, 78:126-137.

Elmasry, S., Asfour, S., Gjolaj, J., Latta, L., Esmont, F., & Travascio, F. (2016). "Implications of Spine Fixation on the Adjacent Lumbar Levels for Surgical Treatment of Thoracolumbar Burst Fractures: A Finite Element Analysis". J Spine care, 1 (1): 1-5.

Elmasry, S., Asfour, S., de Rivero Vaccari, Juan Pablo, Travascio, F. (2015). "Effects of Tobacco Smoking on the Degeneration of the Intervertebral Disc: a Finite Element Study". PLOS ONE, 10(8): e0136137.

Asfour, S., Travascio, F., Elmasry, S., & de Rivero Vaccari, Juan Pablo. (2015). "A computational analysis on the implications of age-related changes in the expression of cellular signals on the role of IGF-1 in intervertebral disc homeostasis". Journal of Biomechanics, 48(2): 332-339.

Travascio, F., Asfour, S., Gjolaj, J., Latta, L., & Elmasry, S. (2015). "Implications of decompressive surgical procedures for lumbar spine stenosis on the biomechanics of the adjacent segment: A finite element analysis". Journal of Spine, 4(220): 2.

Eltoukhy, M., Travascio, F., Asfour, S., Elmasry, S., Heredia-Vargas, H., & Signorile, J. (2015). "Examination of a lumbar spine biomechanical model for assessing axial compression, shear, and bending moment using selected olympic lifts". Journal of Orthopaedics, 13(3): 210-219.

Travascio, F., Elmasry, S., & Asfour, S. (2014). "Modeling the role of IGF-1 on extracellular matrix biosynthesis and cellularity in intervertebral disc". Journal of Biomechanics. 47(10): 2269-76.

Presentations

Lovald, S., Petersen, C., Shannon, D., Elmasry, S., Kreuzer, S. Model Optimization and Uncertainty Estimation of a Lumbar Spine Finite Element Model. Medical Device Innovation Consortium (MDIC) 2025 Computational Modeling & Simulation (CM&S) Symposium. Hyattsville, MD, Nov. 4-6, 2025.

Miller BD, Elmasry SE, Sharpe SS, Allin LJ, Salipur Z. Effectiveness of Bicycle, Motorcycle, and Skateboard Helmets in Reducing Risk of Concussion and Skull Fracture Across Various Impact Locations and Velocities. American Society of Biomechanics Annual Meeting, Pittsburgh, PA, August 13-16, 2025.

Bove R, Elmasry S, Amin D, Aber R, Rapp van Roden E, Miller B. Evaluation of Pedestrian Overturn Risk Associated with Railing Interaction. American Society of Biomechanics Annual Meeting, Pittsburgh, PA, August 13-16, 2025.

Siljander B., Elmasry S., Kahlenberg C., Mayman D., Cross M., Pearle A., Westrich G., Imhauser C., Sculco P. “Accuracy of Arthroplasty Surgeons in Estimating Flexion and Extension Gaps in Total Knee Arthroplasty” Poster presentation, American Academy of Orthopaedic Surgeons, San Francisco, CA, 2024

Elmasry, S., Kahlenberg, C., Wright, T., Pearle A., Cross, M., Westrich, G., Mayman, D., Sculco, P., Imhauser, C. “How Accurate Are Surgeons in Estimating the Medial and Lateral Gaps in Total Knee Arthroplasty?”. Oral presentation, Orthopaedic Research Society (ORS), Dallas, TX, 2023.

Elmasry, S., Chalmers, B., Kahlenberg, C., Sculco, P., Wright, T., Mayman, D., Westrich, G., Cross, M., Imhauser, C. “Role of Midlevel Constraint in Reducing Midflexion Laxity After Additional Distal Femoral Resection in Posterior Stabilized TKA”. Oral presentation, International Society for Technology in Arthroplasty (ISTA), Maui, HI, 2022.

Elmasry, S., Chalmers, B., Kahlenberg, C., Sculco, P., Wright, T., Mayman, D., Cross, M., Westrich, G., Imhauser, C. “Role of Midlevel Constraint in Reducing Midflexion Laxity after Additional Distal Femoral Resection in Posterior Stabilized TKA”. Oral presentation, Orthopaedic Research Society (ORS), Symposium on Practical Considerations on Model Credibility, Tampa, FL, 2022.

Elmasry, S., Chalmers, B., Kahlenberg, C., Sculco, P., Westrich, G., Mayman, D., Wright, T., Cross, M., Imhauser, C. “Additional Distal Femoral Resection Increases Mid-flexion Laxity In A Computational Model Of Posterior Stabilized TKA With Flexion Contracture”. Oral presentation, Summer Biomechanics, Bioengineering & Biotransport Conference (SB3C), Virtual 2021.

Elmasry, S., Chalmers, B., Kahlenberg, C., Sculco, P., Westrich, G., Mayman, D., Wright, T., Cross, M., Imhauser, C. “Additional Distal Femoral Resection Increases Mid-Flexion Laxity in Posterior Stabilized TKA: A Computational Model of a Flexion Contracture”. Oral presentation, International Society for Technology in Arthroplasty (ISTA), Virtual 2020.

Elmasry, S., Kahlenberg, C., Gandhi, S., Sculco, P., Wright, T., Pearle, A., Cross, M., Westrich, G., Mayman, D., Imhauser, C. “Quantifying the art of Surgical Decision-making in Total Knee Arthroplasty”. Oral presentation, Research in Progress series at the Clinical and Translational Science Center at Weill Cornell Medicine, NYC 2020.

Elmasry, S., Kahlenberg, C., Gandhi, S., Sculco, P., Wright, T., Pearle, A., Cross, M., Westrich, G., Mayman, D., Imhauser, C. “How Accurate Are Surgeons in Estimating the Medial and Lateral Gaps in Total Knee Arthroplasty?”. Oral presentation, Summer Biomechanics, Bioengineering, and Biotransport conference (SB3C), Virtual 2020.

Elmasry, S., Erdemir, A., Halloran, J., Hume, D., Imhauser, C., Zaylor W., Abdollahi, Shelburne, K., N., Besier, T “F.A.I.R.ness and Credibility in Computational Biomechanics”. Oral presentation, Orthopaedic Research Society (ORS), Phoenix, AZ 2020.

Elmasry, S., Sculco, P., Kia, M., Kahlenberg, C., Cross, M., Pearle, A., Mayman, D., Wright, T., Westrich, G., Imhauser, C “A Novel Geometric Ratio to Predict the Flexion Gap in Total Knee Arthroplasty”. Oral presentation, Summer Biomechanics, Bioengineering, and Biotransport conference (SB3C), Seven Springs, PA 2019.

Elmasry, S., Asfour, S., & Travascio, F. “On the Biomechanical Benefits of Augmenting Percutaneous Pedicle Screw Fixation with Kyphoplasty in the Treatment of Burst Fractures: A Finite Element Analysis”. Poster presentation, Orthopedic Research Society (ORS), New Orleans, LA 2018.

Elmasry, S., Asfour, S., & Travascio, F. “Computational Analysis of the Changes in Intradiscal Pressure at Adjacent Segments After Posterior Fixation for Burst Fracture”. Poster presentation. Summer Biomechanics, Bioengineering & Biotransport Conference (SB3C) Tucson, AZ 2017.

Elmasry, S., Asfour, S., Gjolaj, J, Latta, L., Eismont, F & Travascio, F. “Advantage of Pedicle Fixation at the Injured Level for Treating Unstable Thoracolumbar Fracture: A Finite Element Analysis”. Poster presentation, Orthopedics Research Society ORS, San Diego, CA 2017.

Elmasry, S., Asfour, S., de Rivero Vaccari, Juan Pablo, Travascio, F. “A Computational Analysis on the Effects of Reduced Bioavailability of Insulin-Like Growth Factor-1 on the Homeostasis of the Intervertebral Disc”. Poster presentation, Orthopedics Research Society ORS San Diego, CA 2017.

Elmasry, S., Asfour, S., Gjolaj, J, Latta, L., Eismont, F & Travascio, F. “Treatment Of Thoracolumbar Burst Fracture: A Biomechanical Analysis Of Three Different Fixation Constructs”. Poster presentation, Summer Biomechanics, Bioengineering & Biotransport Conference (SB3C), National Harbor, MD 2016.

Elmasry, S., Asfour, S., Gjolaj, J, Latta, L., Eismont, F & Travascio, F. (2016). “Implications of Different Fixation Constructs for Treating Thoracolumbar Burst Fractures on Adjacent Lumbar Spine Levels: A Finite Element Analysis”. Poster presentation, Orthopedics Research Society (ORS), Orlando, FL 2016.

Elmasry, S., Asfour, S., de Rivero Vaccari, Juan Pablo, Travascio, F. “Smoking and smoking Cessation: Implications on the Degeneration of the Intervertebral Disc”. Poster presentation, Summer Biomechanics, Bioengineering & Biotransport Conference (SB3C), National Harbor, MD 2016.

Gjolaj, J, Elmasry, S., Asfour, S., Latta, L., Eismont, F & Travascio, F. “Implications of Decompressive Surgical Procedures for Lumbar Spine Stenosis on the Biomechanics of the Adjacent Segment: a Finite Element Analysis”. Poster presentation, North American Spine Society (NASS), Boston, MA 2015.

Asfour, S., Elmasry, S., Latta, L., Gjolaj, J, Eismont, F & Travascio, F.” Comparative Analysis on the Implications of Anterior Lumbar Interbody Fusion and Posterior Lumbar Interbody Fusion on Adjacent Segment Biomechanics: a Finite Element Study”. Poster presentation, Orthopedics Research Society (ORS), Las Vegas, NV 2015.

Elmasry, S., Asfour, S., Gjolaj, J, Latta, L., Eismont, F & Travascio, F. “Changes in Adjacent Segment Biomechanics After Laminectomy and Laminotomy in Lumbar Spine”. Poster presentation, Orthopedics Research Society (ORS), Las Vegas, NV 2015.

Elmasry, S., Asfour, S., de Rivero Vaccari, Juan Pablo, Travascio, F. “A Quantitative Evaluation of the Role of Cell Senescence in Intervertebral Disc Degeneration”. Poster presentation, Summer Biomechanics, Bioengineering & Biotransport Conference (SB3C), Salt Lake City, UT 2015.

Elmasry, S., Asfour, S., Gjolaj, J, Latta, L., Eismont, F & Travascio, F. “Biomechanical Comparison between Facet Sparing Laminectomy and Laminectomy with Facetectomy in Lumbar Spine”. Poster presentation, Summer Biomechanics, Bioengineering & Biotransport Conference (SB3C) Salt Lake City, UT 2015.

Travascio, F., Elmasry, S., & Asfour, S. (2014). “Barriers to Growth Factor Therapy for Intervertebral Disc Degeneration: A Quantitative Analysis on the Effectiveness of Exogenous IGF-1 Administration”. Poster presentation, World Congress of Biomechanics (WCB), Boston, MA 2014.

Elmasry, S., Eltoukhy, M., Ziff, M., Travascio, F., Asfour, S. “A Novel Approach for Predicting In-vivo Lumbar Spine Loads and Kinematics Based on Motion Analysis”. Poster presentation, World Congress of Biomechanics (WCB), Boston, MA 2014.

Research Grants

NIH TL1 Training Award for Career development, 2019-2021

Peer Reviews

Spine Journal

The Bone and Joint Journal (BJJ)

Journal of Orthopedic Research (JOR)

Journal of Biomechanical Engineering

Journal of Biomechanics (JOB)

The Knee