

Stanford



Matthew Smuck, MD

Professor of Orthopaedic Surgery

CLINICAL OFFICE (PRIMARY)

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ACADEMIC CONTACT INFORMATION

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Bio

BIO

Dr. Matthew Smuck is the Chief of PM&R, Vice Chair of Rehabilitation Services and Professor of Orthopaedic Surgery at Stanford University. He is the Medical Director of Rehabilitation Services for Stanford Healthcare where his clinical work concentrates on medical and interventional management of spine disorders. He is a physician leader and current Deputy Editor-in-Chief of Interventional Pain Medicine, past President of the Spine Intervention Society (SIS), and he served on the Executive Editorial Board of The Spine Journal and the Board of Directors of the North American Spine Society (NASS) and the Foundation for PM&R. Dr. Smuck is an award-winning researcher and pioneer in the field of human physical performance monitoring. He founded and directs the Wearable Health Lab at Stanford, focused on developing methods of wearable sensor data analytics to discover digital phenotypes of mobility-limiting orthopedic and neurologic diseases, and applying these methods to improve disease detection, prevention and treatment. Dr. Smuck has authored more than 100 peer-reviewed publications. His work is recognized by numerous research society awards and publication awards, including the ISSLS Medtronic Award, the American Academy of PM&R's President's Citation Award, the PM&R Journal's Best Original Research Award, several Outstanding Paper Awards from The Spine Journal, the ISSLS Prize, and the NASS Henry Farfan Award.

CLINICAL FOCUS

- Spine
- Physical Medicine & Rehabilitation
- Pain Medicine

ACADEMIC APPOINTMENTS

- Professor - University Medical Line, Orthopaedic Surgery
- Member, Bio-X
- Member, Wu Tsai Human Performance Alliance
- Member, Wu Tsai Neurosciences Institute

ADMINISTRATIVE APPOINTMENTS

- Director, University of Michigan PM&R Interventional Spine Fellowship, (2007-2008)

- Interim Director, The University of Michigan Spine Program, (2008-2008)
- Director, Stanford PM&R Spine Fellowship, (2009-2014)
- Chief, Physical Medicine & Rehabilitation, Stanford University, (2011- present)
- Medical Director of Rehabilitation Services, Stanford University Hospital & Clinics, (2011- present)
- Director and Founder, Wearable Health Lab, (2014- present)
- Vice Chair of Rehabilitation Services, Department of Orthopaedic Surgery, (2023- present)

HONORS AND AWARDS

- Henry Farfan Award, NASS (2021)
- Outstanding Paper Award: Basic Science, The Spine Journal (2018)
- Outstanding Paper Award: Surgical Science, The Spine Journal (2017)
- Runner-up: Outstanding Paper Award: Medical and Interventional Science, The Spine Journal (2017)
- The ISSLS Prize for Lumbar Spine Research, ISSLS (2016)
- Runner-up: Outstanding Paper Award: Medical and Interventional Science, The Spine Journal (2016)
- Best Original Research Award, Foundation for Physical Medicine and Rehabilitation and the PM&R Journal (2015)
- President's Citation Award, AAPM&R (2014)
- Best Pain and Spine Abstracts, American Academy of Physical Medicine & Rehabilitation (2014, 2013)
- Best Papers, North American Spine Society (NASS) Annual Meeting (2013, 2009)
- Instructor, International Spine Intervention Society (2013)
- Outstanding Paper Award: Medical and Interventional Science, The Spine Journal (2013)
- Best Clinical Research Award, International Spine Intervention Society (2014, 2013, 2012)
- Medtronic Best Poster Award, International Society for the Study of the Lumbar Spine (2012)
- Best Basic Science Research Award, International Spine Intervention Society (2011)
- Best Musculoskeletal Research Award, American Academy of Physical Medicine & Rehabilitation (2011)
- Jose C. Montero MD Teaching Award, Stanford University, PM&R residency program (2010)
- Faculty Mentor, 1st Place Theodore M. Cole Resident Research Award, University of Michigan (2009, 2007, 2004)
- Young Investigator Award, US Bone and Joint Decade (2006)
- Most Outstanding Biomedical Research Paper, Indiana University School of Medicine (1997)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Deputy Editor, The Spine Journal (2011 - 2017)
- Board of Directors, North American Spine Society (NASS) (2015 - 2018)
- North American Representative, ICHOM Low Back Pain Steering Group (2014 - 2018)
- Assistant Editorial Board, European Spine Journal (2011 - 2016)
- Board of Directors, Foundation for PM&R (2016 - 2018)
- Vice Chair, Spine and Pain Track, AAPM&R Program Planning Committee (2010 - 2014)
- Board of Directors, Spine Intervention Society (SIS) (2013 - present)
- Chair, Research Division, Spine Intervention Society (SIS) (2013 - 2015)
- Co-Chair, North American Spine Society 2013 annual meeting (2013 - 2014)
- Chair, NASS Advanced Lumbar Spinal Injections Course (2011 - 2015)

- Co-Editor, Orthopedics Knowledge Update (OKU) Spine, 4th edition (2011 - 2012)
- Section Editor, Spine & Sports, SpineLine (2008 - 2013)

PROFESSIONAL EDUCATION

- Board Certification: Pain Medicine, American Board of Physical Medicine and Rehabilitation (2003)
- Board Certification: Physical Medicine and Rehab, American Board of Physical Medicine and Rehabilitation (2002)
- Residency: Stanford University School of Medicine (2001) CA
- Fellowship: Stanford University Hospital - Interventional Spine (2002) CA
- Internship: Oakwood Healthcare System (1998) MI
- Medical Education: Indiana University School of Medicine (1997) IN
- Fellow, Stanford University , Interventional Spine Medicine (2002)
- Resident, Stanford University , PM&R (2001)
- M.D., Indiana University , School of Medicine (1997)
- B.S., Milligan College , Biology, Humanities, French (1993)

COMMUNITY AND INTERNATIONAL WORK

- Exercise Committee
- ICHOM Low Back Pain Workgroup

LINKS

- Wearable Health Lab: <http://pmr.stanford.edu/research/cmmt.html>
- Public lecture on "Non Invasive Treatment of Back Pain" to the Stanford community: <http://www.youtube.com/watch?v=BEQIPv79EU0>
- The Spine Journal's 2013 Outstanding Paper Awards presentation: https://www.youtube.com/watch?v=z_uDicD42ro#t=565
- On Mobile Technology in Medical Research: <http://www.healio.com/spine-surgery/basic-science/news/online/%7B2ebf18f6-9ae2-4b0e-ae94-be4cea026abb%7D/video-smuck-on-barriers-in-spine-research>
- mHealth Connect conference presentations: <https://www.youtube.com/watch?v=6eXwqqGz204&feature=youtu.be>
- Spine Foundation Research Summit - Occupational Factors: <https://elearning.spine.org/Mediasite7/Play/ce30b41bd45f47ada8e764f17e97eee31d?catalog=23a72182-c7c7-478f-925b-4a86d96932e1>
- ICHOM outcomes recommendations for low back pain: <http://www.ichom.org/project/low-back-pain/>
- Get a Second Opinion: <https://stanfordhealthcare.org/second-opinion/overview.html>

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

I direct the Wearable Health Lab at Stanford, investigating medical applications of mobile technology to improve musculoskeletal and neurologic disease detection, treatment and prevention.

CLINICAL TRIALS

- Prescribed Physical Activity in Improving Sleep and Physical Performance in Patients Undergoing Stem Cell Transplant, Not Recruiting
- Stanford Spine Keeper - Managing Your Low Back Pain, Not Recruiting
- Use of PET/MR Imaging in Chronic Pain, Not Recruiting

Publications

PUBLICATIONS

- **Biomechanical Phenotyping of Chronic Low Back Pain: Protocol for BACPAC.** *Pain medicine (Malden, Mass.)*
Adam Quirk, D., Johnson, M. E., Anderson, D. E., Smuck, M., Sun, R., Matthew, R., Bailey, J., Marras, W. S., Bell, K. M., Darwin, J., Bowden, A. E.
2022
- **Evaluation of Motion Segment Size as a New Sensor-based Functional Outcome Measure in Stroke Rehabilitation.** *The Journal of international medical research*
Nam, H. S., Lee, W. H., Seo, H. G., Smuck, M. W., Kim, S.
2022; 50 (9): 3000605221122750
- **Magnetic Resonance Imaging Characteristics Associated with Treatment Success from Basivertebral Nerve Ablation: An Aggregated Cohort Study of Multicenter Prospective Clinical Trials Data.** *Pain medicine (Malden, Mass.)*
McCormick, Z. L., Conger, A., Smuck, M., Lotz, J. C., Hirsch, J. A., Hickman, C., Harper, K., Burnham, T. R.
2022; 23 (Supplement_2): S34-S49
- **Vertebrogenic Pain: A Paradigm Shift in Diagnosis and Treatment of Axial Low Back Pain.** *Pain medicine (Malden, Mass.)*
Conger, A., Smuck, M., Truumees, E., Lotz, J. C., DePalma, M. J., McCormick, Z. L.
2022; 23 (Supplement_2): S63-S71
- **Prospective, randomized, multicenter study of intraosseous basivertebral nerve ablation for the treatment of chronic low back pain: 24-Month treatment arm results.** *North American Spine Society journal*
Koreckij, T., Kreiner, S., Khalil, J. G., Smuck, M., Markman, J., Garfin, S., INTRACEPT Trial Investigators
2021; 8: 100089
- **What does the Patient with Back Pain Want? A Comparison of Patient Preferences and Physician Assumptions.** *The spine journal : official journal of the North American Spine Society*
Smuck, M., Barrette, K., Martinez-Ith, A., Sultana, G., Zheng, P.
2021
- **Examining the Association Between Self-Reported Estimates of Function and Objective Measures of Gait and Physical Capacity in Lumbar Stenosis.** *Archives of rehabilitation research and clinical translation*
Odonkor, C. A., Taraben, S., Tomkins-Lane, C., Zhang, W., Muaremi, A., Leutheuser, H., Sun, R., Smuck, M.
2021; 3 (3): 100147
- **PHYSICAL ACTIVITY THRESHOLDS FOR PREDICTING LONGITUDINAL GAIT DECLINE IN ADULTS WITH KNEE OSTEOARTHRITIS**
Sun, R., Tomkins-Lane, C., Muaremi, A., Kuwabara, A., Smuck, M.
ELSEVIER SCI LTD.2021: S17
- **Intraosseous Basivertebral Nerve Radiofrequency Ablation for the Treatment of Vertebral Body Endplate Low Back Pain: Current Evidence and Future Directions.** *Pain medicine (Malden, Mass.)*
Michalik, A., Conger, A., Smuck, M., Maus, T. P., McCormick, Z. L.
2021; 22 (Supplement_1): S24-S30
- **Prospective, randomized, multicenter study of intraosseous basivertebral nerve ablation for the treatment of chronic low back pain: 12-month results.** *Regional anesthesia and pain medicine*
Smuck, M., Khalil, J., Barrette, K., Hirsch, J. A., Kreiner, S., Koreckij, T., Garfin, S., Mekhail, N., INTRACEPT Trial Investigators, Beall, D., Bainbridge, S., Khalil, J., Koreckij, T., et al
2021
- **Physical Activity Thresholds for Predicting Longitudinal Gait Decline in adults with Knee Osteoarthritis.** *Osteoarthritis and cartilage*
Sun, R., Tomkins-Lane, C., Muaremi, A., Kuwabara, A., Smuck, M.
2021
- **The emerging clinical role of wearables: factors for successful implementation in healthcare.** *NPJ digital medicine*
Smuck, M., Odonkor, C. A., Wilt, J. K., Schmidt, N., Swiernik, M. A.
2021; 4 (1): 45

- **Contrast Flow Patterns Based on Needle Tip Position During Cervical Transforaminal Epidural Injections.** *PM & R : the journal of injury, function, and rehabilitation*
Levin, J. n., Levi, D. n., Gall, N. n., Horn, S. n., Smuck, M. n.
2021
- **Objective features of Sedentary Time and Light Activity Differentiate People with Low Back Pain from Healthy Controls, a Pilot Study.** *The spine journal : official journal of the North American Spine Society*
Tomkins-Lane, C., Sun, R., Muaremi, A., Zheng, P., Mohan, M., Ith, M. A., Smuck, M.
2021
- **Skin Mountable Capillaric Strain Sensor with Ultrahigh Sensitivity and Direction Specificity** *ADVANCED MATERIALS TECHNOLOGIES*
Rivas Yepes, L., Demir, E., Lee, J., Sun, R., Smuck, M., Araci, I.
2020
- **Preoperative epidural steroid injections are not associated with increased rates of infection and dural tear in lumbar spine surgery.** *European spine journal : official publication of the European Spine Society, the European Spinal Deformity Society, and the European Section of the Cervical Spine Research Society*
Koltsov, J. C., Smuck, M. W., Alamin, T. F., Wood, K. B., Cheng, I., Hu, S. S.
2020
- **Predicting Poor Functional Status In Adults With Knee Osteoarthritis Using Real-life Accelerometry Data**
Sun, R., Kuwabara, A., Tomkins-Lane, C., Smuck, M.
LIPPINCOTT WILLIAMS & WILKINS.2020: 823–24
- **Cervical Epidural Steroid Injections: Incidence and Determinants of Subsequent Surgery.** *The spine journal : official journal of the North American Spine Society*
Kleimeyer, J. P., Koltsov, J. C., Smuck, M. W., Wood, K. B., Cheng, I., Hu, S. S.
2020
- **Variability among Methods and Timing of Pain Assessment Tools for Tracking Improvement of Lumbar Stenosis Patients after Surgery.** *The spine journal : official journal of the North American Spine Society*
Tomkins-Lane, C., Zheng, P. Z., Sun, R., Smuck, M.
2020
- **Approaching the Management of Expectations in Patients with Chronic Low Back Pain: Enthusiasm vs Realism.** *Pain medicine (Malden, Mass.)*
McCormick, Z. L., Schneider, B. J., Prather, H., Sullivan, W., Smuck, M.
2020
- **Consensus practice guidelines on interventions for lumbar facet joint pain from a multispecialty, international working group.** *Regional anesthesia and pain medicine*
Cohen, S. P., Bhaskar, A., Bhatia, A., Buvanendran, A., Deer, T., Garg, S., Hooten, W. M., Hurley, R. W., Kennedy, D. J., McLean, B. C., Moon, J. Y., Narouze, S., Pangarkar, et al
2020
- **PREDICTING DECLINE IN CLINICAL GAIT SPEED IN ADULTS WITH KNEE OSTEOARTHRITIS USING BASELINE PHYSICAL ACTIVITY DATA**
Sun, R., Muaremi, A., Kuwabara, A., Tomkins-Lane, C., Smuck, M.
ELSEVIER SCI LTD.2020: S314
- **Digital care for chronic musculoskeletal pain: a 10,000 user longitudinal observational study.** *Journal of medical Internet research*
Bailey, J. F., Agarwal, V., Zheng, P., Smuck, M., Fredericson, M., Kennedy, D. J., Krauss, J.
2020
- **Spine Nonoperative Cost Before Surgery.** *Spine*
Schneider, B. J., Sullivan, W. n., Prather, H. n., Smuck, M. n., McCormick, Z. n.
2020
- **Who is physically active? : Classification and Analysis of Physical Activity using NHANES data**
Nu, U., Touati, T., Buddhadev, S., Sun, R., Smuck, M., Song, I., IEEE
IEEE.2020: 527-533

- **TO THE EDITOR.** *Spine*
Schneider, B. J., Sullivan, W. n., Prather, H. n., Smuck, M. n., McCormick, Z. n.
2020; 45 (7): E412–E413
- **Incidence of Extravascular Perivertebral Artery Contrast Flow During Cervical Transforaminal Epidural Injections.** *Pain medicine (Malden, Mass.)*
Levin, J. n., Mohan, M. n., Levi, D. n., Horn, S. n., Smuck, M. n.
2020
- **Gait features for discriminating between mobility-limiting musculoskeletal disorders: Lumbar spinal stenosis and knee osteoarthritis.** *Gait & posture*
Odonkor, C. n., Kuwabara, A. n., Tomkins-Lane, C. n., Zhang, W. n., Muaremi, A. n., Leutheuser, H. n., Sun, R. n., Smuck, M. n.
2020; 80: 96–100
- **Modification of the Cervical Transforaminal Epidural Steroid Injection Technique Based Upon the Anatomic Angle of the Superior Articular Process on MRI.** *Pain medicine (Malden, Mass.)*
Levi, D. n., Horn, S. n., Murphy, J. n., Smuck, M. n., Levin, J. n.
2020
- **Smoking Is Associated with Pain in All Body Regions, with Greatest Influence on Spinal Pain.** *Pain medicine (Malden, Mass.)*
Smuck, M., Schneider, B. J., Ehsanian, R., Martin, E., Kao, M. J.
2019
- **A Prospective, Randomized, Multi-Center Study of Intraosseous Basivertebral Nerve Ablation for the Treatment of Chronic Low Back Pain.** *The spine journal : official journal of the North American Spine Society*
Khalil, J., Smuck, M., Koreckij, T., Keel, J., Beall, D., Goodman, B., Kalapos, P., Nguyen, D., Garfin, S., INTRACEPT Trial Investigators
2019
- **Effect of Injectate Viscosity on Epidural Distribution in Lumbar Transforaminal Epidural Steroid Injection.** *Pain research & management*
Choi, J., Kim, N., Smuck, M., Lee, S. H.
2019; 2019: 2651504
- **Lumbar epidural steroid injections for herniation and stenosis: incidence and risk factors of subsequent surgery** *SPINE JOURNAL*
Koltsov, J. B., Smuck, M. W., Zagel, A., Alamin, T. F., Wood, K. B., Cheng, I., Hu, S. S.
2019; 19 (2): 199–205
- **Intra-articular Steroids vs Saline for Lumbar Z-Joint Pain: A Prospective, Randomized, Double-Blind Placebo-Controlled Trial** *PAIN MEDICINE*
Kennedy, D. J., Fraiser, R., Zheng, P., Huynh, L., Levin, J., Smuck, M., Schneider, B. J.
2019; 20 (2): 246–51
- **Does the presence of the fibronectin-aggrecan complex predict outcomes from lumbar discectomy for disc herniation?** *SPINE JOURNAL*
Smith, M. W., Ith, A., Carragee, E. J., Cheng, I., Alamin, T. F., Golish, S., Mitsunaga, K., Scuderi, G. J., Smuck, M.
2019; 19 (2): E28–E33
- **Effect of Injectate Viscosity on Epidural Distribution in Lumbar Transforaminal Epidural Steroid Injection** *Pain Research and Management*
Choi, J., Kim, N., Smuck, M., Lee, S.
2019; 2019: 6
- **Digital biomarkers of spine and musculoskeletal disease from accelerometers: Defining phenotypes of free-living physical activity in knee osteoarthritis and lumbar spinal stenosis** *SPINE JOURNAL*
Tomkins-Lane, C., Norden, J., Sinha, A., Hu, R., Smuck, M.
2019; 19 (1): 15–23
- **Intra-articular Steroids vs Saline for Lumbar Z-Joint Pain: A Prospective, Randomized, Double-Blind Placebo-Controlled Trial.** *Pain medicine (Malden, Mass.)*
Kennedy, D. J., Fraiser, R., Zheng, P., Huynh, L., Levin, J., Smuck, M., Schneider, B. J.
2018
- **Guidelines for Composing and Assessing a Paper on the Treatment of Pain: A Practical Application of Evidence-Based Medicine Principles to the Mint Randomized Clinical Trials** *PAIN MEDICINE*
McCormick, Z. L., Vorobeychik, Y., Gill, J. S., Kao, M. J., Duszynski, B., Smuck, M., Stojanovic, M. P.
2018; 19 (11): 2127–37

- **Gait Symmetry Assessment with a Low Back 3D Accelerometer in Post-Stroke Patients.** *Sensors (Basel, Switzerland)*
Zhang, W., Smuck, M., Legault, C., Ith, M. A., Muaremi, A., Aminian, K.
2018; 18 (10)
- **Corticosteroid Injections Into Lumbar Facet Joints: A Prospective, Randomized, Double-Blind Placebo-Controlled Trial** *AMERICAN JOURNAL OF PHYSICAL MEDICINE & REHABILITATION*
Kennedy, D. J., Huynh, L., Wong, J., Mattie, R., Levin, J., Smuck, M., Schneider, B. J.
2018; 97 (10): 741–46
- **Gait Symmetry Assessment with a Low Back 3D Accelerometer in Post-Stroke Patients** *SENSORS*
Zhang, W., Smuck, M., Legault, C., Ith, M. A., Muaremi, A., Aminian, K.
2018; 18 (10)
- **The Global Spine Care Initiative: public health and prevention interventions for common spine disorders in low- and middle-income communities** *EUROPEAN SPINE JOURNAL*
Green, B. N., Johnson, C. D., Haldeman, S., Kane, E. J., Clay, M. B., Griffith, E. A., Castellote, J. M., Smuck, M., Rajasekaran, S., Hurwitz, E. L., Nordin, M., Randhawa, K., Yu, et al
2018; 27: 838–50
- **The Global Spine Care Initiative: methodology, contributors, and disclosures** *EUROPEAN SPINE JOURNAL*
Johnson, C. D., Haldeman, S., Nordin, M., Chou, R., Cote, P., Hurwitz, E. L., Green, B. N., Kopansky-Giles, D., Randhawa, K., Cedraschi, C., Ameis, A., Acaroglu, E., Aartun, et al
2018; 27: 786–95
- **The Global Spine Care Initiative: model of care and implementation** *EUROPEAN SPINE JOURNAL*
Johnson, C. D., Haldeman, S., Chou, R., Nordin, M., Green, B. N., Cote, P., Hurwitz, E. L., Kopansky-Giles, D., Acaroglu, E., Cedraschi, C., Ameis, A., Randhawa, K., Aartun, et al
2018; 27: 925–45
- **The Global Spine Care Initiative: World Spine Care executive summary on reducing spine-related disability in low- and middle-income communities** *EUROPEAN SPINE JOURNAL*
Haldeman, S., Nordin, M., Chou, R., Cote, P., Hurwitz, E. L., Johnson, C. D., Randhawa, K., Green, B. N., Kopansky-Giles, D., Acaroglu, E., Ameis, A., Cedraschi, C., Aartun, et al
2018; 27: 776–85
- **The Global Spine Care Initiative: public health and prevention interventions for common spine disorders in low- and middle-income communities.** *European spine journal : official publication of the European Spine Society, the European Spinal Deformity Society, and the European Section of the Cervical Spine Research Society*
Green, B. N., Johnson, C. D., Haldeman, S., Kane, E. J., Clay, M. B., Griffith, E. A., Castellote, J. M., Smuck, M., Rajasekaran, S., Hurwitz, E. L., Nordin, M., Randhawa, K., Yu, et al
2018
- **Simple Gait Symmetry Measures Based on Foot Angular Velocity: Analysis in Post Stroke Patients.** *Conference proceedings : ... Annual International Conference of the IEEE Engineering in Medicine and Biology Society. IEEE Engineering in Medicine and Biology Society. Annual Conference*
Zhang, W., Smuck, M., Legault, C., Ith, M. A., Muaremi, A., Aminian, K.
2018; 2018: 5442–45
- **Lumbar Epidural Steroid Injections for Herniation and Stenosis: Incidence and Risk Factors of Subsequent Surgery.** *The spine journal : official journal of the North American Spine Society*
Koltsov, J. C., Smuck, M. W., Zagel, A., Alamin, T. F., Wood, K. B., Cheng, I., Hu, S. S.
2018
- **F-18-FDG PET/MRI in Chronic Sciatica: Early Results Revealing Spinal and Nonspinal Abnormalities** *JOURNAL OF NUCLEAR MEDICINE*
Cipriano, P. W., Yoon, D., Gandhi, H., Holley, D., Thakur, D., Hargreaves, B. A., Kennedy, D. J., Smuck, M. W., Cheng, I., Biswal, S.
2018; 59 (6): 967–72
- **A scoping review of biopsychosocial risk factors and co-morbidities for common spinal disorders** *PLOS ONE*
Green, B. N., Johnson, C. D., Haldeman, S., Griffith, E., Clay, M. B., Kane, E. J., Castellote, J. M., Rajasekaran, S., Smuck, M., Hurwitz, E. L., Randhawa, K., Yu, H., Nordin, et al
2018; 13 (6)

- **Reliability and Validity of Athletes Disability Index Questionnaire** *CLINICAL JOURNAL OF SPORT MEDICINE*
Noormohammadpour, P., Khezri, A., Farahbakhsh, F., Mansournia, M., Smuck, M., Kordi, R.
2018; 28 (2): 159–67
- **Objective measurement of function following lumbar spinal stenosis decompression reveals improved functional capacity with stagnant real-life physical activity** *SPINE JOURNAL*
Smuck, M., Muaremi, A., Zheng, P., Norden, J., Sinha, A., Hu, R., Tomkins-Lane, C.
2018; 18 (1): 15–21
- **Inferring Physical Function from Wearable Activity Monitors: Analysis of Activity Data from Patients with Knee Osteoarthritis.** *JMIR Mhealth Uhealth*
Agarwal, V., Smuck, M., Tomkins-Lane, C., Shah, N. H.
2018
- **Objective measurement of function following lumbar spinal stenosis decompression reveals improved functional capacity with stagnant real-life physical activity.** *The spine journal : official journal of the North American Spine Society*
Smuck, M., Muaremi, A., Zheng, P., Norden, J., Sinha, A., Hu, R., Tomkins-Lane, C.
2018; 18 (1): 15-21
- **Inferring Physical Function From Wearable Activity Monitors: Analysis of Free-Living Activity Data From Patients With Knee Osteoarthritis.** *JMIR mHealth and uHealth*
Agarwal, V. n., Smuck, M. n., Tomkins-Lane, C. n., Shah, N. H.
2018; 6 (12): e11315
- **A minimum of 5-year follow-up after lumbar transforaminal epidural steroid injections in patients with lumbar radicular pain due to intervertebral disc herniation** *SPINE JOURNAL*
Kennedy, D. J., Zheng, P. Z., Smuck, M., McCormick, Z. L., Huynh, L., Schneider, B. J.
2018; 18 (1): 29–35
- **A scoping review of biopsychosocial risk factors and co-morbidities for common spinal disorders.** *PloS one*
Green, B. N., Johnson, C. D., Haldeman, S., Griffith, E., Clay, M. B., Kane, E. J., Castellote, J. M., Rajasekaran, S., Smuck, M., Hurwitz, E. L., Randhawa, K., Yu, H., Nordin, et al
2018; 13 (6): e0197987
- **Advice to give advice** *SPINE JOURNAL*
Zheng, P. Z., Smuck, M.
2017; 17 (10): 1547–48
- **A minimum of 5-year follow-up after lumbar transforaminal epidural steroid injections in patients with lumbar radicular pain due to intervertebral disc herniation.** *The spine journal : official journal of the North American Spine Society*
Kennedy, D. J., Zheng, P. Z., Smuck, M., McCormick, Z. L., Huynh, L., Schneider, B. J.
2017
- **Stagnant Physical Therapy Referral Rates Alongside Rising Opioid Prescription Rates in Patients With Low Back Pain in the United States 1997-2010** *SPINE*
Zheng, P., Kao, M., Karayannis, N. V., Smuck, M.
2017; 42 (9): 670-674
- **App Development for Therapeutic Exercise** *PM&R*
Zheng, P., Leff, G., Ith, M., Smuck, M.
2017; 9 (5): S116–S117
- **Long-Term Effects of Repeated Injections of Local Anesthetic With or Without Corticosteroid for Lumbar Spinal Stenosis: A Randomized Trial.** *Archives of physical medicine and rehabilitation*
Friedly, J. L., Comstock, B. A., Turner, J. A., Heagerty, P. J., Deyo, R. A., Bauer, Z., Avins, A. L., Nedeljkovic, S. S., Nerenz, D. R., Shi, X. R., Annaswamy, T., Standaert, C. J., Smuck, et al
2017
- **Physical performance analysis: A new approach to assessing free-living physical activity in musculoskeletal pain and mobility-limited populations.** *PloS one*
Smuck, M., Tomkins-Lane, C., Ith, M. A., Jarosz, R., Kao, M. J.
2017; 12 (2)

- **Quantifying the relative change in physical activity after Total Knee Arthroplasty using accelerometer based measurements.** *AMIA Joint Summits on Translational Science proceedings. AMIA Joint Summits on Translational Science*
Agarwal, V., Smuck, M., Shah, N. H.
2017; 2017: 463–72
- **¹⁸F-FDG PET/MRI in Chronic Sciatica: Early Results Revealing Spinal and Non-spinal Abnormalities.** *Journal of nuclear medicine : official publication, Society of Nuclear Medicine*
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