UNT | HEALTH SCIENCE CENTER

Research

FY 2014 Goal: Develop innovative opportunities for local and national research collaborations. Optimize local and national OMM research competency.

FY 2014 Initiatives:

- Increase number and total dollar amount of collaborative research proposals.
- Increase number of OMM publications.
- Increase number of research presentations.
- Develop innovative research projects drawing from clinical resources.
- Determine student involvement and communicate in research projects.
- Continue multi center collaborations in the North Texas area.

OMM Division of Research
(2013-2014)

The OMM research division consists of collaborative and translational research programs involved in interdepartmental, interscholastic and interdisciplinary projects. From local funding of student and resident projects through NIH/NCCAM funded clinicians, our diverse program in osteopathic manipulation, as it relates to biomechanics, aging, orthopedics, clinical and bench research, is a leader in the national effort to enhance osteopathic medical education and research.

Included in this effort is the Osteopathic Heritage Foundation Physical Medicine Core research Facility (OHFPMCRG). This facility is a collaboration between several departments and schools at the University of North Texas Health Science Center in Fort Worth that are interested in human performance. Our team of engineers, physical therapists, physicians and basic scientists work together to understand biomechanics and kinematics in the neuro-musculo-skeletal system. Through video motion capture, virtual reality environments, custom instrumentation and computational modeling we analyze abnormal motions due to disease processes and evaluate rehabilitation treatments.

Facilities and Other Resources

OHFPMCRF Laboratory

This core lab occupies 2,300 square feet of space located in the Center for BioHealth. Offices are immediately adjacent to the laboratory with an office suite for support staff. Research fellows and Technical staff have their own desks in the laboratory area. The laboratory is equipped with a motion analysis system for kinematic testing of normal and pathological motion, force plates for measurement of center of pressure, and computational facilities for creating patient-specific models and simulations. A Delsys electromyographic system, capable of surface and fine wire data collection, is also available. The V-Gait CAREN system consists of a dual-belt instrumented treadmill (Culemborg, The Netherlands) with capabilities to deliver 2 degrees of freedom perturbation, along with visual display and CAREN software, and provides us with the necessary tools to create and test human movement and posture in virtual environments. The laboratory is equipped with several software programs, among them Matlab and LabVIEW. Both of these software programs are routinely used in the lab and supported by the Lab Engineer.

Photo of V-Gait system

Equipment

V-gait CAREN system is a state-of-the-art Computer Assisted Rehabilitation Environment Network that integrates traditional instrumentation of investigating posture and gait with a virtual reality environment.

Specific components include:

- Dual belt instrumented treadmill that can function in self-pace or predetermined speed mode. Two force plates are embedded under each belt (Forcelink, Culemborg, The Netherlands). The treadmill can deliver perturbations in 2 degrees of freedom, pitch (± 10 degrees variable incline in walking direction), and fast sway (± 10 cm sideways perturbations).
- 180 cylindrical screen for visualization with 3 front projectors and custom driver to blend images
- CAREN software to control and synchronize all inputs and data collected

- Magician's Apprentice, a VR environment scene and application developed by Motek Medical and Grundel Games Inc. specifically for our upper extremity application.
- Motion Analysis Capabilities: 12-camera Eagle real-time digital motion capture system (Motion Analysis Corp, Santa Rosa, CA) with real-time kinetics and extremity calculation software. The motion system is capable of full integration with a Delsys electromeyographic system capable of surface or fine wire data collection.

The laboratory is equipped with several software programs, among them Matlab (several tool boxes) and LabVIEW. Both these software programs are extensively used in the lab supported by the Lab Engineer.

Research activity is inclusive of all Principal Investigators that utilize the OHFPMCRF Laboratory

Research Awards

I. Funded Grants (current):

A. 08/01/2011 – 05/31/2012, $99,930, Bugnariu, N., Jafari, R. (UTD), Hart, J. (UTD), TxMED: Texas Medical Research Collaborative. Fall Prevention Through Retraining Sensory Weighting Using a Virtual Environment and Vibrotactile Biofeedback. (in no cost extension).

B. 08/01/2013 – 07/31/2014, $15,000, Bugnariu, N., Stevens, G., and Patterson, R.M., Functional Performance and Evaluation of Dynamic Response Feet, American Orthotic and Prosthetic Association.

C. September 1, 2012 – August 31, 2016, $1,729,767 ($264,551 to UNTHSC), Popa D, Z.Celik-Butler, D.Butler, F.L.Lewis, Bugnariu, N, Multi-Modal Skin Garments for Healthcare and Home Robots, NSF.

D. 06/01/2013 – 05/31/2014: $100,000 ($1,970 UNTHSC and $80,000 UTD) PI, Jafari, R., Co-I, Shi, X., Hensel, K., Wrist-based Non-invasive Wearable Sensors for Continuous Blood Pressure Monitoring using Pulse Transit Time, TxMRC.

E. 08.01/2010 – 06/30/2014: $140,429, PI Yavuz, M., Investigation of Plantar Shear Stresses in Diabetic Patients: Relevance to Foot Ulcers, NIH/NIDDK.

F. 03/01/2014 – 08/31/2014, $9,825, Use of a Torque Range of Motion Device to Teach evaluation of Somatic Dysfunction, Patterson, RM, PI, Mason, D, Collins, V, and Kominsky, Co-I's, 2014 UNTHSC Innovations in Teaching Using Technology Seed Grant.

G. 03/01/2014 – 08/31/2014, $5,258, Use of instructional videos to improve student learning and quality of teaching osteopathic manipulative medicine skills, Seals, R., PI, Gustowski, S., Massey, R., and Kominsky, Co-I's, 2014 UNTHSC Innovations in Teaching Using Technology Seed Grant.

H. 10/01/2013 – 09/31/2014, $23,862.50, Osteopathic Management of Leg Length Inequality with Heel lift Therapy: Analysis of Altered Gait Kinematics, PI Mason, D., Patterson, Co-I, UNTHSC Seed grant program.

I. 10/01/2013 – 09/31/2014, $23,113, Visuomotor Integration in Autism Spectrum Disorders (ASD), PI, Bugnariu, N., Miller, H., and Patterson, R.M., Co-I's, UNTHSC Seed grant program.

J. 2014, $7,300, Novel Diabetic Footwear Prototype Development, PI Yavuz, M., NIH UL1 Grant (UTSW CTM).

Research Proposals

II. Submitted grants (2013-2014 year)

1) 10/01/2013 – 09/31/2014, $23,113, Clinical Tool to Evaluate Shoulder Stiffness, PI, Patterson, R.M., Connors, M. and Bugnariu, N., Co-I's, in collaboration with UTA: Lee, W.H., Mayyas, M., and Shin, J., UNTHSC Seed grant program.

2) 10/01/2013 – 09/31/2014, $23,113, Visuomotor Integration in Autism Spectrum Disorders (ASD), PI, Bugnariu, N., Miller, H., and Patterson, R.M., Co-I's, UNTHSC Seed grant program.
3) 09/01/14 – 8/31/17, $303,484, Development of virtual reality environments to test the interaction between physical and cognitive performance in lower and upper limb loss, PI, Patterson, R.M., Bugnariu, N., Co-I, NSF, CBET - Gen & Age Rel Disabilities Eng,
4) Letter of Intent: 01/01/2015 – 12/31/2017, $1,500,000, Evaluation and Rehabilitation of Neurosensory Interactions in Hearing Loss, Tinnitus and Balance, Bugnariu, N., PI, Thibodeau, L., Vanneste, Wilson, Faulkenburg and Patterson, RM., Co-I's, DOD, CDMRP.
5) 08/01/2014 – 08/31/2015, $47,811, Mason, D. C., PI, Effects of Osteopathic Manipulative Treatment on the Inflammatory Mediators Related to Asthma, American Osteopathic Association.
6) 08/01/2014 – 08/31/2016, $99,980, Mason, D.C. PI, Patterson, R.M. Co-I, Osteopathic Management of Leg Length Inequality with Heel Lift Therapy: Analysis of Altered Gait Kinematics, American Osteopathic Association.
7) 08/01/2014 – 08/31/2016, $99,960, Patterson, R.M. PI, Crow, T. Co-I, Use of a Torque Range of Motion Device for Evaluation and Teaching of Somatic Dysfunction, American Osteopathic Association.
8) 08/01/2014 – 08/31/2016, $97,420, Hensel, K. PI, Effects of Osteopathic Manipulation of Gastric Motility, American Osteopathic Association.
9) 03/01/2014 – 08/31/2014, $5,258, Use of instructional videos to improve student learning and quality of teaching osteopathic manipulative medicine skills, Seals, R., PI, Gustowski, S., Massey, R., and Kominsky, Co-I's, 2014 UNTHSC Innovations in Teaching Using Technology Seed Grant.
10) 03/01/2014 – 08/31/2014, $2,739, Use of Poll Everywhere Technology to Improve Student Engagement in a Large Classroom Setting, Gustowski, S., PI, and Kominsky, Co-I.
11) 10/01/2013 – 09/31/2014, $5,000, Visuomotor integration in ASD during virtual reality and robot interaction tasks, PI Miller, H., Co-I Bugnariu, N., Autism Science Foundation.
12) 07/01/2014 – 06/31/2015, $35,000, Visual and motor response to 3-dimensional object motion in ASD, PI Haylie Miller, Nicoleta Bugnariu (Sponsoring Scientist), Autism Science Foundation Postdoctoral Fellowship.
13) 10/01/2013 – 09/31/2014, $250,000, Visuomotor integration in Autism Spectrum Disorder, PI Bugnariu, N., Co-I Miller, H., Simons Foundation Autism Research Initiative.
14) 07/01/2014 – 06/31/2015, $170,824, Integrating new technologies to assess visual and attentional influences on movement and imitative behavior in Autism, Pi Miller, Co-I's Bugnariu, N., and Hayhoe, M, NSF Postdoctoral fellowship.
15) 06/01/2014 – 05/31/2019, $928,776, Visuomotor integration and attention in Autism Spectrum Disorder, PI, Miller, H., Primary Mentor, Bugnariu, N., Co-mentor's, Hayhoe, M. and Patterson, R.M., NIH/NIMH K99/R00 Pathway to independence.
16) 06/01/2014 – 05/31/2019, $867,784, Falls risk due to physical, visual & cognitive challenges in gait, PI, Singhal, K., Primary Mentor, Patterson, R.M., Co-mentor's, Bugnariu, N. and Parsons, T., NIH/NIA K99/R00 Pathway to independence.
17) Letter of Intent: 06/01/2014 – 05/31/2014, $100,000 ($50,000 to UTARI and $50,000 to UNTHSC), Clinical Tool to Evaluate Shoulder Stiffness, Patterson, RM and Shin, J, PI's, Connors, M, Bugnariu, N., and Lee, W, CO-I's, UTARI , TexasMRC Texas Medical Research Collaborative.
18) 06/01/2014 – 05/31/2014, $100,000 ($50,000 to UTARI and $50,000 to UNTHSC), Clinical Tool to Evaluate Shoulder Stiffness, Patterson, RM and Shin, J, PI's, Connors, M, Bugnariu, N., and Lee, W, CO-I's, UTARI , TexasMRC Texas Medical Research Collaborative.
19) 01/01/2015 – 12/31/2018, $438,000, Variability of Triaxial Plantar Loading in Diabetic Patients, PI Yavuz, M., NIH R15.
20) 01/01/2015 – 12/31/2015, $75,000, Novel Footwear for Diabetic Population to Minimize Ulceration Rates, PI Yavuz, M., NIH SBIR, impact score 51.

Publications in Peer Reviewed Journals

III. Published Manuscripts

1. Hensel, K.L., Pacchia, C.F., and Smith, M.L., Acute improvement in hemodynamic control after osteopathic manipulative treatment in the third trimester of pregnancy, *Complementary Therapies in Medicine.*
2. Yavuz, M., Plantar shear stress distributions in diabetic patients with and without neuropathy, Clinical Biomechanics, Feb 29(2):223-9, 2014. **American Society of Biomechanics Clinical Biomechanics Award 2012.**
3. Hensel, K., Pacchia, C., Smith, M. Acute improvement in hemodynamic control after osteopathic manipulative treatment in the third trimester of pregnancy. *Complement Ther Med* (2013) 21, 618—626
4. Prinsen, JK, Hensel, KL, and Snow, RJ, OMT Associated With Reduced Analgesic Prescribing and Fewer Missed Work Days in Patients With Low Back Pain: An Observational Study, J Am Osteopath Assoc February 1, 2014 114:90-98.
5. Miller, H. L., Odegard, T. N., & Allen, G. (2014). Evaluating information processing in Autism Spectrum Disorder: The case for Fuzzy Trace Theory. *Developmental Review, 34,* 44–76. doi: 10.1016/j.dr.2013.12.002.
6. Kim, J., Wilson, M.A., Singhal, K., Gamblin, S., Suh, C.-Y & Kwon, Y.-H. Generation of vertical angular momentum in single, double, and triple- turn *pirouette en dehors* in ballet. *Sports Biomechanics*.
7. Jeans, K., Carol, L., Cummings, D. & Singhal, K. A comparison of Syme and Trans-Tibial Gait in Children: Factors that may play a role in outcome. *Journal of Bone & Joint Surgery*.
8. Licciardone, J.C., Kearns, C.M., Crow, W.T., Changes in biomechanical dysfunction and low back pain reduction with osteopathic manual treatment: Results from the OSTEOPATHIC Trial, Manual Therapy, (2014) 1-7.
9. Licciardone, J.C., Kearns, C.M., Hollis, H.H., Seffinger, M.A., Crow, W.T., Zajac, P., Devine, W.H., Abu-Shaih, R.Y., Miller, S.J., Berkowitz, M.R., Dyer, R., Heath, D.M., Treffer, K.D., Nevins, N.A., and Aral, S., Somatic Dynsfunction and Use of Osteopathic Manual Treatment Techniques During Ambulatory Medical Care Visits: A CONCORD-PBRN Study, JAOA, vol 114:no 5, May 2014, 344-355.
10. Licciardone, J.C., Kearns, C.M., Crow, T., Changes in biomechanical dysfunction and low back pain reduction with osteopathic manual treatment: Results from the OSTEOPATHIC Trial, Manual Therapy 19 (2014) 324-330.
11. Singhal, K., Kim, J., Casebolt, J. B., Lee, S., Han, K. H., Kwon, Y. -H. (Accepted). Kinetic comparison of older men and women during walk-to-stair descent transition. *Gait & Posture*
12. Licciardone, J.C., Kearns, C.M., and Crow, T., Changes in Biomechanical Dysfunction and Low Back Pain Reduction with Osteopathic Manual Treatment: Results from the OSTEOPATHIC Trial, Manual Therapy. On line March 18, 2014.
13. Hensel, K., Pregnancy Research on Osteopathic Manipulation Optimizing Treatment Effects: The PROMOTE Study A Randomized Controlled Trial, American Journal of Obstetrics & Gynecology.
14. Yavuz M. ASB Clinical Biomechanics Award 2012: Plantar Shear Stress Distributions in Diabetic Patients with and without Neuropathy. Clinical Biomechanics, 29(2): 223-9, 2014.
15. Yavuz M, Brem R, Davis BL et al. Temperature as a Predictive Tool for Plantar Tri-axial Loading. Journal of Biomechanics, (under revision).

IV. Abstracts

RAD:

1. Joe Hidrogo III, J, Stevens, G, Patterson, RM, and Bugnariu, N, Functional Assessment of Balance and Gait in Transtibial Amputees using K2 vs. K3 Prosthetics Feet.
2. Patel, A, Patterson, RM, Mason, D, Osteopathic Manipulative Treatment in Hispanic Patients: A Retrospective Chart Study.
3. Rose, G., Nordon-Craft, A., Jaffari, R., Patterson, RM., and Bugnariu, N., Ischemia-induced

reduction of somatosensory input decreases balance; added vibratory noise partially restores function.

Accepted:

1. Bugnarui, H., Patterson, R.M., Garver, C., Torres, N.A., and Popa, D.O., Human-Robot Upper Body Gesture Imitation Analysis for Autism Spectrum Disorders, ICSR2013, International Conference on Social Robotics, Bristol, UK, October 27-29, 2013.
2. Gustowski, S, Translating Knowledge into Practice: Developing Application Skills for Clinical Practice, AACOM 2014, Washington DC.
3. Patterson, RM, Singhal, K, Young, C, and Bugnariu, N, Comparison of Upper Extremity Motion in a Virtual and Real World Task, 2014 World Congress of Biomechanics, July 6-11, 2014 Boston, MA.
4. Young, C, Stanford, J., Popa, D., Bugnariu, N, and Patterson, RM, Maximum Velocity of Opening a Door for Simulation, 2014 South Central American Society of Biomechanics Regional Meeting, Dallas, TX.
5. Singhal, K., Bugnariu, N., and Patterson, R., Methodological consideration for application of Multi-Scale Entropy on Center of Pressure data from children with Autism Spectrum Disorder-A Pilot Study, 2014 South Central American Society of Biomechanics Regional Meeting, Dallas, TX.
6. Snider, K.T., Dowling, D.J. Seffinger, M.A., Channell, M.K., Yao, S.C., Gustowski, S.M., Johnson, J.C., Pryor, M.J., The Effect of Table Trainer Ratios on Student Learning of Cervical Muscle Energy Techniques, MAOPS, 116th Missouri Osteopathic Annual Convention, Branson, Missouri, April 30- May 4, 2014. **Received resident High Honors.**
7. Patterson, R., Stanford, J.,Young, C., Popa, D., and Bugnariu, N., Functional Task Analysis for Human-Machine Performance Limits, Poster accepted at BioMedical Engineering Society Conference, San Antonio, TX.
8. Singhal, K., Kim, J., Casebolt, J. B., Lee, S., Han, K. H., Kwon, Y. -H. (Accepted). *Gender Differences In How Older Adults Regulate Angular Momentum During Stair Descent*. Poster accepted at BioMedical Engineering Society Conference, San Antonio, TX.

Noteworthy accomplishments

V. Invited Abstracts/Presentations

A. NSF funded Symposium at the World Congress of Biomechanics, Boston 6-11, 2014 Title: Neural Functionality Failure Analysis and Augmented Repair. Patterson organizer. Bugnariu, N., invited speaker. "Use of virtual environments for evaluation of human motor performance for clinical rehabilitation"

B. Patterson, RM, September 23, 2013, Texas A&M University Bioengineering department seminar speaker. Evaluation of Upper Extremity Function and Motor Performance.

C. Patterson, RM, February 16th, 2014, North Carolina State University Biomedical Engineering seminar speaker. Evaluation of Upper Extremity Function and Motor Performance.

D. Yavuz, M., Clinical value of temperature in assessing foot loading in diabetic patients. "Art-in-science Award" Nomination Talk, Expert Scientific Meeting, Cambridge, MA, July 2014.

VI. Honors

A. Yavuz, M. 2014 Art-In-Science Award Finalist, Expert Scientific Meeting 2014.

B. Yavuz, M., Plantar shear stress distributions in diabetic patients with and without neuropathy, Clinical Biomechanics, Feb 29(2):223-9, 2014. American Society of Biomechanics Clinical Biomechanics Award 2012.

C. Hensel, K. L., new Associate Editor for the Journal of the American Osteopathic Association (JAOA).

VII. Community Outreach/Other

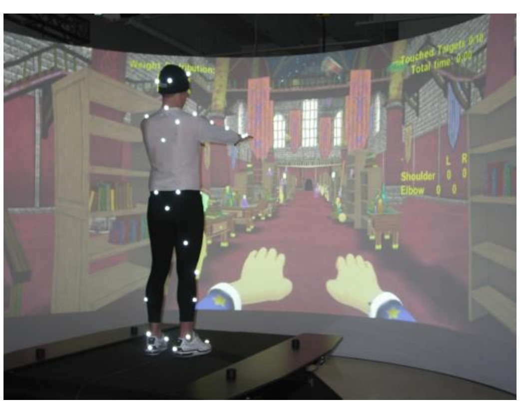
A. Creation of a lab Promotional Video that is posted on you tube.

http://www.youtube.com/watch?v=xe54fGHhtrw

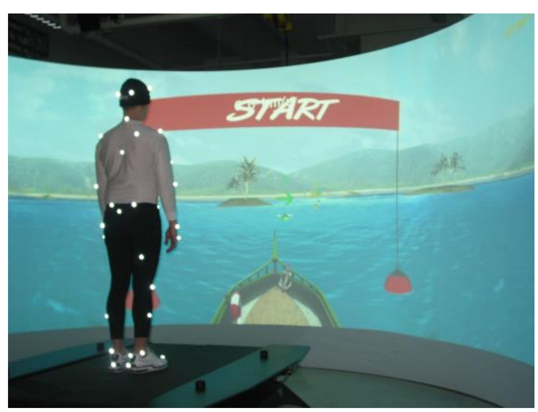
B. Lab tour for UNTHSC Board of Regents.
C. Lab tour for UNTHSC office of Advancement.
D. Lab tour for Community Advisory Committee to the PT department, Dec. 12, 2013
E. Lab tour for UT Southwestern Diabetic researchers, Lawrence Lavery, December 16, 2013.
F. Lab tour for Lieutenant General Lynch and UTARI leaders
G. Lab tour on February 28, 2014, Weatherford ISD student tours, 5 groups of 30 students came to the lab for 30 minute interactive tours.
H. Lab tour for Jordanian Delegation, March 6, 2014
I. Annual lab tour (3rd one) to Engineering students from Toluca, Mexico.
J. Lab tour for UNTHSC office of Community Engagement.

Status of ongoing and prospective research projects within the lab (IRB/IACUC approvals)

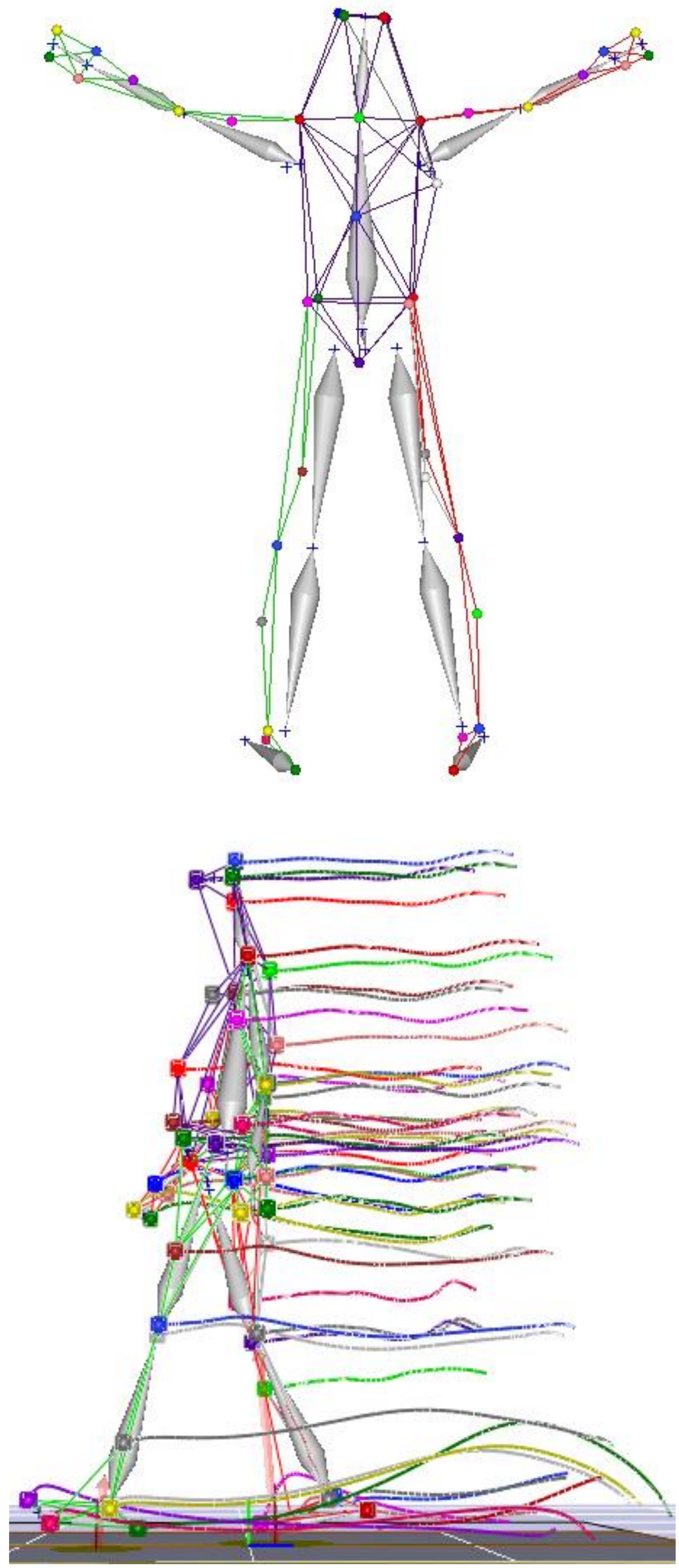
A. Dr. Bugnariu, P.I. and Dr. Patterson, Co-P.I.: Maintaining Balance in Condition of Sensory Conflicts: The Impact of Individual Perceptual Style on Mechanisms of Control with Multi-Modal Skin and Garments for Healthcare and Home Robots. IRB amended to include testing with UTA robots (summer 2012), IRB Project # 2010-156
B. Dr. Patterson, P.I. and Dr. Connors and Bugnariu, Co-P.I's.: Stiffness Evaluation of Shoulder Disability, IRB Approved October 7, 2011, IRB Project #2011-101
C. Dr. Bugnariu, PI and Drs. Patterson, Popa (UTA), Garver (Autism Treatment Center, Dallas) Co-P.I's.: Human-Robot Interaction System for Early Diagnosis and Treatment of Childhood Autism Spectrum Disorder, IRB Approved November 8, 2011 IRB Project #2011-137; Data collection to begin March 9, 2012
D. Dr. Patterson, P.I. and Dr. Bugnariu, Co-P.I.: Effect of Compensatory Motion in Acute and Chronic Arm Injury on Posture and Balance, IRB Approved January 12, 2012, IRB Project #2011-161; Amended application submitted March 2012 to include lower limb subjects and reflect title change
E. Dr. Bugnariu, PI and Drs. Patterson, Jafari (UTD) and Hart (UTD) Co-P.I's.: Fall Prevention Through Retraining Sensory Weighting Using a Virtual Environment and Vibrotactile Biofeedback, IRB Approved February 17, 2012, IRB Project # 2012-007
F. Dr. Patterson, P.I. and Drs. Bugnariu and Mason, Co-P.I.s: Effects of orthotic devices on gait, posture, and balance, IRB Initial Application Approved April 2012, IRB Project #2012-084
G. Dr. Michael Smith, PI, Dr. Sharon Gustowski, Nancy Tierney, RN, PhD, Geoffrey Kline, DO, PhD, Aaron Adamson, BS, Alyson Buick, BS, and Luke Husby, BS, CO-Is: Mechanisms of Osteopathic Manipulative Medicine (OMM): Effects of OMM on Pain-Induced Sympathoexcitation in Congestive Heart Failure.



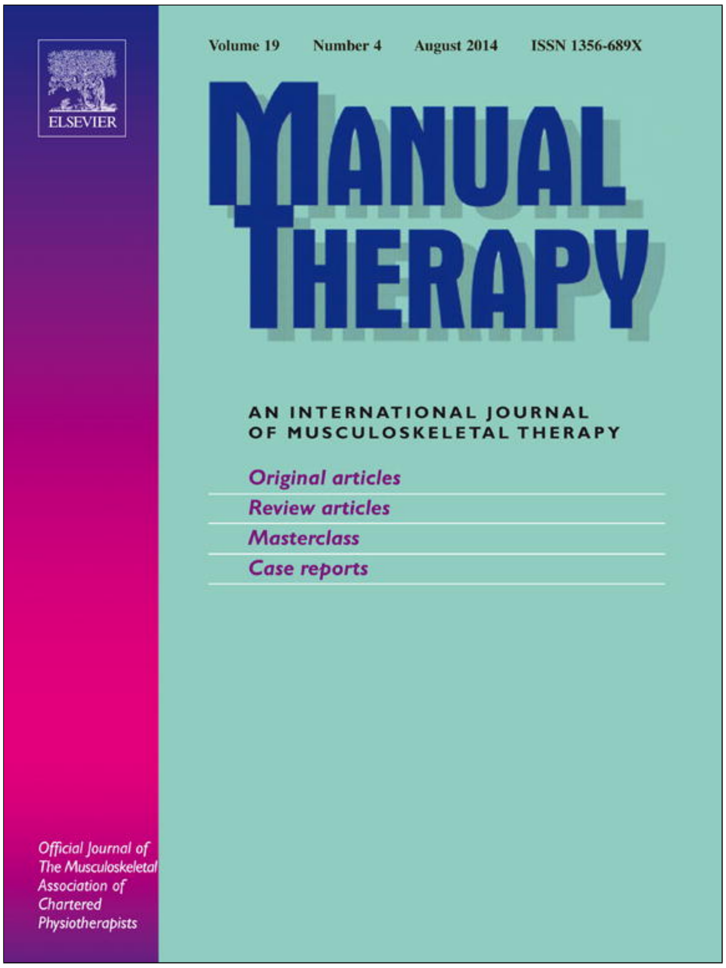
Example of upper extremity application.



Example of boat application that can use marker or force plate information to control the boat.



Human Body Model


Volume 19 Number 4 August 2014 ISSN 1356-689X
MANUAL THERAPY
AN INTERNATIONAL JOURNAL OF MUSCULOSKELETAL THERAPY
Original articles
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Official Journal of The Musculoskeletal Association of Chartered Physiotherapists

Manual Therapy 19 (2014) 324–330

Contents lists available at ScienceDirect

Manual Therapy

journal homepage: www.elsevier.com/math

Original article

Changes in biomechanical dysfunction and low back pain reduction with osteopathic manual treatment: Results from the OSTEOPATHIC Trial

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ARTICLE INFO

Article history:
Received 10 September 2013
Received in revised form
20 January 2014
Accepted 6 March 2014

Keywords:
Osteopathic manual treatment
Low back pain
Biomechanical dysfunction
Psoas syndrome

ABSTRACT

The purpose of this study was to measure changes in biomechanical dysfunction following osteopathic manual treatment (OMT) and to assess how such changes predict subsequent low back pain (LBP) outcomes. Secondary analyses were performed with data collected during the OSTEOPATHIC Trial wherein a randomized, double-blind, sham-controlled, 2 × 2 factorial design was used to study OMT for chronic LBP. At baseline, prevalence rates of non-neutral lumbar dysfunction, pubic shear, innominate shear, restricted sacral nutation, and psoas syndrome were determined in 230 patients who received OMT. Five OMT sessions were provided at weeks 0, 1, 2, 4, and 6, and the prevalence of each biomechanical dysfunction was again measured at week 8 immediately before the final OMT session. Moderate pain improvement (≥30% reduction on a 100-mm visual analogue scale) at week 12 defined a successful LBP response to treatment. Prevalence rates at baseline were: non-neutral lumbar dysfunction, 124 (54%); pubic shear, 191 (83%); innominate shear, 69 (30%); restricted sacral nutation, 87 (38%), and psoas syndrome, 117 (51%). Significant improvements in each biomechanical dysfunction were observed with OMT; however, only psoas syndrome remission occurred more frequently in LBP responders than non-responders (P for interaction = 0.002). Remission of psoas syndrome was the only change in biomechanical dysfunction that predicted subsequent LBP response after controlling for the other biomechanical dysfunctions and potential confounders (odds ratio, 5.11; 95% confidence interval, 1.54–16.96). These findings suggest that remission of psoas syndrome may be an important and previously unrecognized mechanism explaining clinical improvement in patients with chronic LBP following OMT.

1. Introduction

An estimated 632 million persons worldwide are reported to suffer from low back pain (LBP), making it the leading cause of years lived with disability (Vos et al., 2013). Patients with LBP frequently consult manual therapy practitioners in the United States, including osteopathic physicians and chiropractors (Barnes et al., 2008). Although established practice guidelines recommend manual therapies for chronic or persistent LBP (Chou et al., 2007; National Institute for Health and Clinical Excellence, 2009), questions remain about the mechanisms by which they exert their effects. Previous mechanistic research has focused on biomechanical effects of high-velocity, low-amplitude techniques, or "thrusts" (Triano, 2001; Evans, 2002; Maigne and Vautravers, 2003; Evans and Breen, 2006). Nevertheless, the *Biology of Manual Therapies* conference hosted by the National Institutes of Health raised key questions about the underlying foundational biomechanics of manual therapies and how such therapies impact body biomechanics (Khalsa et al., 2006). Research suggests that the underlying mechanisms of manual therapy may be multifactorial, including such elements as decreased spinal stiffness and improved lumbar multifidus muscle recruitment (Fritz et al., 2011).

Osteopathic medicine has integrated manual therapy techniques, collectively known as osteopathic manual treatment (OMT), into its system of health care (Mein et al., 2001). Osteopathic physicians are an important source of medical care for chronic LBP in the United States, providing one-third of medical visits for this condition (Licciardone, 2008). The results of the OSTEOPATHIC Trial

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http://dx.doi.org/10.1016/j.math.2014.03.004
1356-689X/

recently demonstrated statistically significant and clinically relevant improvements in patients with chronic LBP following a short-term, multimodal OMT regimen (Licciardone et al., 2013b, 2013c). The purpose of the present study was to perform secondary analyses of the OSTEOPATHIC Trial data to measure changes in biomechanical dysfunction following OMT and to assess how such changes predict subsequent chronic LBP outcomes.

2. Methods

2.1. Study overview

The methodology and outcomes of the OSTEOPATHIC Trial have been reported elsewhere (Licciardone et al., 2008; Licciardone and Kearns, 2012; Licciardone et al., 2012a, 2012b, 2013a, 2013b, 2013c). The trial featured a randomized, double-blind, sham-controlled, 2×2 factorial design to study OMT and ultrasound therapy over 12 weeks in patients with nonspecific chronic LBP. Patients were recruited within Dallas-Fort Worth from August 2006 to September 2010 through newspaper advertisements, community agencies, and medical clinics.

Patients 21–69 years of age were eligible to participate if they reported having LBP most days in the past three months. Patients were excluded if they reported “red flags” suggesting serious underlying conditions as the cause of LBP (Bigos et al., 1994). These included history of any of the following: cancer; unexplained weight loss; immunosuppression; urinary infection; intravenous drug use; prolonged use of corticosteroids; spinal fracture or significant trauma; urinary retention or overflow incontinence; loss of anal sphincter tone or fecal incontinence; saddle anesthesia; or global or progressive motor weakness in the lower extremities. Patients were also excluded if they reported history of any of the following: recent low back surgery; receipt of worker’s compensation benefits or ongoing litigation involving back problems; medical conditions that might impede OMT (or ultrasound therapy) protocol implementation; corticosteroid use in the past month; or use of manual therapy in the past three months or more than three times in the past year. Patients were excluded if any of the following signs of lumbar radiculopathy was observed during clinical screening: ankle dorsiflexion weakness; great toe extensor weakness; impaired ankle reflexes; loss of light touch sensation in the medial, dorsal, and lateral aspects of the foot; or shooting posterior leg pain or foot pain upon ipsilateral or contralateral straight leg raising (Bigos et al., 1994).

Patients were randomly allocated to treatment and these assignments were conveyed to treatment providers via opaque sealed envelopes. Neither patients nor outcome assessors were informed of treatment group assignments. Study procedures were approved by the Institutional Review Board at the University of North Texas Health Science Center and the trial was registered with ClinicalTrials.gov (NCT00315120) prior to implementation.

The 230 patients in the OSTEOPATHIC Trial who were assigned to receive active OMT were the focus of this study because data on biomechanical dysfunction were systematically recorded throughout the trial only in these patients. This cohort consisted of 115 patients who received active OMT and active ultrasound therapy, and another 115 patients who received active OMT and sham ultrasound therapy. Active ultrasound therapy was not efficacious when compared with sham ultrasound therapy in providing improvements in LBP or secondary outcomes (Licciardone et al., 2013c).

2.2. Structural examination for biomechanical dysfunction

During each treatment session patients were examined for five biomechanical dysfunctions that are often present with persistent LBP (Greenman, 1996; Kuchera, 2007). Non-neutral lumbar dysfunction was diagnosed by finding either restricted extension or flexion upon assessing the lumbar transverse processes with the patient in the seated or prone positions. Pubic shear dysfunction was diagnosed by finding the superior aspect of the pubic tubercle higher on one side than the other in the horizontal plane with the patient in the supine position. Innominate shear dysfunction was diagnosed by finding the inferior aspect of the ischial tuberosity lower on one side than the other or a dramatically inferior and slightly posterior inferolateral sacral angle on the side of the deep sacral sulcus with the patient in the prone position. Restricted sacral nutation was diagnosed by finding inability of either sacral base to nod forward across a transverse axis between the innominates with the patient in the prone position. Psoas syndrome was diagnosed by finding a psoas muscle tender point upon palpation in conjunction with suspected imbalance of the psoas muscles as determined by restriction during a sweeping motion of the hip capsule. These examinations were performed by each patient’s designated provider to give equal attention to all patients and to help maintain blinding throughout the study; however, the findings were used primarily to guide OMT delivery. Consequently, the presence or absence of these biomechanical dysfunctions was systematically recorded only for those 230 patients assigned to receive OMT.

2.3. Osteopathic manual treatment

Osteopathic manual treatment targeted the lumbosacral, iliac, and pubic regions and consisted primarily of high-velocity, low-amplitude thrusts; moderate-velocity, moderate amplitude thrusts; soft tissue stretching, kneading, and pressure; myofascial stretching and release; positional treatment of myofascial tender points (counterstrain); and muscle energy techniques. These techniques were delivered by 15 osteopathic physicians, fellows, or residents during 15-min treatment sessions at weeks 0, 1, 2, 4, 6, and 8. Treatment fidelity methods (Bellg et al., 2004) were used to train providers to perform the structural examination for biomechanical dysfunction and to deliver OMT. These methods included standardized provider training using structured practice and role playing with pilot participants and regular booster sessions to minimize drift in provider skills over time. Patients were allowed to receive their usual LBP care and other co-treatments during the study except for non-assigned manual therapies.

2.4. Low back pain response

Low back pain was measured at baseline, prior to each subsequent treatment session, and at week 12 using a 100-mm visual analogue scale (VAS), which was anchored by “no pain” at 0 mm and “worst possible pain” at 100 mm. Moderate pain improvement, defined by $\geq 30\%$ reduction from baseline through week 12, was the minimal threshold for detecting a successful LBP response. This relative criterion, based on the Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials (IMMPACT) consensus statement recommendations (Dworkin et al., 2008), was used rather than an absolute criterion to minimize floor effects in assessing OMT efficacy. This criterion is highly sensitive and specific in predicting global impression of change in chronic pain patients (Emshoff et al., 2011) and provides readily interpretable evidence for clinical applications and recommendations (Farrar et al., 2000).

2.5. Statistical analysis

Descriptive statistics were used to summarize the baseline characteristics of patients and to compare the characteristics of LBP responders and non-responders. Complete data were available for LBP scores at baseline; however, missing pain data at subsequent visits were imputed using the last observation carried forward. Measures of biomechanical dysfunction at baseline were not recorded for 11 (5%) patients. Multiple imputation modeling was used to estimate these missing data based on the presence or absence of key somatic dysfunction within each of three anatomical regions (lumbar, sacrum/pelvis, and pelvis/innominate). The presence or absence of such findings, assessed only at baseline, was determined using the osteopathic concept of "somatic dysfunction." The latter is defined as "impaired or altered function of related components of the somatic (body framework) system: skeletal, arthrodial, and myofascial structures, and related vascular, lymphatic, and neural elements" (American Association of Colleges of Osteopathic Medicine, 2009). Key somatic dysfunction is intuitively appealing as a surrogate measure of biomechanical dysfunction because it is present only with severe (grade 3) findings that help maintain other secondary dysfunctions (American Association of Colleges of Osteopathic Medicine, 2009). Key somatic dysfunction was associated with baseline deficits in back-specific functioning and general health in OSTEOPATHIC Trial patients (Licciardone and Kearns, 2012). Similarly, we used multiple imputation modeling with key somatic dysfunction and achievement of moderate LBP improvement to impute missing biomechanical dysfunction data for 52 (23%) patients at week 8. The Spearman rank correlation coefficient was used to measure associations among the five biomechanical dysfunctions at baseline.

We initially assessed how changes in each biomechanical dysfunction between weeks 0 and 8 predicted subsequent LBP response. This was summarized using odds ratios (ORs) and 95% confidence interval (CIs) for LBP response in patients with remission (i.e., biomechanical dysfunction present at baseline and absent at week 8) relative to those with progression (biomechanical dysfunction absent at baseline and present at week 8). Patients with stable biomechanical dysfunction were not included in this analysis. A *P*-value for interaction (Altman and Bland, 2003) was computed to determine the statistical significance of differences between LBP responder and non-responder subgroups. We subsequently used logistic regression to more extensively study the relationships among changes in biomechanical dysfunction and LBP response while simultaneously controlling for changes in each of the other biomechanical dysfunctions (partially adjusted model) and for other potential confounders (fully adjusted model). The latter included age, sex, and educational level; baseline measures of employment status, co-morbid osteoarthritis, LBP duration, and use of prescription and non-prescription medication for LBP; and co-treatment with either active or sham ultrasound therapy. In these models, the ORs and 95% CIs for LBP response were computed for patients with remission or stability of biomechanical dysfunction relative to those with progression.

Hypothesis testing was by intention-to-treat with a two-sided $\alpha = 0.05$. Rothman's T statistic (Hogan et al., 1978) was initially used to test for statistical interaction between OMT and ultrasound therapy before assessing subsequent LBP improvement outcomes. Three sensitivity analyses were performed to assess the internal validity of our results: using only patients who completed the study per protocol (i.e., attended all treatment sessions and provided complete data); using substantial LBP improvement ($\geq$50% pain reduction) as the criterion for LBP response; and comparing the subgroups who received co-treatment with active or sham

Table 1
Baseline patient characteristics.[a]

Characteristic	Low back pain response status			
	Overall ($n = 230$)	Responders ($n = 145$)	Non-responders ($n = 85$)	*P*
Median age (yrs) (IQR)	41 (22)	41 (22)	41 (23)	0.65
No. (%) of women	144 (63)	90 (62)	54 (64)	0.83
No. (%) completed college education	107 (47)	81 (56)	26 (31)	<0.001
No. (%) employed full-time	110 (48)	72 (50)	38 (45)	0.47
No. (%) medically uninsured	86 (37)	49 (34)	37 (44)	0.14
No. (%) current smoker	61 (27)	34 (23)	27 (32)	0.17
No. (%) with co-morbid conditions				
Hypertension	42 (18)	27 (19)	15 (18)	0.85
Diabetes mellitus	19 (8)	11 (8)	8 (9)	0.63
Osteoarthritis	17 (7)	12 (8)	5 (6)	0.50
Depression	44 (19)	23 (16)	21 (25)	0.10
No. (%) with duration of chronic LBP greater than 1 year	118 (51)	72 (50)	46 (54)	0.51
No. (%) previously hospitalized for LBP	13 (6)	5 (3)	8 (9)	0.08[e]
No. (%) previously had surgery for LBP	5 (2)	2 (1)	3 (4)	0.36[e]
Median VAS score for LBP (mm) (IQR)[b]	44 (36)	47 (34)	38 (37)	0.08
Median Roland-Morris disability score (IQR)[c]	5 (6)	5 (6)	5 (5)	0.87
Median SF-36 general health score (IQR)[d]	67 (25)	72 (25)	67 (22)	0.10
No. (%) received ultrasound therapy co-treatment	115 (50)	72 (50)	43 (51)	0.89
No (%) with biomechanical dysfunction				
Non-neutral lumbar dysfunction	124 (54)	73 (50)	51 (60)	0.16
Pubic shear	191 (83)	122 (84)	69 (81)	0.57
Innominate shear	69 (30)	41 (28)	28 (33)	0.45
Restricted sacral nutation	87 (38)	59 (41)	28 (33)	0.24
Psoas syndrome	117 (51)	79 (54)	38 (45)	0.15
No. (%) used medication for LBP during past four weeks				
Non-prescription	115 (50)	74 (51)	41 (48)	0.68
Prescription	27 (12)	16 (11)	11 (13)	0.66

IQR = interquartile range; LBP = low back pain; SF-36 = Medical Outcomes Study Short Form-36 Health Survey; VAS = visual analogue scale.
[a] Low back pain response was defined as $\geq$30% pain reduction from baseline to week 12.
[b] A VAS (0–100 mm) was used to measure LBP, with higher scores indicating more pain.
[c] The Roland-Morris Disability Questionnaire (0–24 points) was used to measure back-specific functioning, with higher scores indicating greater disability.
[d] The SF-36 general health scale (0–100 points) was used to measure generic health, with higher scores indicating better health.
[e] Based on Fisher's exact test.

Table 2
Correlations among each of the baseline biomechanical dysfunctions.[a]

	Non-neutral lumbar dysfunction	Pubic shear	Innominate shear	Restricted sacral nutation	Psoas syndrome
Non-neutral lumbar dysfunction	…	0.02 (0.74)	0.07 (0.31)	0.37 (<0.001)	0.20 (0.002)
Pubic shear		…	0.06 (0.41)	−0.03 (0.67)	−0.08 (0.24)
Innominate shear			…	0.25 (<0.001)	0.07 (0.30)
Restricted sacral nutation				…	0.37 (<0.001)
Psoas syndrome					…

[a] Table entries are Spearman rank correlation coefficient (*P*-value). $n = 230$.

ultrasound therapy. Data management and statistical analyses were performed with the SPSS Statistics version 20 software (IBM Corporation, Armonk, NY).

3. Results

3.1. Patient characteristics and flow

The median age of patients at baseline was 41 years, and 144 (63%) were women (Table 1). The median VAS score was 44 mm. There was no statistical interaction between OMT and ultrasound therapy in assessing moderate pain improvement (*T*, −0.04; 95% CI, −0.22 to 0.14). There were 145 (63%) LBP responders and 85 (37%) non-responders at week 12. The only significant subgroup difference at baseline was that LBP responders were more likely than non-responders to have completed college education ($P < 0.001$). A total of 191 (83%), 197 (86%), and 180 (78%), respectively, attended all six treatment sessions, the week 12 exit visit, and completed the trial per protocol. The subgroups of patients who received co-treatment with active or sham ultrasound

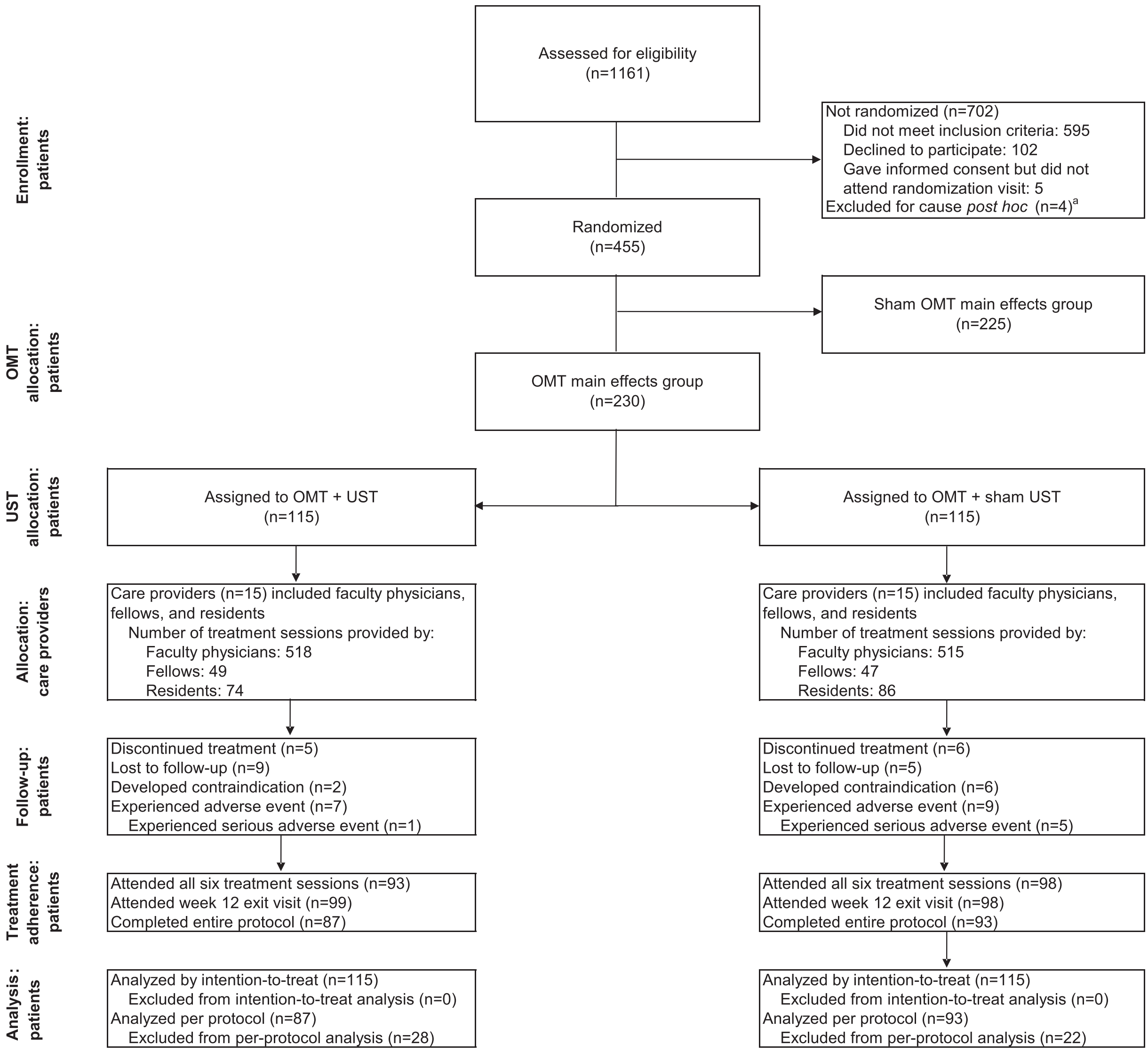

Fig. 1. Flow of patients through the OSTEOPATHIC Trial. OMT = osteopathic manual treatment; UST = ultrasound therapy. [a]Four patients were excluded for cause *post hoc* because it was subsequently discovered that they did not meet the inclusion criteria. Two of these patients provided false information to initially qualify for the study.

therapy were comparable with respect to distribution of types of care providers, levels of follow-up and adherence, and safety profiles (Fig. 1).

3.2. Baseline biomechanical dysfunction

The baseline prevalence rates of each biomechanical dysfunction were: non-neutral lumbar dysfunction, 124 (54%); pubic shear, 191 (83%); innominate shear, 69 (30%); restricted sacral nutation, 87 (38%), and psoas syndrome, 117 (51%). There was no significant difference between LBP responders and non-responders in the prevalence of any biomechanical dysfunction at baseline. Eight of the 10 correlations among biomechanical dysfunctions at baseline were positive (Table 2). However, only four correlations were statistically significant, with Spearman rank correlation coefficients ranging from 0.20 to 0.37. Restricted sacral nutation was most strongly correlated with other biomechanical dysfunctions. Although pubic shear was the most prevalent biomechanical dysfunction, it was not significantly correlated with any other biomechanical dysfunction.

3.3. Changes in biomechanical dysfunction

There were significant improvements in each biomechanical dysfunction with OMT (Table 3). The odds of remission of biomechanical dysfunction were generally on the order of two- to three-fold greater than progression. However, the only significant subgroup difference was that psoas syndrome was more likely to remit in LBP responders (OR, 3.07; 95% CI, 1.68–5.61) than in non-responders (OR, 0.72; 95% CI, 0.35–1.47) (*P* for interaction = 0.002).

3.4. Multivariate factors associated with low back pain response

Remission of psoas syndrome persisted as a significant predictor of LBP response to OMT when assessing all patients and simultaneously controlling for each biomechanical dysfunction and other potential confounders (Table 4). Remission of psoas syndrome most strongly predicted LBP response in the fully adjusted model, (OR, 5.11; 95% CI, 1.54–16.96). Completion of college education was the only other factor significantly associated with LBP response in this fully adjusted model (OR, 3.26; 95% CI, 1.72–6.16).

3.5. Sensitivity analyses

The results of our three sensitivity analyses were congruent with those reported herein. We have reported only the intention-to-treat results for moderate pain improvement because these incorporated a larger number of patients and thereby represented more precise measures of treatment effect.

4. Discussion

Patients who received OMT in the OSTEOPATHIC Trial experienced significant improvements in non-neutral lumbar dysfunction, pubic shear, innominate shear, restricted sacral nutation, and psoas syndrome over eight weeks. However, remission of psoas syndrome with OMT was the only improvement that occurred significantly more often in LBP responders than non-responders. This finding was further corroborated in multivariate analyses that demonstrated the preeminence of psoas syndrome remission with OMT in predicting subsequent LBP response after simultaneously controlling for changes in other biomechanical dysfunctions and for potential confounders.

A previous study measured the prevalence rates of biomechanical dysfunction in 183 patients with disabling LBP (mean duration, 31 months), including 33 (18%) patients who had failed previous surgical intervention (Greenman, 1996). Therein, the prevalence rate of psoas syndrome and related muscle imbalances exceeded 90% (Greenman, 1996). The lower prevalence of psoas syndrome (51%) in our patients with chronic LBP, coupled with its common remission following OMT, suggests an opportunity to intervene with OMT at an earlier stage before psoas syndrome becomes chronic. Such intervention may decrease the need for surgery and prevent subsequent back-related disability.

Psoas syndrome is not included within the common classification schemes that primary care clinicians use for subgrouping

Table 3
Changes in biomechanical dysfunction from baseline to week 8.[a]

Biomechanical dysfunction	Stable (present)	Remission	Progression	Stable (absent)	OR	95% CI	*P* for interaction
	No. (%)	No. (%)	No. (%)	No. (%)			
Non-neutral lumbar dysfunction							
Overall (n = 230)	55 (24)	69 (30)	23 (10)	83 (36)	3.00	1.87–4.81	…
Responders (n = 145)	35 (24)	38 (26)	17 (12)	55 (38)	2.24	1.26–3.96	0.12
Non-responders (n = 85)	20 (24)	31 (36)	6 (7)	28 (33)	5.17	2.16–12.38	
Pubic shear							
Overall (n = 230)	144 (63)	47 (20)	18 (8)	21 (9)	2.61	1.52–4.50	…
Responders (n = 145)	87 (60)	35 (24)	11 (8)	12 (8)	3.18	1.62–6.26	0.29
Non-responders (n = 85)	57 (67)	12 (14)	7 (8)	9 (11)	1.71	0.67–4.35	
Innominate shear							
Overall (n = 230)	23 (10)	46 (20)	23 (10)	138 (60)	2.00	1.21–3.30	…
Responders (n = 145)	13 (9)	28 (19)	14 (10)	90 (62)	2.00	1.05–3.80	>0.99
Non-responders (n = 85)	10 (12)	18 (21)	9 (11)	48 (56)	2.00	0.90–4.45	
Restricted sacral nutation							
Overall (n = 230)	45 (20)	42 (18)	20 (9)	123 (53)	2.10	1.23–3.58	…
Responders (n = 145)	32 (22)	27 (19)	13 (9)	73 (50)	2.08	1.07–4.03	0.96
Non-responders (n = 85)	13 (15)	15 (18)	7 (8)	50 (59)	2.14	0.87–5.26	
Psoas syndrome							
Overall (n = 230)	61 (27)	56 (24)	32 (14)	81 (35)	1.75	1.13–2.70	…
Responders (n = 145)	36 (25)	43 (30)	14 (10)	52 (36)	3.07	1.68–5.61	0.002
Non-responders (n = 85)	25 (29)	13 (15)	18 (21)	29 (34)	0.72	0.35–1.47	

CI = confidence interval; OR = odds ratio.
[a] Low back pain response was defined as ≥30% pain reduction from baseline to week 12. The 230 overall patients included 145 responders and 85 non-responders. Percentages may not total 100 because of rounding. The ORs are for remission relative to progression of each biomechanical dysfunction.

Table 4
Factors associated with low back pain response at week 12.[a]

	Responders	Non responders	Unadjusted		Partially adjusted[b]		Fully adjusted[c]	
	No. (%)	No. (%)	OR	95% CI	OR	95% CI	OR	95% CI
Change in non-neutral lumbar dysfunction								
Progression	17 (12)	6 (7)	1.00	…	1.00	…	1.00	…
Stable	90 (62)	48 (56)	0.66	0.24–1.79	0.57	0.15–2.12	0.55	0.13–2.24
Remission	38 (26)	31 (36)	0.43	0.15–1.23	0.34	0.09–1.30	0.31	0.07–1.30
Change in pubic shear								
Progression	11 (8)	7 (8)	1.00	…	1.00	…	1.00	…
Stable	99 (68)	66 (78)	0.95	0.35–2.59	0.93	0.30–2.90	0.70	0.21–2.34
Remission	35 (24)	12 (14)	1.86	0.59–5.88	1.55	0.40–5.97	1.20	0.29–5.02
Change in innominate shear								
Progression	14 (10)	9 (11)	1.00	…	1.00	…	1.00	…
Stable	103 (71)	58 (68)	1.14	0.47–2.80	1.15	0.35–3.74	1.52	0.43–5.39
Remission	28 (19)	18 (21)	1.00	0.36–2.79	1.05	0.29–3.89	1.50	0.37–6.10
Change in restricted sacral nutation								
Progression	13 (9)	7 (8)	1.00	…	1.00	…	1.00	…
Stable	105 (72)	63 (74)	0.90	0.34–2.37	0.93	0.28–3.06	0.86	0.25–2,99
Remission	27 (19)	15 (18)	0.97	0.32–2.95	0.91	0.24–3.42	0.77	0.19–3.07
Change in psoas syndrome								
Progression	14 (10)	18 (21)	1.00	…	1.00	…	1.00	…
Stable[d]	88 (61)	54 (64)	2.10	0.96–4.55	2.38	0.94–6.04	2.45	0.88–6.83
Remission[e]	43 (30)	13 (15)	4.25	1.67–10.82	4.70	1.52–14.58	5.11	1.54–16.96

[a] Low back pain response was defined as ≥30% pain reduction from baseline to week 12. The 230 patients included 145 responders and 85 non-responders. Changes in biomechanical dysfunction were assessed at week 8 in comparison with baseline. Percentages may not total 100 because of rounding.
[b] The partially adjusted model simultaneously controlled for changes in each of the other biomechanical dysfunctions.
[c] The fully adjusted model simultaneously controlled for changes in each of the other biomechanical dysfunctions; age, sex, and educational level; baseline measures of work status, co-morbid osteoarthritis, low back pain duration, and use of prescription and non-prescription medication for low back pain; and co-treatment with either active or sham ultrasound therapy. The only unreported factor that achieved statistical significance in this model was completion of college education (OR, 3.26; 95% CI, 1.72–6.16).
[d] Statistical trend ($P < 0.10$) for each OR (95% CI).
[e] $P < 0.01$ for each OR (95% CI).

patients with nonspecific LBP (Kent and Keating, 2005). Thus, psoas syndrome may be a frequently missed diagnosis in patients initially presenting with a variety of clinical scenarios involving LBP (Tufo et al., 2012). Gradual forceful stretching of the psoas muscle, which can induce relaxation and produce marked muscle elongation, has been suggested as an alternative mechanism to explain the effects of manual therapy in the absence of convincing evidence on treatment of "manipulable" lesions (Maigne and Vautravers, 2003). Muscle functional magnetic resonance imaging has been used to measure transverse relaxation time (T2) asymmetry of lumbar muscles in patients with nonspecific acute LBP, and to measure changes in T2 asymmetry and in LBP severity following a single OMT session that included one or more manual therapy techniques comparable to those used in our study (Clark et al., 2009). There was a relatively large difference between patients with LBP and controls in T2 asymmetry of the psoas muscle, and a significant reduction in T2 asymmetry and corresponding LBP improvement was observed only in the psoas muscle immediately following OMT (Clark et al., 2009).

A recent imaging study has provided additional insight on the psoas muscle in patients with chronic LBP. These patients were found to have larger cross-sectional areas of the psoas muscle relative to the corresponding intervertebral disc at the levels of L3/L4 and L4/L5 than controls, presumably because of increased activity during the healing processes following mild degenerative changes of the lumbar spine (Arbanas et al., 2013). However, in the presence of marked degenerative disease or Modic changes, the relative cross-sectional area of the psoas muscle was diminished (Arbanas et al., 2013). Muscular imbalance, particularly involving the psoas muscle, can promote poor biomechanics and chronic LBP (Greenman, 1996; Kuchera, 2007). A novel treatment of botulinum toxin A injected under ultrasound guidance to treat psoas muscle imbalance demonstrated promising results in a series of three patients with chronic LBP (Finkelstein et al., 2008).

The overarching strengths and limitations of the OSTEOPATHIC Trial have been described (Licciardone et al., 2008, 2013c). To our knowledge, the OSTEOPATHIC Trial is the largest OMT trial to date. Other strengths included allocation concealment, blinding of outcome assessors, high levels of treatment adherence and outcomes reporting, and intention-to-treat analysis; however, it is possible that some degree of patient unblinding may have occurred during the trial. We pragmatically assessed OMT, using a multimodal regimen as practiced in clinical settings to complement usual care and self-care for chronic LBP. Several techniques included in our protocol were accepted for LBP treatment by professional associations representing chiropractors and physiotherapists (Harvey et al., 2003).

Limitations specific to the present study include: systematic lack of data on biomechanical dysfunction for, and consequent exclusion of, 225 patients who received sham OMT; need for imputed data on biomechanical dysfunction in 5% and 23% of patients at baseline and week 8, respectively; that the moderate pain improvement threshold of ≥30% reduction classified patients with less beneficial pain outcomes as LBP non-responders; and that one-half of patients each received co-treatment with active or sham ultrasound therapy. Nevertheless, the congruence between reported findings and those observed in our sensitivity analyses tends to mitigate concerns relating to missing biomechanical dysfunction data, differing LBP response thresholds, and ultrasound co-treatments. Finally, it is possible that subgroup comparisons of LBP responders and non-responders may have been biased by unknown confounders that were no longer distributed at random within these subgroups (Hennekens and Demets, 2009). Low back pain responders were more likely than non-responders to have completed college education; nevertheless, we were able to control for this factor in our multivariate analysis. It is unclear, however, if other unknown and uncontrolled factors may have distorted the relationships between changes in biomechanical dysfunction with OMT and subsequent LBP response.

5. Conclusions

A short course of OMT commonly led to remission of biomechanical dysfunction of the lumbar spine, sacrum, and pelvis. However, only remission of psoas syndrome with OMT emerged as a significant predictor of subsequent LBP response. Additional research is warranted to corroborate these findings using an appropriate control treatment arm and other types of manual therapy.

Acknowledgments

This study was funded by grants to JCL from the National Institutes of Health–National Center for Complementary and Alternative Medicine (K24-AT002422) and the Osteopathic Heritage Foundation. The authors thank the personnel at The Osteopathic Research Center for their contributions to this study.

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FOR IMMEDIATE RELEASE
July XX, 2014

American Osteopathic Association Names Kendi L. Hensel, DO, PhD, Associate Editor of *The Journal of the American Osteopathic Association*

(CHICAGO) — The American Osteopathic Association (AOA), the national professional membership organization for the nation's more than 104,000 osteopathic physicians (DOs) and osteopathic medical students, announces the appointment of Kendi L. Hensel, DO, PhD, as associate editor of *The Journal of the American Osteopathic Association (JAOA)*.

As associate editor, Dr. Hensel will work with the *JAOA's* editor in chief and other associate editors to advance the AOA's strategic agenda toward the advancement of osteopathic medical research by establishing editorial policies with high standards for the integrity of the *JAOA's* content and promoting the *JAOA* to shareholders by encouraging faculty and students to enhance the evidence base for osteopathic medicine.

"Dr. Hensel is one of the fresh faces of osteopathic medicine and the first woman to become associate editor of the *JAOA*," says AOA Editor in Chief Robert Orenstein, DO. "As a federally funded researcher and nationally recognized educator, she excels in patient care, research and education. The *JAOA* will surely benefit from her expertise and fresh perspectives in research."

As one of the fastest-growing segments of health care professionals in the nation, the number of DOs has grown more than 200% over the past 25 years. With more than 50% of DOs in active practice specializing in one of the primary care areas of medicine, the osteopathic medical profession also has a strong tradition of serving in rural and medically underserved areas.

Professional Background
Dr. Hensel is AOA board certified in family medicine and neuromusculoskeletal medicine/osteopathic manipulative medicine. In addition to her position with the *JAOA*, she will continue to serve as an associate professor of osteopathic manipulative medicine at the University of North Texas Health Science Center Texas College of Osteopathic Medicine (UNTHSC/TCOM) in Fort Worth.

Her research background includes serving on the AOA's Bureau of Osteopathic Clinical Education and Research since 2010 and being a peer reviewer for the *JAOA* since 2009. Dr. Hensel has served as principal investigator and co-investigator of several research projects focusing on the use of osteopathic manipulative treatment in pregnancy, elderly pneumonia patients and pain. Her work has been published in numerous peer reviewed scientific journals, including the *JAOA*, *The American Journal of Obstetrics & Gynecology* and *American Academy of Osteopathy Journal*. She has also served as a peer reviewer for *The Journal of Alternative and Complementary Medicine, the Osteopathic Family Physician,* and *The American Journal of Obstetrics & Gynecology*.

Dr. Hensel has been UNTHSC/TCOM's representative to the American Association of Colleges of Osteopathic Medicine's Educational Council on Osteopathic Principles (ECOP) since 2004, and currently serves as its vice chair. ECOP, comprised of representatives from all osteopathic medical schools, is charged with maintaining the profession's glossary and standardization of language in the schools' curricula.

"As associate editor, I hope to encourage authors to use standardized terms so that our osteopathic literature is better understood and codified both within our profession and outside it," Dr. Hensel says. "Another goal is to encourage more evidence-based research within the osteopathic medical profession."

Additionally, Dr. Hensel serves on the American Academy of Osteopathy's (AAO) Board of Trustees, and has served on committees within the AAO, the American College of Osteopathic Obstetricians & Gynecologists, and the National Board of Osteopathic Medical Examiners.

After receiving her undergraduate degree from Northwestern State University of Louisiana in Natchitoches, Dr. Hensel earned her osteopathic medical degree from the Oklahoma State University Center for Health Sciences College of Osteopathic Medicine in Tulsa. She completed her postdoctoral training at the University of New England College of Osteopathic Medicine in Biddeford, Maine, and was one of the first graduates from an integrated family practice/neuromusculoskeletal medicine residency. After completing her residency, Dr. Hensel returned to her native Texas where she completed her doctorate degree in OMM clinical research and education at UNTHSC/TCOM in 2009.

What is a DO?
DOs are licensed physicians who can prescribe medication and practice in all specialty areas, including surgery, in the United States. They complete four years of medical school followed by graduate medical education through internship and residency programs typically lasting three to eight years. In addition, DOs receive extra training in the musculoskeletal system, providing them with an in-depth knowledge of the ways that illness or injury in one part of the body can affect another. As one of the fastest-growing segments of health care professionals in the nation, the number of DOs has grown more than 200% during the past 25 years.

About the American Osteopathic Association
The American Osteopathic Association (AOA) represents more than 104,000 osteopathic physicians (DOs) and osteopathic medical students; promotes public health; encourages scientific research; serves as the primary certifying body for DOs; is the accrediting agency for osteopathic medical schools; and has federal authority to accredit hospitals and other health care facilities. More information on DOs/osteopathic medicine can be found at www.osteopathic.org.

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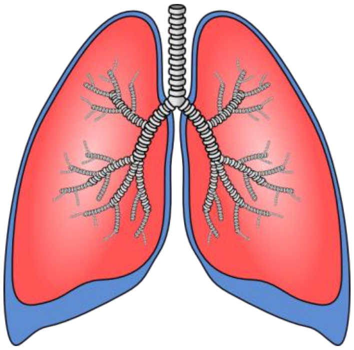
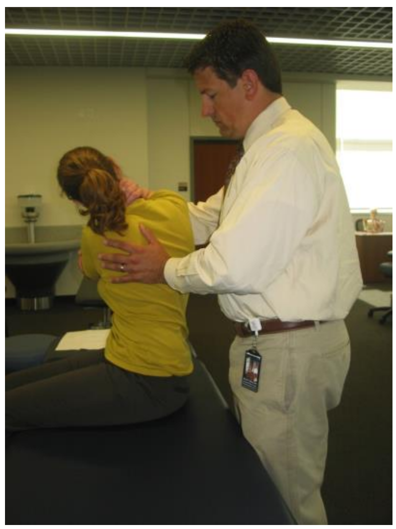


EFFECTS OF OSTEOPATHIC MANIPULATIVE TREATMENT ON THE INFLAMMATORY MEDIATORS RELATED TO ASTHMA

Investigators: **David Mason, DO, FACOFP**
Chair, Osteopathic Manipulative Medicine
Rita M. Patterson, PhD
Professor, Osteopathic Manipulative Medicine
Sid E. O'Bryant, PhD
Associate Professor, Internal Medicine
Clinical Partner: **Sharif T. Al-Farrah, MD**
Pulmonologist Fort Worth, TX

Asthma is a chronic respiratory disease characterized by episodes or attacks of impaired breathing. Symptoms are caused by inflammation and narrowing of small airways and may include shortness of breath, coughing, wheezing, and chest pain. Bronchial asthma is a common chronic disease affecting approximately 15 million children and young adults in the USA. Asthma causes around one million hospital admissions annually and over 5,000 deaths. It is a complex genetic disorder with a heterogeneous phenotype, largely attributed to the interactions among many genes and between the expression of these genes and the environment. Osteopathic physicians use manipulative treatment in asthma to attempt to affect respiratory function mechanically by affecting the excursion of the diaphragm and thoracic cage and immunologically by enhancing the clearing of airway secretions and the autoimmune system. We are investigating whether or not osteopathic manipulative treatment (OMT) can influence the inflammatory cascade in persons who have asthma. This will be accomplished by collecting biomarkers pre- and post OMT sessions.

Approach:
The project will address the immuno-physiological changes associated with Osteopathic Manipulative Treatment (OMT) of asthma. Changes in objective measurements of asthma severity will be compared with the effect of OMT on recognized immunological parameters known to mediate the physiological aspects of asthma and its symptoms. The significance of this work will make available a new therapeutic avenue to offer patients that will compliment their existing treatment without the burden of additional pharmaceutical intervention.



- Recruit subjects with asthma and healthy subjects
- Randomize subjects into two groups: OMT and sham. Subjects in the OMT group will receive a protocol of Osteopathic manipulative treatments. Subjects in the sham group will receive light touch.
- Pulmonary function will be measured before and after OMT to assess pulmonary mechanical function.
- Serum and blood will be obtained before and after OMT to assess immunological mediators of asthma**.**

Cost and Duration of Study:
The timeline for completion of the study proposed is one year. For this time frame, funds are requested to support technical staff, graduate students, laboratory costs and subject compensation. This support will provide the data needed to submit a competitive NIH grant application.

EFFECT OF LEG LENGTH DISCREPANCY ON POSTURE AND BALANCE

Investigators:

Rita M. Patterson, PhD
Professor, Osteopathic Manipulative Medicine
David Mason, DO, FACOFP
Chair, Osteopathic Manipulative Medicine
Nicoleta Bugnariu, PT, PhD
Associate Professor, Physical Therapy

Leg length discrepancy (LLD) affects approximately one in every 1000 persons and often results in abnormal and compensatory motions which have the potential to permanently alter gait and posture. These compensatory strategies put persons at risk for overuse injury, as well as long-term musculoskeletal changes. Many people develop LLD later in life, and may experience greater challenges compared to persons with LLD since birth. The goal of this study is to understand the impact of osteopathic manipulative treatment (OMT) on LLD. Osteopathic physicians treat the compensatory changes related to LLD as well as identify and correct LLD with heel lift therapy. X-rays are used for postural studies to look for sacral base unleveling and related scoliosis due to LLD. Management of the patient after placement of the heel lift includes OMT.

Approach:
The effect of non-prescriptive devices, such as heel lifts, shoe inserts, orthotics, and other over the counter aides on walking and gait patterns can be varied. Traditionally, the success or failure of an orthosis has been based on clinical observations of gait patterns and patient self-report of pain and effort. Specifically the human body integrates the motions of the various body segments and controls the activity of the muscles so that metabolic energy is minimized. Using a dynamic visual virtual environment we will investigate the affect of LLD on posture and balance before and after OMT as well as after wearing heel lifts.

Figure 1: V-Gait CAREN System

- Recruit subjects with LLD
- Use a V-Gait CAREN (Computer Assisted Rehabilitation Environment Network) System and a 12-Camera Motion Analysis System to measure kinematics and postural stability (Figure 1).
- Evaluate gait parameters to understand the temporal, spatial, kinematic and kinetic effects of non-prescription devices and their potential effect on posture and balance.
- Evaluate changes in muscle function and activation patterns using electromyography.

Cost and Duration of Study:
The timeline for completion of the study proposed is one year. For this time frame, funds are requested to support technical staff, graduate students, x-rays, heel lifts, and subject compensation. This support will provide the data needed to submit a competitive NIH grant application.

EFFECT OF COMPENSATORY MOTION IN ACUTE AND CHRONIC ARM INJURY ON POSTURE AND BALANCE

Investigators: **Rita M. Patterson, PhD**
Professor, Osteopathic Manipulative Medicine
Nicoleta Bugnariu, PT, PhD
Associate Professor, Physical Therapy
Clinical Partner: **Tiffany Ryan, MOT, OTR, CSCS, Advanced Arm Dynamics**
Rob Dodson, CPO, Advanced Arm Dynamics

Upper limb injuries are common and affect persons of all ages. However the impact of an upper extremity injury and resulting overuse in the non-injured side has not yet been discovered. Upper extremity injuries, particularly those resulting in a limb loss, often result in abnormal and compensatory motions which have the potential to permanently alter trunk and shoulder posture. These compensatory strategies put persons with an upper limb loss at risk for overuse injury, as well as long-term musculoskeletal changes. Due to an increase in traumatic injuries to the upper extremity occurring as a result of military conflicts, there is renewed interest to objectively measure performance and change in upper limb loss individuals in order to justify the costs of providing improved prosthetic devices.

Approach:
This study is a collaboration project with Advanced Arm Dynamics, a nation-wide leading provider of upper extremity prostheses and prosthetic rehabilitation services. The company assists hundreds of persons each year, and specializes in prosthetic fittings for arm, hand, and partial hand amputees, as well as persons with congenital upper limb deficits.

- Collaborate with Advanced Arm Dynamics, a leader in upper extremity prosthetics, to investigate the effects of compensatory motions
- Recruit subjects with and without upper limb loss
- Use a V-Gait CAREN (Computer Assisted Rehabilitation Environment Network) System and a 12-Camera Motion Analysis System to measure upper arm function, kinematics, and postural stability (Figure 1)
- Subjects will interact with virtual objects in various scenes to assess compensatory joint motions that occur while performing dynamic unilateral (single-handed reaching) tasks and bimanual (two-handed) tasks
- Virtual scenes may include opening doors in a castle, reaching for objects placed on shelves of varying heights in a library, or interacting with birds in a forest (Figure 2)

Figure 1: V-Gait CAREN System

Cost and Duration of Study:
The timeline for completion of the study proposed is one year. For this time frame, funds are requested to support technical staff, graduate students, and subject compensation. This support will provide the data needed to submit a competitive NIH grant application.

Figure 2: CAREN virtual scenes: *Magician's Apprentice* (left) and *The Road* (right)

MAINTAINING BALANCE IN CONDITIONS OF SENSORY CONFLICTS: THE IMPACT OF PERCEPTUAL STYLE ON MECHANISMS OF CONTROL

Investigators: **Nicoleta Bugnariu, PT, PhD**
Associate Professor, Physical Therapy
Rita M. Patterson, PhD
Professor, Osteopathic Manipulative Medicine

The central nervous processes information from visual, vestibular and somatosensory channels and activates appropriate muscles to maintain balance. The ability to reweight multiple sensory inputs adaptively is one of the most critical factors for postural control. It enables the system to produce appropriate responses even in the presence of sensory conflicts, i.e. when visual perception of the environment is discordant with somatosensory information gathered from the feet. Preliminary evidence suggests that older adults rely heavily on their vision in order to maintain balance, and their ability to maintain balance in conditions with non-optimal or non-reliable visual information is compromised. A great percentage of falls in the elderly happen in conditions of poor lighting and/or environments with moving visual fields. Dependence on one sensory input in particular may be an indication of an age-related process or an individual perceptual style. The goal of this study is to understand the impact of sensory conflicts on postural responses.

Approach:
Using a dynamic visual virtual environment we will investigate the influence of individual perceptual style on the mechanisms of sensory conflicts resolution. Postural responses will be quantified by muscle activity and body movements. The understanding of sensory conflicts created with visual virtual environments and their impact on postural responses will influence the design and implmentation of virtual reality technology for preventive and rehabilitation programs targeting postural control in patients at risk of falls.

- Recruit young healthy subjects between 18-35 years and older adults between 65-85 years
- Use a V-Gait CAREN (Computer Assisted Rehabilitation Environment Network) System and a 12-Camera Motion Analysis System to measure individual perceptual style and postural stability (Figure 1)
- Subjects will interact with virtual objects in various scenes to assess whether subjects rely more on visual or somatosensory inputs
- Virtual scenes may include opening doors in a castle, reaching for objects placed on shelves of varying heights in a library, aligning a rod vertically and horizontally within a skewed and non-skewed frame, or interacting with birds in a forest (Figure 2)

Figure 1: V-Gait CAREN System

Cost and Duration of Study:
The timeline for completion of the study proposed is one year. For this time frame, funds are requested to support technical staff, graduate students, and subject compensation. This support will provide the data needed to submit a competitive NIH grant application.

Figure 2: CAREN virtual scenes: *Magician's Apprentice* (left) and *The Road* (right)

FALL PREVENTION THRGOUH RETRAINING SENSORY WEIGHTING USING A VIRTUAL ENVIRONMENT AND VIBRATORY VIBROTACTILE BIOFEEDBACK

Investigators: **Nicoleta Bugnariu PT, PhD**
Associate Professor, Department of Physical Therapy
Rita M. Patterson, PhD
Professor, Department of Osteopathic Manipulative Medicine
Technical Partner: Roozbeh Jafari, PhD, University of Texas at Dallas
Clinical Partner: John Hart, Jr., MD, University of Texas at Dallas

Most persons who have experienced a fall, or have a high risk of falls, are visually dependent; that is, they rely primarily on their sense of vision to determine the location of their body in space. This is an acquired coping strategy for people with poor balance and decreases the weight of vestibular and somatosensory information. Therefore, being able to re-weight the somatosensory information with increased reliance is important, especially in situations when the visual information is not accurate. This study aims to help patients relearn to effectively coordinate and select appropriate sensory information for postural control.

Approach:
This project brings together researchers with expertise in physical therapy, engineering, and neuroscience to develop a balance rehabilitation protocol. The study is a collaboration project with Roozbeh Jafari, PhD and John Hart, Jr., MD, of the University of Texas at Dallas, and will use a virtual environment and vibrotactile biofeedback in order to retrain sensory weighting mechanism for improved balance and fall prevention.

- Recruit healthy young adults between 18-35 years of age
- Recruit adults 65 years of age and older with peripheral neuropathies and healthy age-matched older adults
- Use a V-Gait CAREN (Computer Assisted Rehabilitation Environment Network) System and a 12-Camera Motion Analysis System to measure motor performance and postural control (Figure 1)
- Subjects will interact with virtual objects in various scenes to assess sensory-motor performance and balance
- Use a wearable biofeedback system (worn around the thigh or ankle) to record gait measures and produce appropriate biofeedback (Figure 2)

Figure 1: V-Gait CAREN System

Figure 2: Wearable biofeedback system.

Cost and Duration of Study: The timeline for completion of the study proposed is one year. For this time frame, funds are requested to support technical staff, graduate students, and subject compensation. This support will provide the data needed to submit a competitive NIH grant application.

HUMAN-ROBOT INTERACTION SYSTEM FOR EARLY DIAGNOSIS AND TREATMENT OF CHILDHOOLD AUTISM SPECTRUM DISORDERS

Investigators: **Nicoleta Bugnariu, PT, PhD**
Associate Professor, Department of Physical Therapy
Rita M. Patterson, PhD
Professor, Department of Osteopathic Manipulative Medicine
Clinical Partner: Carolyn Garver, MD, PhD, Dallas Autism Treatment Center
Technical Partner: Dan Popa, PhD, University of Texas at Arlington

Autism spectrum disorders (ASD) are among the most common pediatric diagnoses and are often defined by impairments in social reciprocity, verbal and nonverbal language, and by restricted and repetitive behavior. Additionally, motor difficulties are one of the common sources of referral for physical and occupational therapy, and there is growing evidence that individuals with autism experience motor difficulties as well, including balance and gait difficulties, slower movements, and reduced postural stability. Two main features of ASD are the inability of these children to recognize and react accordingly to facial expression and to imitate movements. A long term goal of this research is to investigate how certain tools, such as robots that are capable of imitating children's movements, could help children with ASD learn to imitate others.

Approach:
This study is a collaboration project with Dr. Carolyn Garver of Dallas Autism Treatment Center and Dr. Dan Popa of the University of Texas at Arlington, and will evaluate the motor performance and postural control in children with ASD. Additionally, children's sensory-motor performance will be evaluated using an advanced looking and behaving robot that interacts with children by imitating gestures, and responding to movements and commands.

- Recruit subjects with and without an ASD diagnosis between 18 months and 12 years of age
- Use a V-Gait CAREN (Computer Assisted Rehabilitation Environment Network) System and a 12-Camera Motion Analysis System to measure motor performance and postural control in children with ASD
- Subjects will interact with virtual objects in various scenes to assess sensory-motor performance and balance
- Virtual scenes may include opening doors in a castle, or riding a boat through calm or turbulent waters (Figure 1)
- Subjects will interact with Zeno. Zeno is a 1foot tall robot that resembles a child between 4-7 years of age, and is capable of imitating emotions and movements (Figure 2).

Figure 1: CAREN virtual scenes: *Magician's Apprentice* (top) and *Let's Go Fishin'* (bottom)

Cost and Duration of Study:
The timeline for completion of the study proposed is one year. For this time frame, funds are requested to support technical staff, graduate students, and subject compensation. This support will provide the data needed to submit a competitive NIH grant application.

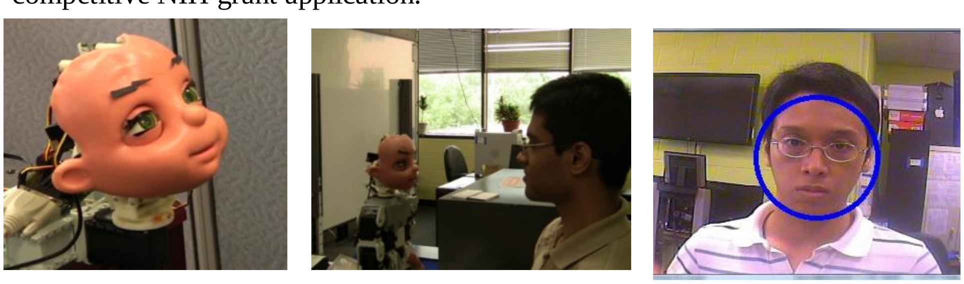


Figure 2: Side view of the Zeno head tracking (left); Person talking with Zeno at the UTA Multiscale Robotics Lab (center); An image captured through Zeno's eyes (right)

STIFFNESS EVALUATION OF SHOULDER DISABILITY

Investigators: Michael Connors, PT, DPT
Assistant Professor, Department of Physical Therapy
Rita M. Patterson, PhD
Professor, Department of Osteopathic Manipulative Medicine

Shoulder problems are among the most common of all peripheral joint complaints, and it is estimated that 1 in 4 persons will experience some form of shoulder related problems in their lifetime. The prevalence of shoulder pain is increased with today's lifestyle of poor posture and computer/desk work. These actions require the upper extremity to be in front of the body reducing overhead arm motions and resulting in decreased strength in the upper back muscles causing a vicious cycle of muscle imbalance, pain, and eventually disability due to abnormal movements of the joint. Currently, it is difficult to objectively quantify shoulder stiffness in a clinical setting and assess shoulder function in individuals with shoulder restriction.

Approach:
This study aims to test a passive torque range of motion device to measure shoulder joint viscoelastic stiffness parameters. This will allow for a better description of function so that innovative advancements in rehabilitation, ergonomics for mechanical advantage, adaptive methods, and assistive aids can be provided to patients with a variety of age-or trauma related disabilities.

- Recruit subjects with and without shoulder pain between 18 – 65 years of age
- Use a transducer based torque range of motion (TROM) device on the upper extremity via an elbow splint to measure passive TROM variables (Figure 1).
- Use three self report questionnaires to assess shoulder pathology: 1) triple visual Analog Pain Scale, 2) shoulder pain and disability index (SPADI), 3) quality of life measure (SF-36)

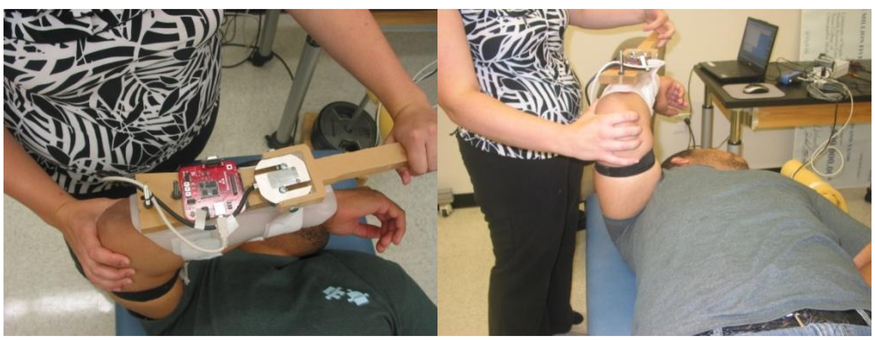


Figure 1: TROM device

Cost and Duration of Study:
The timeline for completion of the proposed pilot study is one year. For this time frame, funds are requested to support technical staff, graduate students, and subject compensation. This support will provide the data needed to submit a competitive NIH grant application.

Research Activities

Research - Research Conference or Seminar Attended:

Mason, David, DO, FACOFP

- Attendee, AOA Project Planning Meeting, Diabetes/LBP/OMT, CBH, December 5, 2013
- Attendee, AOA Project Planning Meeting, Diabetes/LBP/OMT, PCC, December 16, 2013
- Asthma Study Committee, Asthma OMT MS Research, CBH, May 12, 2014
- Asthma Study Thesis Meeting, Asthma OMT MS Research, CBH, May 19, 2014
- AOA Project Planning Committee, OMT DM2 Low Back Pain, LIB, May 19, 2014
- TEd Grant Lab/Testing, Teaching OMM Research, May 21, 2014
- IRB Meeting Ted, Teaching OMM Research, June 3, 2014

Crow, Thomas, DO, FAAO

- Attendee, AOA Project Planning Meeting, Diabetes/LBP/OMT, CBH, December 5, 2013
- Attendee, AOA Project Planning Meeting, Diabetes/LBP/OMT, PCC December 16, 2013
- Committee Member, Osteopathic Research Center, Data & Safety Board Meeting, UNTHSC, February 14, 2014

Gamber, Russell, DO, MPH

- Fibromyalgia Conference Call, TCOM, October 11, 2013
- Poster Judge, RAD Day, UNTHSC, March 21, 2014

Gustowski, Sharon, DO, MPH

- Research Conducted: Table Trainer Study, TCOM Researcher, November 2 & November 16, 2013
- Poster Judge, RAD Day, UNTHSC, March 21, 214

Hensel, Kendi, DO, PHD

- Presenter, AAO Convocation Faculty Development Session, Faculty Development: Publication Pearls, March 22, 2014

Seals, Ryan, DO

- Table Trainer, Table Trainer Research Study, MET OMM Lab, November 2, 2013

Walsh, Clay, DO

- Participant / Committee, AAO Convocation, Various lecture and committee meetings (OES-Chair), March 19-23, 2014
- Participant, Standing Postural Plumb line Research Meeting, MET 214, April 9, 2014
- Researcher, Standing Postural Research Study, Accomplished above study protocol using Faculty, Year 1 and 2 students, April 14, 2014

Papers/Abstracts/Articles Presented:

Mason, David, DO, FACOFP

- Xyphoidyna Osteopathic Surgical Approach, Submitted, JAOA, Yurvati, Mason
- JPS Poster Research Day, Poster Presented, Ragland / Mason

Clearfield, Daniel, DO, MS

- Enhancing Ankle Functionality Status-Post Acute Inversion Injury Utilizing Osteopathic Manipulative Treatment, RAD, Being submitted for publication, Clearfield, Hall, Strot, Patterson
- Assessment and Management for Concussions in Athletes, Being submitted for publication, Clearfield, Aronson
- Examining the Safety of Joint Injections in Patients on Warfarin, Published, Practical Pain Management, Published, Clearfield, Ruane, Diehl
- Patellar dislocation, Submitting to IRB, Kreines, Clearfield
- Poterior tibial tendinosis, Submitted to OFP, Utturkar, Clearfield
- Biceps tendonitis and Multidirectional Instability, Being submitted for publication, Moreland, Clearfield
- Importance of History & Physical Exam: Abscess vs. Muscle Tear, Poster, AOASM Annual Meeting, Wooldridge, Clearfield, Dirksen
- RAD, Being submitted for publication, Enhancing Ankle Functionality Status-Post Acute Inversion Injury Utilizing Osteopathic Manipulative Treatment, Clearfield, Hall, Strot, Patterson
- Assessment and Management for Concussions in Athletes, Being submitted for publication, Clearfield, Aronson
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- Biceps Tendonitis and Multidirectional Instability, Being submitted for publication, Moreland, Clearfield
- Importance of History and Physical Exam: Abscess vs. Muscle Tear, Poster, AOASM Annual Meeting, Wooldridge, Clearfield, Dirksen

- Non-Operative management for a Cuboid Fracture, Submitted, Clinical Journal of Sports Medicine, Clearfield, Bodenhamer, Kelley
- Sacroiliac Dysfunction in Female Volleyball Athletes, Poster Presentation, AOASM Annual Conference, Kjolhede, Clearfield
- Presenter, Non-Operative Management for a Cuboid Fracture, UNTHSC RAD, Clearfield, Bodenhamer, Kelley
- Poster Presentation, Sacroiliac Dysfunction in Female Volleyball Athletes, AOASM Annual Conference, Kjolhede, Clearfield
- MSK US in Anatomy Curriculum, Educational, UNTHSC
- Submitted, Non-Operative management for a Cuboid Fracture, Clinical Journal of Sports Medicine, Clearfield, Bodenhamer, Kelley
- Poster Presentation, Sacroiliac Dysfunction in Females Volleyball Athletes, AOASM Annual Conference, Kjolhede, Clearfield

Crow, Thomas, DO, FAAO

- Changes in biomechanical dysfunction and low back pain reduction with osteopathic manual treatment: Results from the Somatic Dysfunction and use of Osteopathic Manual, Published, Manual Therapy, April 2014, John Liccardone, DO, MS, Cathleen M. Kearns, W. Thomas, Crow
- Somatic Dysfunction and use of Osteopathic Manual Treatment Techniques, In press, JAOA, John Liccardone, DO, MS, MBA, Cathleen M. Kearns, BA, Hollis H. King
- Techniques during Ambulatory Medical Care Visits: A CONCORD-PBRN Study, John C. Licciardone, DO, MS, MBA, Cathleen M. Kearns, BA, Hollis H. King, DO, In press, JAOA

Gustowski, Sharon, DO, MPH

- Poster Presentation, AACOM

Hensel, Kendi, DO, PhD

- Acute Improvement in Hemodynamic Control After Osteopathic Manipulative Treatment in the Third Trimester of Pregnancy, Complementary Therapies in Medicine, Hensel, Pacchia, Smith
- Osteopathic Manipulative Treatment is Associated with Reduced Analgesic Prescribing and Fewer Missed Work Days, JAOA, Prinsen, Hensel, Snow
- Acute Improvement in Hemodynamic Control After Osteopathic Manipulative Treatment in the Third Trimester of Pregnancy, Complementary Therapies in Medicine, Published, Hensel, Pacchia, Smith
- Pregnancy Research on Osteopathic Manipulation Optimizing Treatment Effects: The PROMOTE Study A Randomized Controlled Trial, American Journal of Obstetrics and Gynecology, Submitted, Hensel, Buchanan, Brown, Rodriguez, Cruser
- Response to the Letter to the Editor: Observational Study demonstrates that OMT is associated with reduced analgesic prescribing and fewer missed work days, Prinsen, Hensel, Snow, Published, JAOA
- Pregnancy Research on Osteopathic Manipulation Optimizing Treatment Effects: The PROMOTE Study, Hensel, Buchanan, Brown, Rodriguez, Cruser, AJOG

Patterson, Rita, PhD

- Functional Assessment of Balance and Gait in transtibial Amputees using K2 vs. K3 Prosthetics Feet, RAD, Joe Hidrogo, III, J., Stevens, G., Patterson, RM and Bugnariu, N.
- Osteopathic manipulative Treatment in Hispanic Patients: A Retrospective Chart Study, RAD & AAO, Patel, A., Patterson, RM, Mason, D.
- Ischemia-induced reduction of somatosensory input decreases balance; added vibratory noise partially restores function, RAD, Rose, G., Nordon-Craft, A., Jaffari, R., Patterson, RM. and Bugnariu, N.
- Visuomotor integration and attention in Autism Spectrum Disorder, NIH/NI, K99/R00, 928,776
- Falls risk due to physical, visual & cognitive challenges in gait, NIH/NIA, K99/R00, 867,784
- Clinical tool to evaluate shoulder stiffness, Texas MRC, 100,000

Walsh, Clay, DO

- Osteopathic Approach to Jaw Pain due to Otitis Externa in a 38 year old Male, JAOA, Submitted December 20, 2013, Schutt, MS4 and Walsh, DO
- Application of Osteopathic Manipulative treatment in Irritable Bowel Syndrom, OFP (ACOFP), Submitted December 20, 2013, Yu, MS4 and Walsh, DO

Grants Submitted - Title:

Mason, David, DO, FACOFP

- Osteopathic Management of Leg Length Inequality with Heel, AOA, $99, 980
- Asthma and OMT Biomarkers, AOA, $50,000

Clearfield, Daniel, DO, MS

- MSK US in Anatomy Curriculum, Educational, UNTHSC

Gustowski, Sharon, DO, MPH

- Use of Poll Everywhere, Education, Intramural – UNTHSC, Not Awarded Yet

Hensel, Kendi, DO, PhD

- Effect of Osteopathic Manipulation on Gastric Motility, Clinical, AOA, $97,420

Patterson, Rita, PhD

- Osteopathic Management of Leg Length Inequality with Heel, AOA, $99, 980
- UNTHSC Seed Grant, Use of Torque Range of Motion Device to Teach Evaluation of Somatic, $9, 825
- Texas MRC, Clinical Tool to Evaluate Shoulder Stiffness, Letter of Intent, $99, 759

- The future of the personalized stent: "A Computational Approach to Study Hemodynamics in a Superficial Femoral Artery Model" Mentor for Aleksandra Fortier, UNT department of Mechanical Engineering, NIH, K25
- Evaluation and rehabilitation of neurosensory interactions in hearing loss, tinnitus and balance, Co-Investigator, NIH, Proposal ID 11667483

Grants Received - Title:

Gustowski, Sharon, DO, MPH

- Effect of Table Trainer Ratios, SUB-114-077, AT Still University, $3, 890

Patterson, Rita, PhD / Mason, David, DO, FACOFP

- Use of Torque Range of Motion Device to Teach evaluation of Somatic, UNTHSC Seed Grant, Education research
- Osteopathic Management of Leg Length Inequality with Heel Life, UNTHSC seed grant, Research, 23,863