

## ABSTRACTS

# LBORC-NUFA Poster Abstracts 2024: Students

Every year at the American Academy of Osteopathy Convocation, the Louisa Burns Osteopathic Research Committee (LBORC) and the National Undergraduate Fellows Association (NUFA) together host a research poster presentation session for residents and medical students. The 2024 poster abstracts for students are presented here and may have been edited to conform to AMA 11th Edition style guide.

## CASE STUDY

*Varasiddimounish Reddy Bandi, OMS III; Katherine Teixeira, OMS IV; Ellet Stone; Matthew Hyzy, DO*

### **Case Study: Novel use of Platelet Lysate injections via Ultrasound Guided Hydrodissection for treatment of Traumatic Peripheral Nerve Injuries**

**Introduction/Background:** Peripheral Nerve Injuries (PNIs) present a pervasive clinical challenge, lacking optimal regeneration solutions. Platelet-rich plasma (PRP), specifically platelet lysate, emerges as a non-invasive, cost-effective alternative rich in growth factors, holding promise for regenerative medicine. Advanced ultrasound technologies like shear-wave elastography (SWE) and contrast-enhanced ultrasonography (CEUS) augment PRP's potential in nerve hydro-dissection for PNIs treatment, warranting exploration and further investigation to enhance therapeutic strategies.

**Case:** The objective of this study is to investigate the potential efficacy of ultrasound-guided platelet-rich plasma (PRP) injections in hydro-dissection for treating traumatic peripheral nerve injuries, with a specific focus on cases involving gunshot wounds.

**Methods:** Despite successful physical therapy, a 73-year-old male with a gunshot wound (GSW) to the right biceps presented persistent dysesthesias and neuropathic pain. Proximal median mononeuropathy, managed with gabapentin, was revealed through electrodiagnostics. Physical examination indicated reflex changes, sensory abnormalities, and weakness, especially in thumb and forearm movements, with Abductor Pollicis Brevis (APB) atrophy. Diagnostic ultrasound depicted significant changes in the right median nerve, leading to

hydrodissection with positive outcomes.

**Results:** A 3-month follow-up reported strength improvements with residual dysesthesias. Electromyography (EMG) and nerve conduction studies (NCS) at four months showed sensorimotor neuropathy, improving by seven months.

**Discussion:** This case study suggests the potential of ultrasound-guided PRP injections in hydro-dissection for treating traumatic peripheral nerve injuries, offering a cost-effective, non-invasive option for surgery-averse patients. Further research is crucial to validate and extend these findings.

*Amanda M. Bernett, BS, OMS III; Kyle K. Henderson, PhD; Kurt P. Heinking, DO, FAAO; Kimberley McKinnon, DO*

### **Workin' 9 to 5, but Now Can Thrive: Chronic Headache Diagnosed and Treated with OMT**

**Introduction/Background:** Chronic headaches are enigmatic due to multi-faceted origins - leading to a lack of treatment effectiveness. This case presentation demonstrates the value of osteopathic diagnosis and osteopathic manipulative treatment (OMT) for chronic headache management, by addressing 1) Somatic dysfunction of thoracic and cervical spine, and ribs; 2) Cranial strain patterns and suture compression; and 3) Sinus congestion.

**Case:** A 47-year-old male patient with the chief complaint of chronic headaches (over a year in duration), reported plans for early retirement due to pain rated six out of ten in severity. His allopathic physician had investigated these headaches and diagnosed Myofascial Pain Syndrome and Temporomandibular Joint Dysfunction. Physical therapy offered limited relief. At our clinic, he described his headache pain as daily, often localized to his

right temple with intermittent pain on the right side of his jaw, associated with facial and neck tension, aggravated when bending over. Osteopathic evaluation revealed somatic dysfunction in the thoracic and cervical spine, an elevated right first rib, tissue texture change at the right occipitomastoid suture, suboccipital hypertonicity, and pain during sinus palpation. Based on these diagnoses, we hypothesized our patient's headaches could be treated by addressing each component.

**Results:** The patient tolerated treatment well, and at his 2-week follow-up, reported his headache severity was 2 out of 10. One month later, the patient reported no headaches.

**Discussion:** This case demonstrates the need to use our palpatory skills to diagnose and treat the probable causes of chronic headaches. The relevance of this study is the duration of pain suffered by our patient until they sought Osteopathic diagnosis and care. Future research is needed to stratify the causative mechanisms of headaches and efficacy of OMT.

*Justin Blankenbaker, OMS IV; Eren Ural, DO*

### **Piriformis or Not Piriformis? The Impact of OMT on Buttock and Hip Pain: A Case Report**

**Introduction/Background:** Piriformis syndrome frequently causes buttock and hip pain, comprising up to 6.0% of sciatic-like syndromes. It impairs quality of life by causing physical, mental, and emotional distress due to its chronicity. Despite its prevalence, treatment using manual therapies is not well-documented. After ruling out emergent pathology, a strong understanding of anatomy helps distinguish this from other musculoskeletal pathologies and guides manual treatment. Osteopathic Manipulative Treatment (OMT) modalities such as Fascial Distortion Model (FDM), Strain-Counterstrain (SCS), and Muscle Energy (ME) may play an important role in alleviating distress where other methods have failed.

**Case:** A 28-year-old female presented with a one-month course of left buttock and hip pain exacerbated by sitting, standing, and laying down, associated with left leg paresthesia and insomnia. She was found to have piriformis hypertonicity with a corresponding SCS tenderpoint, and fascial distortions including several herniated trigger points (HTPs) and a triggerband (TB). Anti-inflammatories, alternative medicine modalities, physical therapy (PT), ME, and SCS provided minimal transient relief.

**Results:** With subsequent FDM implementation to the

HTPs and TB, as well as lifestyle modifications, standing pain resolved completely and seated pain improved substantially. Additionally, she reported multiple objective sleep improvements from baseline. Objective improvement in both outcome measures demonstrated treatment success.

**Discussion:** This report presents a case of piriformis syndrome superimposed by fascial distortion viewed through the Osteopathic perspective. After ME and SCS had proven ineffective, identification of the HTPs and TB allowed for a natural stepwise treatment progression to FDM while prone and seated. Overall, use of OMT resulted in meaningful improvements in outcome measures of pain and sleep. This case highlights the necessity of applying Osteopathic principles in assessment, diagnosis, and treatment of piriformis syndrome.

*Alyssa Bowen, OMS III; Kyle K. Henderson, PhD; Kurt P. Heinking, DO, FAAO; Kimberly McKinnon, DO*

### **Osteopathic Management of Bertolotti Syndrome**

**Introduction/Background:** Bertolotti Syndrome (BS) is characterized as low back pain due to a lumbosacral transitional vertebrae (LSTV). Osteopathic management of BS includes treatment with oral anti-inflammatories, physical therapy, corticosteroid injections, and Osteopathic Manipulative treatment (OMT). If a patient fails conservative management, spinal surgery is the final intervention. This case demonstrates the effectiveness of OMT in the conservative treatment of BS to alleviate pain and potentially prevent/delay spinal surgery.

**Case:** A 25-year-old male presented for the evaluation of chronic low back pain (up to 6/10) that was disrupting his quality of life. The patient had generalized stiffness, an S-shaped scoliotic curve with leg length inequality (LLI). His diagnosed somatic dysfunctions (SD) included a thoracolumbar curve convex right, deep right sacral sulcus, posterior left inferior lateral angle, and restricted sacral motion. Lumbar spine x-rays were ordered, showing a partial lumbarization of S1 on the right. Following an articular model, four OMT procedures were performed and well tolerated. Direct techniques (primarily high velocity low amplitude and muscle energy) were utilized for diagnosed SD. The goal was to alleviate the SD burden on adjacent vertebrae and slow degenerative changes.

**Results:** After the final session, the patients' pain was reduced to 2/10 while reporting decreased pain with physical labor at work. His osteopathic findings improved,

including improved range of motion/tenderness along the S-curve, and resolution of LLI and seated flexion test.

**Discussion:** This case demonstrates efficacy of OMT in pain reduction and improving functionality in a patient living with BS, increasing participation in their physical job and active lifestyle. Future research could investigate long-term effects of OMT in patients with BS and determine if OMT can delay or prevent spinal surgery in these patients.

*Kaylee Bressler, OMS II; Grace Macmillan, OMS IV; Jayme Mancini, DO; Sheldon C. Yao, DO, FAAO; Dimitria Papadopoulos, DO; Reem Abu-Sbiah, DO*

### **Resolution of Notalgia Paresthetica Symptoms following Osteopathic Manipulative Treatment (OMT): A Case Report**

**Introduction/Background:** Notalgia paresthetica (NP) is characterized by chronic pruritus medial to the scapula with associated sensations of pain, numbness, burning and skin hyperpigmentation resulting from potential T2-T7 thoracic spinal nerve posterior rami compression. Symptomatic NP represents ~8% of chronic pruritus and may persist for months to years. Current treatments including topical capsaicin, gabapentin, lidocaine injections, and physical therapy have not shown long-term relief. Somatic dysfunctions (SD) contributing to NP may be treated with OMT.

**Case:** A 51-year-old female with a history of Hashimoto's thyroiditis presented with an 8-week history of burning and itching in the left upper back. Symptoms began after ergonomic changes at work which led to poor posture and back strain. Pain was constant, non-radiating, with intermittent 10/10 burning and itching at the medial edge of the left scapula. Ibuprofen did not provide pain relief. Physical examination revealed left-sided cervical lymphadenopathy, bilateral shoulder protraction and mild skin discoloration medial to scapula. Structural exam findings demonstrated key cranial, cervical, and thoracic cage SDs, left scapular restriction, and left posterior ribs 2-7. OMT included cranial OMT, myofascial release, balanced ligamentous tension (BLT), lymphatic drainage techniques and percussion hammer use.

**Results:** Following the first session, the patient's burning sensation was more localized. After the second OMT session the pain and frequency of burning decreased. Following the third session there was complete symptom resolution. Two months after the last treatment there has

been no recurrence of NP symptoms.

**Discussion:** The chronic and recalcitrant nature of NP is associated with frustration, distress, and decreased quality of life. This case highlights the potential for OMT to provide symptomatic relief and even resolve NP. Further research is required to determine OMT efficacy for NP.

*Sarah Carpinelli, OMS IV; Carlton Richie, III, DO*

### **Oh Snap! Osteopathic Treatment of Tendon Rupture with Link to Long Term Statin Use**

**Introduction/Background:** Statins, the preferred medication for hyperlipidemia, tout minimal side effects. Used by over 90-million patients, their role in lifetime cardiovascular disease risk reduction supports interest in long-term therapy implications. Recent studies demonstrate induced tendon matrix disruption, clinical cases pose suspected relationships to significant ruptures, and a 104-patient retrospective study concludes 2-times greater risk of distal bicep tendon rupture. The availability/efficacy of alternative medications accentuates the importance of physician awareness to preserve quality of life in at-risk patients.

**Case:** An 86-year-old male experienced 2 successive rare tendinous ruptures. Regularly active, 60+ years removed from competitive sports, and without history of related trauma/surgery; he was without typical risk factors. His medications included unchanged, long-term pravastatin. After a "pop!" while lifting boxes, he was diagnosed in clinic with a semitendinosus rupture. Within 9 weeks, still rehabbing his injury, and again lifting boxes, he ruptured his latissimus dorsi. Therapy for both included strain-counterstrain and muscle energy techniques to rebalanced muscle groups and myofascial release to aid lymphatic clearance. Review of literature, prompted by this second rupture, indicated replacement of his statin with evolocumab.

**Methods/Results:** Osteopathic Manipulative Treatment (OMT) expedited resolution of his ecchymosis/swelling and was documented via photographs. Replacement of his statin with evolocumab enabled return to activity without further ruptures.

**Discussion/Conclusion:** This case study captures successive rare tendon ruptures, without classic risk factors, in the setting of chronic statin therapy. Limited to one patient, it provides an opportunity to update education regarding statins and illustrates the application of OMT in tendinopathy treatment. This case demonstrates the



strong clinical application of functional medicine and osteopathic principles and emphasizes the need for further research into the long-term prevalence of tendinopathy with statin therapy.

*Jessica Coxon, OMS III; Thomas M. Gannon, DO*

### **Response to Osteopathic Manipulative Treatment in a Newborn with Breastfeeding Difficulties: A Case Report**

**Introduction/Background:** The forces of labor on infants may induce dysfunctions that interfere with their ability to thrive. The Centers for Disease Control (CDC) recommends exclusively breastfeeding for 6 months. However, according to their database, in 2020, 20.8 % of breastfed infants were supplemented with infant formula before 2 days of life. A factor that influences breastfeeding includes latch disorders. The use of OMT following delivery may improve the number of successful breastfeeding infants at 2 days of life, although there is little research on OMT and latch disorders.

**Case:** A 1-day-old female presented with fussiness, a painful latch, and nursing sessions lasting 5 minutes. The patient was born weighing 8 lbs following an unmedicated, spontaneous vaginal delivery with occiput anterior presentation. Osteopathic structural exam revealed plagiocephaly, overlapping parietal bones, right occipitomastoid suture compression, right SBS torsion, and diminished CRI amplitude with an elevated rate of 16. Treatment included cranial membranous release and frontal lift, followed by sutural release with direct distraction of the overlapped parietal bones.

**Results:** Following treatment, the plagiocephaly and compressed suture were improved, and cranial amplitude was restored with a rate of 11. One week after treatment, the infant had a painless latch, weighed 8 lbs 3oz, and increased nursing sessions to 10-15 minutes in length. This suggests that the patient's cranial dysfunctions may have contributed to her difficulties breastfeeding.

**Discussion:** This study suggests that the use of OMT can be effective in treating latch difficulties related to cranial dysfunctions following vaginal delivery. This may improve the number of successful breastfeeding infants. A limitation of the study was the need for more objective measurements to assess cranial plagiocephaly before and after treatment.

*Taylor Edgar, OMS II; Gregory R. Heller, DO; Madison Hutson, OMS II; Davis Melin, OMS II; Allison Bardowell, DO, MS*

### **Osteopathic Management of Chronic Pain Following Bilateral Periacetabular Osteotomy in Developmental Hip Dysplasia**

**Introduction/Background:** When diagnosed in late adolescence, the treatment of choice for hip dysplasia is periacetabular osteotomy (PAO) and post-operative physical therapy (PT). However, postsurgical compensatory changes can result in femoral anteversion (FAV) and resultant femoral acetabular impingement (FAI) which increases the risk of early-onset osteoarthritis and the need for total hip replacement (THR) in young patients.

**Case:** A 26-year-old female presents with chronic right lower extremity (RLE) pain. She was diagnosed with bilateral hip dysplasia at 13 years old. She received a right and left PAO at age 14 and 15 respectively with PT with 90% pain reduction. By age 19, right hip pain returned. She restarted PT by age 22 which achieved 50% pain reduction. At age 23, X-rays showed Tonnis grade 2 and 3 osteoarthritis of the left and right hip, respectively. Analgesics and PT were recommended until THR is indicated. Her initial osteopathic exam at the age of 26 was significant for FAV and FAI based on verbal pain scales, log roll, FADIR, range of motion, and postural and functional biomechanics.

**Methods:** Osteopathy in the Cranial Field, Balanced Membranous Tension, and Ligamentous Articular Strain were applied to correct intraosseous strains, capsular compression, and myofascial strains. Following one treatment session, 90% pain reduction and resolution of postural FAV and FAI at rest were achieved. However, some proprioceptive strains persisted functionally. Treatment plans include further osteopathic re-evaluations, OMT, exercise prescription, and gait retraining with PT if needed.

**Conclusion:** Motion freedom was maintained at 4 weeks, despite a gradual return to 50% of original pain after a prolonged car ride. This case illustrates the benefit of osteopathic management following PAO to decrease pain and correct postsurgical compensatory changes.

*Tatem Fredrickson, OMS III; Danielle Broussard, OMS III, RD; Holly Waters, DO, MS*

### **"I walk funny and I don't know why," Osteopathic manipulative treatment for an adult female with congenital bilateral Femoral Neck Anteversion (FNA)**

**Introduction/Background:** Femoral neck anteversion (FNA) is a structural condition whereby the femoral neck is internally rotated, causing genu valgus and in-toeing of

the feet. It is influenced by genetic predisposition and in-utero positioning, and is more common in females. Most cases self-resolve as children age, however a small percentage persist through adulthood with varying degrees of severity.

**Case:** This case follows a 26-year-old female with several years of hip pain and low back pain secondary to bilateral FNA. Her FNA caused limitations in her ability to walk, run, stand, and exercise, as well as insecurities about her posture and gait. Osteopathic Manipulative Treatment (OMT) targeted at the patient's pelvis, sacrum, and surrounding hypertonic muscles was used to correct compensatory somatic dysfunctions which developed in relation to her FNA.

**Results:** This patient received 3 treatments of OMT over a 10-week period and reported a 60% decrease in her pain from the first to the second visit, with her pain being mostly resolved by the third visit. She was able to increase the duration and frequency of her exercise, as well as enjoy activities that require long periods of walking or standing, without pain. Future treatment and home stretches were advised to maintain these results and treat additional somatic dysfunctions that may occur with her FNA.

**Discussion:** Untreated FNA can lead to chronic low back, hip, and knee pain, and osteoarthritis in adulthood. The standard treatment for FNA in adults at this time is derotational femoral osteotomy (DFO), used mainly for severe cases. This study highlights an alternative and preventative treatment option for patients with FNA. Further research is warranted at how OMT could be used for patients seeking surgical alternatives.

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### **Stagnating the Symptomatic Progression of Primary Lateral Sclerosis**

**Introduction/Background:** Primary lateral sclerosis (PLS) is a motor neuron disease characterized by the degeneration of corticospinal neurons. It occurs in <50,000 people in the United States, but has many similar symptoms to other neurological diseases. These symptoms include limb weakness, stiffness and spasticity, along with decreased airway bulbar muscle strength. There is no cure for PLS.

**Case:** A 61-year-old male with a 10-year history of PLS

presented to the Osteopathic Manipulative Treatment (OMT) clinic with muscle stiffness. On physical exam, the patient exhibited hyperreflexia on upper (3+) and lower (4+) extremities, and decreased range of motion (ROM) of bilateral hips (R>L). He had hoarse, slow speech and ambulated via a walker. On osteopathic exam, the patient exhibited hypertonic lower extremity muscles, bilateral diaphragm restriction and left inhaled ribs 6-8.

**Results:** The patient had 9 visits spanning 6 months. The 2 main goals of OMT were (1) decreasing lower extremity hip restriction and (2) increasing diaphragmatic excursion. Decreasing hip restriction was accomplished via Spencer's articulatory technique, direct myofascial release, and muscle energy. Improvement was measured via ROM flexion measurements (15° to 45° improvement) and the Ashworth scale of muscle tone (3 to 2 improvement). Diaphragmatic excursion was increased via doming the diaphragm, which allowed for compensation for his weakened bulbar muscles. Improvements were assessed through a visual decrease in accessory muscle usage and increased ability to abdominally breathe.

**Discussion:** While PLS is a devastating disease, this case exhibited symptom improvement with OMT. One limitation is basing outcomes on a single patient; however, due to this case's positive results and because PLS has such similar symptomatology to other neuromuscular diseases, further research into OMT's impact is warranted.

*Asha Kurian, BS, OMS III; Nicole Schneider, BS, OMS III; Patrick Barry, DO; Yasmin Qureshi, EdD, DPT, MHS*

### **Transforming Fibromyalgia Care: An Osteopathic Route to Improving Quality of Life**

**Introduction/Background:** : Fibromyalgia, affecting 4 million US adults, is characterized by widespread pain, fatigue, depression, disrupted sleep, anxiety, and limitations in daily activities. Central sensitization, stemming from the musculoskeletal system, leads to a heightened pain response. Given its incurable nature, management is critical. This article explores the effectiveness of Osteopathic Manipulative Treatment (OMT) in enhancing the quality of life (QOL) of Fibromyalgia patients.

**Case:** 70-year-old female with 15 years of Fibromyalgia, presents to the OMT clinic experiencing 10/10, constant, pain throughout the back, both hips, and neck. Twelve of the 18 fibromyalgia tender points were palpated, along with multiple others. Pain and fatigue, significantly

restricted daily activities, causing 70% reliance on indoor and outdoor cane usage, and daily pain medication. Over 5 months, I conducted 5 of the 6 one-hour OMT sessions with a physician, utilizing a variation of soft tissue, direct myofascial, and counterstrain techniques to areas along the back, neck, gluteal region, and extremities.

**Results:** Between the third and fifth session, the Oswestry Disability Index, decreased from 31%, to 24%. By the sixth appointment, the patient communicated a substantial decrease in cane use from 70% to 30%. Notable improvements were self-reported, including dancing, cooking without needing a stool, and extended walking without a cane. Patient self-reported a considerable decrease from 10/10 baseline pain to 3/10, and discontinuation of daily pain medication.

**Discussion:** This case study demonstrates that OMT offers fibromyalgia patients relief, allowing participation in QOL-enhancing activities. Clinicians should consider potential benefits of frequent OMT sessions to optimize outcomes for fibromyalgia patients. One limitation in this study is the extended duration in between visits, approximately 3 weeks, which could have influenced the obtained results.

*Nicole Maddie, MS, OMS III ; Jordan Keys, DO*

### **A case report of improvement of isolated abducens nerve palsy following osteopathic manipulative treatment.**

**Introduction/Background:** Abducens nerve palsy is the most common isolated ocular nerve palsy. Multiple etiologies have been linked to isolated abducens nerve palsy, including viral infections. Strikingly, isolated abducens nerve palsy has been reported in patients with PCR-confirmed COVID-19 infections and after receiving the COVID-19 vaccination. Most cases resolved spontaneously, however some patients experienced persistent intermittent diplopia after recovery from COVID-19.

**Case:** A 56-year-old female presented to the clinic reporting headaches, neck pain, and diplopia. Ocular mobility examination revealed right abduction deficiency. The patient reports these symptoms appeared approximately 1 month prior. The patient had a similar episode after receiving the COVID-19 vaccine that had resolved spontaneously but has now reappeared. A physical exam exhibited no additional abnormalities. Osteopathic structural exam revealed right frontal, temporal and occipitomastoid suture restriction. Osteopathic manipulative treatment (OMT) was employed utilizing balanced ligamentous tension, osteopathic cranial manipulative

medicine, and myofascial release.

**Results:** Immediately after treatment, the patient reported improvement in her headache. An ocular mobility examination was repeated and exhibited approximately 20% improvement in right eye abduction. The patient is scheduled to return to the clinic for additional treatment in two weeks.

**Discussion:** This case demonstrates, for the first time, improvement of persistent isolated abducens nerve palsy with OMT. The limitations of these conclusions include subjective evaluation of degree of abduction of the right eye before and after treatment. Additional research on treatment options for patients with persistent isolated abducens nerve palsy is needed as not all cases resolve spontaneously and can impact patient's quality of life.

*Ashley Ring, MS, BS, BA, MS, OMS III; Lis Llanio, BS, OMS III; Patrick Barry, DO; Yasmin Qureshi, EdD, DPT, MHS*

### **Osteopathic Manipulative Treatment in Occipital Neuralgia**

**Introduction/Background:** Occipital Neuralgia (ON), a debilitating condition involving severe scalp and head pain with 3.2/100,000 people incidence. It is associated with trauma or stress, and significant quality of life effects. Treatments are conservative or surgical. Using an alternative noninvasive treatment of osteopathic manipulative treatment (OMT), ON symptoms and nerve compression can be relieved.

**Case:** A 45-year-old female presented to clinic with three-week history of right-sided headache with onset while driving. Following ER presentation, MRI and CT were performed, which were negative. A neurologist diagnosed ON. Treated with steroid injection, numbness and tingling significantly reduced, but not pain. At clinic, pain was 7/10, constant, throbbing, pulsing, and radiated from occiput to temporal. She noted numbness, tingling, and weakness in this region. The pain disrupted work and sleep significantly. Techniques included cranial, balanced membranous tension, myofascial release to occiput, and muscle energy to cervical spine and soft tissue.

**Results:** She received 2 OMT sessions. Following session 1, burning and pressure headaches were eradicated for 5 weeks. Headache returned 2 days before session 2 without burning or tingling. Quality of life significantly improved as pain or headache no longer affected work and sleep. After session 2, she experienced vertigo with no headache and returned for treatment. Due to lack of



follow-up, it is unknown how vertigo is still impacting her.

**Discussion:** A 45-year-old female with 3-week ON history, improved in 2 clinic visits. ON's impact on sleep and work, headache, burning, weakness, and scalp tingling resolved. OMT is not in the current ON standard of care (SOC). This demonstrates OMT effectiveness in diminishing ON symptoms, indicating more studies should be conducted on its use in the SOC. Case limitation includes limited follow-up.

*Lily Rundquist, OMS III; Susana Shih, OMS III; Mark Sandhouse, DO, MS*

### **An Osteopathic Approach to Cervicogenic Vertigo**

**Introduction/Background:** Cervicogenic vertigo is imbalance or disorientation associated with neck pain and diminished cervical range of motion. Although the relationship between neck pain and dizziness is not fully understood, these symptoms are associated with somatic dysfunction of the cervical spine. Headaches often result from muscular and myofascial attachments between the cervical spine and cranium.

**Case:** 67-year-old female presented to the Osteopathic Manipulative Treatment (OMT) clinic 4 months ago with neck pain, radiating to shoulders, and dizziness described as water sloshing inside her head. She exhibited headaches at base of skull, associated with ringing in ears. She slept elevated on several pillows to avoid dizziness. Upon physical exam, reduced left cervical rotation was observed. OMT included reducing hypertonicity of cervical and upper extremity muscles using direct myofascial release, ligamentous articular strain, soft tissue and Osteopathic Cranial Manipulative Medicine.

**Results:** The patient received 9 sessions of OMT. A Vertigo Symptom Scale was administered, recording different symptom frequencies. Initial score was 22/60 and latest score was 7/60, indicating a decreased frequency of vertigo symptoms with OMT.

**Discussion:** OMT was shown to increase cervical rotation and decrease frequency of vertigo symptoms. Patient now sleeps elevated on her side rather than exclusively on her back, demonstrating an increase in quality of life. Being that cervicogenic vertigo is a diagnosis of exclusion and therefore underdiagnosed, OMT also provides the unique opportunity to better identify these cases due to advanced knowledge of the musculoskeletal system and the body as a complete, interrelated unit. Further research is needed to establish the role of OMT in treating

cervicogenic vertigo. Case study limitations include controlling for confounding variables such as patient's activity and stress levels.

*Elianna Sanchez, OMS II; Dimitria Papadopoulos, DO; Sheldon Yao, DO, FAAO; Reem Abu-Sbaih, DO*

### **Severe Eczema and Hair Growth Improvements with Osteopathic Manipulative Treatment (OMT) in Pediatric Patient: A Case Study**

**Introduction/Background:** Atopic dermatitis (AD) is a chronic, pruritic, inflammatory skin disease. Clinical features include ashy color, dry skin, erythema, lichenification, and hyper/hypopigmentation. Treatment of AD requires a multifaceted approach that involves education, skin hydration, elimination of exacerbating factors, and pharmacologic agents with high side effect profiles like oral immunosuppressants, oral JAK inhibitors, and injectable biologics. OMT may be effective in addressing AD dermatologic dysfunctions by potentially enhancing fluid hemodynamics, blood circulation, and lymphatic drainage.

**Case:** A 3.5-year-old female diagnosed with severe AD presents with associated minimal scalp hair growth. Patient visited a pediatrician, allergist, dermatologist, and attempted over 40 topical creams, and probiotics with minimal relief. On physical examination, a generalized open excoriated rash with crusting thickened skin was noted bilaterally on the antecubital fossa, dorsum of wrists, and posterior cervical spine, with an abdominal dry rash. Bilateral posterior cervical lymphadenopathy and dry brittle 2 inches of hair were also present. An osteopathic structural exam revealed significant somatic dysfunctions (SD) of the cranium, spinal segments, and pelvic regions. OMT included myofascial release, balanced ligamentous tension, thoracic inlet release, cranial osteopathy, rib raising, and percussion utilized to treat the SDs.

**Results:** The patient experienced gradual improvement over 18 months, with OMT every 2-3 weeks, until excoriation resolved, with much reduction of erythema, thickened skin, and scalp hair growth with a shinier softer texture. There was also significantly reduced size and tenderness of cervical lymphadenopathies with improved range of motion of the neck.

**Discussion:** This case demonstrated marked improvement in severe AD refractory to first-line topical therapies in a pediatric patient after addressing severe SD with

OMT possibly due to enhanced range of motion, lymphatic drainage coupled with improved circulation.

*Nicole Schneider, OMS III; Asha Kurian, OMS III; Nathan Widboom, DO; Yasmin Qureshi, EdD, DPT, MHS*

### **An Osteopathic Approach to Temporomandibular Dysfunction Secondary to A Motor Vehicle Accident**

**Introduction/Background:** Temporomandibular joint dysfunction (TMD) can occur from trauma among other causes and manifests as jaw pain, difficulty chewing, and/or lock jaw. The mainstay treatments are injections and surgery; however Osteopathic Manipulative Treatment (OMT) is a less explored approach and has minimal evidence in the literature that may offer a less invasive and promising alternative.

**Case:** A 67-year-old male status post motorcycle accident in November 2022 with jaw fractures in 5 locations presented to the Osteopathic Treatment Center with tinnitus, head injury, jaw pain with posterior right premature contact, and painful chewing. Initially the patient was treated with maxillomandibular fixation and pins placed for eight weeks followed by intraoral OMT; in addition to intraoral, osteopathic cranial manipulative medicine (OCMM) was implemented first followed by soft tissue, direct myofascial release, and Still technique.

**Results:** Disability percentage, measured using the TMD Disability Index Questionnaire, decreased from 68% pre-treatment to 10% post-treatment. In addition, improvement was noted in jaw alignment, consisting of less translation and compression of the right temporomandibular joint which improved consumption of foods that were previously not tolerated. Two days posttreatments, the patient reported a decrease in frequency of headaches and jaw pain.

**Discussion:** This case study suggests that OMT can improve the quality of life for patients with TMD secondary to trauma. The use of cranial techniques followed by head and neck treatments was effective management approach for this patient with TMD pain. Treatment with OCMM yielded significantly improved results when evaluating the Cranial Rhythmic Impulse compared to previous treatment without OCMM as evidenced by further decrease in disability percentage. A limitation to the study was the subjectivity of the disability index.

*Susana Shih, OMS III; Lily Rundquist, OMS III; Yasmin Qureshi, EdD, DPT, MHS*

### **An Osteopathic Approach to Eyelid Myokymia**

**Introduction/Background:** Eyelid myokymia (EMKM) are spontaneous, constant contractions spreading through striated muscle, most commonly orbicularis oculi unilaterally. EMKM typically lasts days to weeks, has unknown etiology, and is precipitated by stress, fatigue, or inadequate sleep. Botulinum toxin injections or surgery can improve symptoms. This case demonstrates the effectiveness of non-invasive osteopathic manipulative treatment (OMT) for EMKM.

**Case:** 51-year-old female presented to OMT clinic with hourly right EMKM for 2 months. Episodes lasted seconds and affected her ability to maintain eye contact while talking. Optometry ruled out vision changes and other abnormalities, and she did not improve with lubricant eye drops. Intraoral techniques and Osteopathic Cranial Manipulative medicine reduced hypertonic bilateral masseters, pterygoids, sphenopalatine ganglion tension, lymphatic congestion and cranial somatic dysfunctions.

**Results:** The patient received 8 OMT sessions over 13 weeks, decreasing EMKM episodes from hourly to weekly. Baseline scores included 6/4 in the Blepharospasm Disability Index (BDI), 4/4 in severity and frequency in the Jankovic Rating Scale (JRS), and 30% in the Neck Disability Index (NDI). At the last visit, improvement in function and activities of daily living were seen: JDI 0/24, JRS 2/4 severity and 3/4 frequency, and 18% NDI.

**Discussion:** Though overlooked by physicians as benign and self-limited, EMKM can be disturbing when persistent and recurrent. OMT offers non-invasive treatment that decreases frequency and improves quality of life. Stimulating the pterygopalatine ganglion by inducing lacrimation and releasing facial muscle tension may affect parasympathetics and improve EMKM. Limitations of this case include potential confounding variables, such as the patient's use of eye drops and stress levels. Further research can substantiate the efficacy of OMT in EMKM treatment.

*Jamie Steach, OMS IV; Jonah Cwik, OMS II; Thomas L. Kincheloe, DO*

### **Herniated Triggerpoint of Posterolateral Rib Cage as Identified by Ultrasound: A Case Study**

**Introduction:** The Fascial Distortion Model (FDM) has relied on hand signals or gestures as diagnostic indicators of the specific pathologies occurring in the soft tissues and fascia of the body. Up to this point, these hand gestures have not been confirmed with any kind of imaging



to be true indicators of dysfunction in the fascia and soft tissues. Ultrasound presents a non-invasive and inexpensive option for assessing construct validity of the FDM hand gestures.

**Case:** This case study presents an active 22-year-old male with recent onset localized posterior trunk pain after a rugby match who gave hand signals consistent with a herniated triggerpoint (HTP) according to the Fascial Distortion Model and this diagnosis was confirmed with ultrasound imaging. After ultrasound confirmation of the HTP, the area was treated with FDM and HTP reduction was confirmed with ultrasound.

**Results:** After treatment with FDM, the patient reported resolution of his symptoms, and repeat ultrasound demonstrated resolution of the HTP findings that were noted on pretreatment imaging.

**Discussion:** This case presents that HTPs can be visualized on ultrasound imaging and that their resolution can be objectively confirmed after treatment. To further characterize the plausibility of its use diagnostically, future studies can begin with ultrasound assessment of a larger group of patients presenting with HTPs. Further studies should also investigate whether the other fascial distortions can similarly be visualized with ultrasonography.

*Kaitlin Unser, OMS III; Anvin Thomas, OMS III; Samantha Cornwell, OMS III; Sheldon Yao, DO, FAAO; Jordan Keys, DO*

### **Effect of Osteopathic Manipulative Treatment (OMT) for Symptomatic Headache Relief in Long-COVID Patient: A Case Report**

**Introduction/Background:** Long-COVID encompasses a wide range of continuing health problems that present weeks to months after an initial COVID-19 infection. Symptoms can be constitutional, respiratory, cardiac, or gastrointestinal. Headaches are among the most frequent symptoms reported with long-COVID and are thought to be caused by activation of the trigeminovascular system in the brain which contains neurons that can trigger migraines. Treatment is limited to analgesics and non-steroidal anti-inflammatories. Osteopathic manipulative treatment (OMT) has been a promising alternative treatment for symptomatic headaches.

**Case:** A 15-year-old male presents with a 6-month history of continuous worsening daily headaches located on “the top of their head” that began 1 week post COVID-19 infection. The patient reports inability to concentrate during school and missing class due to symptoms. He

reports Tylenol and acupuncture provided minimal to no relief. Examination revealed key somatic dysfunctions of the parietal and temporal bones, occipitomastoid (OM) suture, and cervical paraspinal muscles. Treatment included parietal lift, temporal rocking, occipitoatlantal decompression, muscle energy technique (MET), counterstrain, and myofascial release (MFR).

**Results:** After 3 treatments occurring biweekly over 2 months, the patient’s headaches, previously daily and lasting most of the day, reduced to less than weekly, occurring during stressful work weeks or inadequate sleep. Overall, the patient reported improved sleep, concentration, and better mental wellness by the end of the 2 months.

**Discussion:** This case showed marked improvement in a persistent long-COVID headache affecting an adolescent through treatments targeting key somatic dysfunctions, suggesting broader neurological benefits. While OMT is documented for headaches, limited evidence exists for its mechanism in COVID-19 or adolescent health. As OMT’s role in COVID-related diseases gains support, it is crucial that its utilization in symptomatic management is explored.

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### **Reducing Blood Pressure: Use of Osteopathic Manipulative Treatment (OMT) as Adjunct Therapy in Treating Uncontrolled Hypertension**

**Introduction/Background:** Hypertension (HTN) diagnosis requires a systolic blood pressure (SBP) of  $\geq 130$  mmHg and/or a diastolic blood pressure (DBP) of  $\geq 80$  mmHg on 2 separate occasions. First line treatment recommendations for HTN include lifestyle changes and pharmacological agents. While HTN affects almost half of Americans, only 1 in 4 Americans with HTN have their blood pressure (BP) controlled. In this case study, we highlight a patient with uncontrolled HTN whose BP is managed using Osteopathic Manipulative Treatment (OMT) as an adjunct therapy.

**Case:** A 69-year-old male with a long-standing history of uncontrolled HTN has been seen at the clinic regularly for over 10 years. His appointments are scheduled at 12-week intervals. Current medications include multiple diuretics, an angiotensin receptor blocker, multiple beta-blockers, and aspirin. Physical exams regularly reveal

somatic dysfunctions (SDs) of the head, cervical, thoracic, lumbar, sacral, pelvic, upper extremity, and lower extremity regions. The patient's OMT regimen focuses on treating dysfunctions through the lens of the respiratory-circulatory model with the goal of reducing the patient's BP. Frequently utilized techniques include muscle energy, counterstrain, myofascial release, HVLA, and LVMA.

**Results:** Following treatment, the patient exhibits increased range of motion with resolution of the SDs. The patient's post-treatment BP readings are consistently lower than pre-treatment readings. He also self-reports decreased BP readings at home following treatment.

**Discussion:** This case demonstrates the effectiveness of OMT as an adjunct treatment for HTN. Both the immediate and continued lowered BP readings of this patient suggest that OMT can be included in HTN treatment protocols. Limitations include the patient's contributing comorbidities. Future studies should focus on outcomes when OMT is used as an adjunct treatment for HTN in a larger population.

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### **Case Study: The Effect of Osteopathic Manipulation on Diabetic Gastroparesis**

**Introduction/Background:** Diabetes mellitus is a progressive, systemic disease that can lead to diabetic gastroparesis (DG). DG has various theorized etiologies and is associated with symptoms that could impact a patient's quality of life. Few treatment options offer temporary relief from DG, including metoclopramide, pyloric botulinum toxin injection, gastric electrical stimulation, and gastrostomy. This case study is part of ongoing research investigating the effects of osteopathic manipulative treatment (OMT) for patients with a confirmed diagnosis of DG and is an IRB-approved study [IRB M-2321].

**Case:** A 29-year-old male patient, with a confirmed diagnosis of DG, presented to the clinic for 4 OMT visits, scheduled 2 weeks apart. He reported the severity of DG symptoms, as measured by the Gastroparesis Cardinal Symptom Index (GCSI), on visits 1 and 4. OMT techniques used included balanced ligamentous tension, myofascial release, cranial osteopathy, and muscle energy based on the osteopathic structural exam findings each visit.

**Results:** During visit 1, the patient reported the severity of nausea, retching, and loss of appetite were 5/5, with 5 being most severe. He also reported vomiting, stomach fullness, and feeling excessively full were 3/5; inability to finish meals was 4/5; bloating was 4/5. At the fourth visit, he reported an 80% reduction in retching, loss of appetite, and the inability to finish meals. He also reported a 60% reduction in the severity of nausea, vomiting, stomach fullness, bloating, and feeling excessively full.

**Discussion:** This case study suggests OMT may be effective in alleviating the severity of symptoms related to DG and improving the quality of life in patients diagnosed with DG. A limitation includes the lack of objective data from a gastric emptying test.

## **EDUCATION AND PUBLIC HEALTH**

*Emily Krzykwa, MPH, OMS III; Dylan Pietrantoni, MS, OMS II; Holly Waters, DO, MS*

### **Development of an Osteopathic Manipulative Treatment Clinician-Parent Home Care Education Intervention for Children with Otitis Media**

**Introduction/Background:** Acute otitis media (AOM) is the second most frequent pediatric emergency room diagnosis, affecting nearly 90% of children before 2 years of age, totaling over 20 million pediatric visits annually. Standard of care for AOM involves antibiotic therapy, but rising antibiotic resistance has spurred interest in non-pharmacological alternatives. Osteopathic manipulative treatment (OMT) serves as a holistic approach for managing AOM in children. Recent studies indicate that integrating OMT with standard of care decreases the recurrency of AOM and reduces the need for surgical intervention offering a promising alternative.

**Objectives:** The primary aim serves to standardize an OMT protocol to be utilized by physicians and caregivers outlining techniques to treat AOM in children.

**Results:** An interprofessional team of medical students and physicians developed a trifold brochure highlighting evidence based OMT techniques for providers and caregivers. The developed materials underwent thorough review by the faculty of the Osteopathic Manipulative Medicine department. A comprehensive literature review informed the selection of four key techniques incorporated into the educational protocol. Techniques included myofascial release, lymphatic drainage, articulation and viscerosomatics, chosen based on their prevalence and utility. A succinct reference guide was developed for physicians and caregivers, including the treatment protocol,

access to an online portal of videos, and clinician educational materials.

**Conclusion:** This initiative recognizes the widespread impact of AOM in young children and emphasizes the therapeutic benefits of OMT. Future studies will include a validation study to determine the efficacy of the brochure for at home use to determine the impact on frequency and duration of AOM infections. This evidence-based intervention aligns with the holistic nature of OMT and mitigates the challenge of antibiotic resistance in AOM patients.

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### **The Impact of Peer-to-Peer Review-Preview Sessions on Student Confidence and Interest in OMT**

**Background:** The Journal of Osteopathic Medicine reported of 1683 osteopathic physicians surveyed, 1308 indicated they used osteopathic manipulation techniques (OMT) in less than 5% of their patients. While there are a number of potential variables contributing to this limited use of OMT by DOs, this study focuses on effecting change at the level of undergraduate training of futures DOs by measuring the impact of a peer led training program.

**Objectives:** To determine whether or not voluntary participation in a peer-led review and preview program leads to improved competency, confidence, and willingness to apply OMT in upcoming clinical rotations.

**Methods:** OMS2 (Osteopathic Medical Student) teaching assistants (TAs) utilized course skill sheets to direct weekly, hour-long, small-group practice sessions. Sessions began after the midterm exam and involved a hands-on review of the techniques from the previous week's lab as well as a preview of the techniques for the upcoming lab.

An identical course-based survey was administered to OMS1 after the mid-term exam and the week prior to their final exam containing questions about perceived confidence, interest, and competency in applying OMT to clinical practice.

**Results:** Students participating in weekly peer led sessions recorded an average increase in confidence and willingness to utilize OMT in future practice by greater than 10% when comparing the end of course survey to the midterm survey. Conversely, there was an average decline in the measurements by greater than 19% when evaluating the same survey results for student not participating

in weekly sessions. Similar findings were found amongst the 2 groups when evaluating competency, 81% to 76% respectively.

**Conclusion:** Weekly peer-led sessions over 8 weeks increased competency, confidence, and willingness to apply OMT in future practice.

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### **The Fascial Relationships Between the Psoas and the Respiratory Diaphragm**

**Introduction/Background:** Current literature describes connections between the thoracoabdominal diaphragm (TAD) and iliopsoas through the crura and arcuate ligaments. Additionally, the iliopsoas fascia (IPF) connects with the transversalis fascia (TF) of the abdominal cavity. TF is known to connect with fascia on the inferior surface of the TAD. Anatomical dissection can help to better appreciate fascial connections between the psoas and TAD. We hypothesize this dissection will further understanding of how dysfunctions within the psoas impact the TAD and highlight the importance of treating the psoas for patients with respiratory complaints.

**Objective:** Identify fascial connections between the psoas and TAD.

**Methods:** In the supine position, 5 cadavers of various sex, age, and stature were examined. The thoracic and abdominal cavities were previously dissected. The psoas major, TAD, and overlying fascia were identified in the abdominal cavity. We dissected the fascia away from the corresponding musculature to determine anatomical relationship. Palpation was utilized throughout the dissection to determine landmarks and evaluate motion of the TAD while manipulating the psoas.

**Results:** Using dissection, we found the IPF and TF to be intimately connected and converging prior to ascending to the TAD. We dissected an intact portion of the IPF and followed that connection to the inferior surface of the TAD.

**Discussion/Conclusion:** Identifying fascial connections between IPF, TF, and TAD allows for better understanding of the relationship between the psoas and TAD and suggests somatic dysfunctions in the psoas may impact normal motion of the TAD. This highlights the osteopathic relevance of treating the psoas in cases where improving respiration is a primary goal. Limitations include



the utilization of previously dissected cadavers, tissue stiffness secondary to preservation technique, and small sample size.

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### **OMT in the 21st century: current use of technologies in manual therapy education and opportunities for innovation**

**Introduction/Background:** Osteopathic manipulative therapy (OMT) usage decreased 24.5% between 2000 and 2019 in the United States. Lack of confidence and proficiency are cited as barriers. As education evolves, utilizing technologies in OMT instruction may help overcome these obstacles, enhance learning, and stimulate usage. Thus, assessment of current technologies in manipulative therapy (MT) education is valuable for students, educators, and providers.

**Objective:** To investigate the use of technology in MT education, highlight opportunities for future exploration, and propose a video-based intervention.

**Methods:** Three databases were searched for primary articles published after 2014 with variations of keywords: “manual or manipulative,” “therapy or treatment,” “technology or digital,” and “education.” Studies of OMT alone were limited, so chiropractic and physiotherapeutic works were also considered because of similarities in kinesthetic applications. Relevant primary studies were included for initial review. Bibliographies of resulting secondary articles were manually inspected for relevant primary studies. Fourteen studies were included from the initial 244 unique results.

**Results:** Three categories of technology integration were determined: video-based material (71%), measuring devices (21%), and simulators (7%). Objective results supported improved performance in technique setup ( $p < 0.01$ ,  $d = 1.32$ ), applications ( $p < 0.01$ ,  $d = 1.46$ ), and post-intervention assessments (2.87 [0.35] vs 2.14 [0.53];  $p < 0.001$ ) with technological interventions. Subjective trends included improved confidence, appreciation for self-learning, and enhanced study processes.

**Conclusions:** Most studies supported the effectiveness of technological interventions in MT education, with video-based methods acquiring the most evidence. Highlighted opportunities include increased research specific

to OMT education, expansion of simulation technology studies, and additional video-based innovations. To address the gap, a video-based innovation for OMT techniques is proposed to decrease barriers to usage for students and physicians.

## **ORIGINAL RESEARCH**

*Catherine Arnold, OMS II; Dresdan Quackenbush, OMS II; Arsany Fahim, OMS II; Garrick Quackenbush, OMS III; Arielle Navarro, OMS III; Christopher Edwards, DO*

### **Counterstrain Point Frequency and Treatment in Osteopathic Medical Students**

**Introduction/Background:** Counterstrain technique is widely taught in osteopathic medical schools and has been proven to be efficacious for patients treated with the modality despite the lack of literature outlining the physiology of its effects.

**Objective:** The Levator Scapulae is hypothesized to be the most frequent counterstrain point (CSP) among OMS I and OMS II medical students and counterstrain treatment is predicted to reset gamma gain, decreasing muscle stiffness.

**Methods:** 61 first and second year osteopathic medical students were screened by an OMS II CO-PI for identification of 52 common counterstrain points whose locations were approximated by the RVU OPP I and II Manual. 41 students were identified as having the levator scapulae CSP. The MyotonPro was used to measure muscle tone, dynamic stiffness, elasticity, mechanical stress relaxation time, and ratio of relaxation and deformation before and after treatment. Results were compared to the contralateral unaffected limb. The contralateral CSP received a placebo treatment via ultrasound (US) scan, while the identified CSP received counterstrain treatment by an OPP Fellow. The student's dominant hand side was preferentially treated with counterstrain while the nondominant hand received US treatment if bilateral tender points were identified.

**Results:** The 2 most common CSPs identified were the levator scapulae (positive in 41/61 medical students) and the radial head (37/61). Muscle stiffness saw a significant decrease post CSP treatment, going from a mean of 206 N/m pre-treatment to 197 N/m post-treatment ( $p = 0.01$ , paired t-test).

**Conclusion:** Our conclusions will provide a more systematic screening for counterstrain points in populations

found to sit for many hours and quantitative data to support the efficacy of resetting gamma gain with counter-strain treatment.

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### **Comparison of Clinically Relevant Concentrations of Dextrose and Lidocaine Exposure on Fibroblast Viability for use in Prolotherapy**

**Introduction/Background:** Dextrose prolotherapy represents a promising non-surgical treatment option for osteoarthritis; however, few in vitro studies investigating the proposed mechanisms or dosing of dextrose and lidocaine prolotherapy exist.

**Objective:** We sought to compare clinically relevant concentrations of dextrose and lidocaine for prolotherapy to find an optimal condition that minimizes toxicity while inciting cellular proliferation. Based on previous data and known toxicity of lidocaine, we hypothesize hypertonic solutions of 12.5% dextrose mixed with low concentrations of lidocaine will optimize fibroblast proliferation with minimal cellular death.

**Methods:** MRC- 5 fibroblasts were exposed to solutions of 12.5% or 20% dextrose plus 0.1, 0.25, 0.5, or 1.0% lidocaine for 15, 30, 60, or 120 minutes. Media only and media with dextrose were used as controls. XTT assays performed in duplicate were used to determine cell viability immediately after treatments. Two-way ANOVA determined significant differences ( $p < 0.05$ ) between optical density readings.

**Results:** When evaluating the viability of fibroblasts directly treated with 12.5% or 20% dextrose plus lidocaine, no significant differences between 12.5% and 20% dextrose conditions were found.

12.5% and 20% dextrose treatments with lidocaine concentrations  $< 1\%$  did not reduce cell viability immediately after exposures up to one hour duration compared to controls. Longer exposure (two hours) to lidocaine at any concentration reduced cell viability as did higher concentrations of lidocaine (1%) even with shorter durations of exposure.

**Conclusion:** These findings refute our hypothesis that 20% dextrose with varying concentrations of lidocaine would reduce cell viability greater than 12.5% dextrose with lidocaine. Future experiments will investigate these effects at later timepoints and in chondrocytes. Ultimately, our laboratory's research may provide evidence-based

support for the recommended use of prolotherapy as an effective option for OA treatment.

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### **Effects of Osteopathic Manipulative Treatment (OMT) on Self-Reported Benefits and Lower Extremity Functionality in Parkinson's Disease (PD) Patients**

**Background:** Osteopathic manipulative treatment (OMT) can help treat pain and rigidity; symptoms associated with Parkinson's Disease (PD). LE function plays a role in gait and the ability to perform ADLs. This study aims to define the effects of OMT in decreasing rigidity to increase one's ability to perform ADLs and increase function. OMT has shown improvement in PD gait and symptomatology.

**Hypothesis:** We hypothesize that participants receiving OMT will have improved self-reported benefits and lower extremity functionality.

**Methods:** Subjects with PD and lower extremity pain were recruited in this, IRB approved BHS1850, prospective randomized control trial. Subjects were assessed pre-treatment with a lower extremity functional scale (LEFS). The treatment group received muscle energy technique. The control group received passive range of motion without reaching the physiologic barrier. One week later, participants were reassessed via phone call utilizing the LEFS and a post-study survey. Data was analyzed with SPSS using independent t-tests with significance set at alpha 0.05, and a significant LEFS change of 9 points, demonstrated in prior literature.

**Results:** Data analysis revealed no statistically significant differences in LEFS scores between the treatment ( $n=3$ ) and control group ( $n=3$ ) from pre to post treatment. LEFS scores averaged a -3 change for control and +7 change for study, with one participant from each group having a significant  $> 9$ -point increase, one control participant had a  $> 9$ -point decrease. The post study survey was completed by 5/6 participants and showed greater self-reported benefits from study versus control participants.

**Conclusions:** Self-reported scores and opinions demonstrated numerous benefits of OMT in increasing functionality and the ability to perform everyday tasks. These findings set a precedent for potential benefits of MET in PD.

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### **A Novel Quantification Method for Obtaining a Profile of Somatic Dysfunction, Potential Research, and Clinical Implications**

**Introduction/Background:** Somatic dysfunction (SD) is typically localized categorically to a specific body region by the presence of any of 4 TART criteria: tissue texture abnormality, asymmetry, restriction of motion, or tenderness. This work describes a novel quantification method that provides continuous measures of SD for multiple body regions, an overall score of SD across body regions, and a multi-region profile of SD in an individual.

**Methods:** 53 Osteopathic medical students at Rocky Vista University College of Osteopathic Medicine - Colorado served as subjects in this study. SD was quantified by 2 Doctors of Osteopathic Medicine using a novel scoring technique across 9 body regions. SD was assessed by screening areas of greatest restriction (AGR). AGR was scored for each left and right region using a 0-3 scale according to how many TART criteria were present, however, tenderness was not included in the scoring. A score of 0 represented the absence of TART criteria, whereas 3 reflected that all TART criteria were present. SD measures were summed individually within each area, and across all regions together.

**Results:** Summed scores of SD showed a normal distribution across subjects (mean 22.43, standard deviation 8.5, range 4-48). Interclass correlations measuring interrater reliability across subjects were highest for Thoracic, Lumbar, Sacral, and Pelvic regions together (range 0.6-0.7). Calibration between raters improved reliability from 0.34 to 0.78 for these same body regions. SD Measures showed identical patterns for both raters across body regions with the highest SD measures in Thoracic and Lumbar, and the lowest in Pelvis and Upper Extremities.

**Conclusion:** We envision a number of clinical and research applications for a multi-region profile of SD that uses continuous measures within and across body regions.

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### **Exploring the Evolution of the Mind-Body Connection**

### **as First-Year Osteopathic Medical Students Learn about Common Osteopathic Dysfunctions**

**Background:** As first-year osteopathic medical students learn common osteopathic dysfunctions, they seem to become aware of dysfunctions in their own bodies. Despite this widespread experience, few studies explore the effects of how learning osteopathic manipulative medicine (OMM) changes how one perceives their own body.

**Objective:** This prospective observational study aims to determine if proprioception/interoception changes after studying OMM.

**Methods:** IRB approval was obtained (#HSIRB\_2241). Participants included 8 first-year osteopathic medical students (study group) and 5 Touro Masters students (control). Data was collected during first-year orientation (baseline), and +/- 7 days around each OMM Touro-COM examination, representing knowledge acquisition about the thoracic spine (follow-up 1) and the ribs/lumbar spine (follow-up 2). At each session, participants' osteopathic knowledge about each region was assessed as they self-reported pain and underwent an osteopathic evaluation to identify dysfunctions. Qualitative data analysis involved "matching" participant reports to researcher findings, exploring whether reported dysfunctions were confirmed via osteopathic evaluation.

**Results:** At baseline, 50% of osteopathic students who reported thoracic discomfort were found to have thoracic somatic dysfunctions. At follow-up 1, after studying the thoracic spine, student reporting and investigator findings match increased to 87.5%. In comparison, control group baseline for thoracic spine was a 40% match rate, and stayed 40% during follow up 1. Other anatomical regions showed less significant results.

**Discussion/Conclusion:** This pilot study suggests that with increasing thoracic osteopathic knowledge, first-year participants identify real thoracic somatic dysfunctions more accurately than baseline and the control. These clinically significant results not only add to data supporting the benefits of hands-on learning in understanding anatomy/biomechanics, but highlights the advantages gained by student osteopathic physicians as they develop stronger mind-body connections.

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## Effects of OMT on Heart Rate Variability in Rats

**Introduction/Background:** The autonomic nervous system (ANS) includes the sympathetic nervous system (SNS), the body's flight or fight response, and the parasympathetic nervous system (PNS), the body's rest and digest portion. Osteopathic manipulative treatments (OMT) targeting specific regions associated with the ANS- such as suboccipital release and rib raising- can enhance PNS tone.

**Methods:** We explored whether rats can be used as models to evaluate the effectiveness of OMT in increasing heart rate variability (HRV) over time. We hypothesize that rats treated with OMT will have more balanced ANS responses and therefore a higher HRV.

**Results:** Nine male rats were equally divided into control, sham, and treatment groups. The treatment group received OMT with suboccipital release, thoracic inlet release, rib raising, diaphragmatic doming, and prevertebral ganglia release.

Rats were anesthetized with isoflurane and a 5-minute electrocardiogram (ECG) was recorded. The rats received treatment, followed by another 5-minute ECG. Treatments were repeated daily for 5 days, with ECGs obtained on days 1 and 5.

R-R intervals from the ECGs were analyzed using Lab7. The ratio of low frequency to high frequency domain was analyzed using descriptive statistics.

**Results:** Baseline HRV measurements for the control, sham, and OMT group were 2.53 ( $\pm 1.77$ ), 1.08 ( $\pm 1.04$ ), and 0.62 ( $\pm 0.49$ ). After 5 days, the HRV for each group increased to 2.61 ( $\pm 1.91$ ), 2.61 ( $\pm 3.01$ ), 4.68 ( $\pm 2.32$ ), respectively.

**Discussion/Conclusion:** Due to the variance in pre-treatment HRV, no significant conclusions can be drawn regarding the increases seen on day 5. Statistical significance between groups cannot be calculated due to small sample size. Future studies should utilize a higher sample size with similar baseline HRV readings.

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## Impact of Cervical High-Velocity, Low-Amplitude Osteopathic Manipulative Technique on Blood Flow in the Middle Cerebral, Internal Carotid, and Vertebral Arteries

**Introduction/Background:** Introduction/Background: High-velocity, low-amplitude (HVLA) osteopathic

manipulative technique improves range of motion in cervical facet joints and reduces neck pain.

**Objective:** The primary aim of our study was to determine the effect of cervical HVLA on blood flow characteristics in the internal carotid (ICA), middle cerebral (MCA), and vertebral arteries (VA) using Doppler ultrasonography. We hypothesized that cervical HVLA would result in significant changes in blood flow through cervical and cerebral blood vessels.

**Methods:** After receiving institutional review board approval, 19 volunteers were recruited and randomly assigned to cervical HVLA or sham treatment groups. Doppler ultrasonography was used to measure blood flow (peak systolic velocity [PSV]) and heart rate in the ICA, MCA, and VA before and after treatment. Blood pressure (BP) was also measured before and after treatment. Differences between pretreatment and posttreatment outcomes were compared using Welch's 2-sample t tests.

**Results:** Differences between groups were found for PSV in the MCA and for systolic BP. The mean PSV in the MCA increased 3.4 cm/s in the HVLA group and decreased 8.5 cm/s in the sham group ( $P < .001$ ). Mean systolic BP decreased 0.5 mmHg in the HVLA group and increased 0.6 mmHg in the sham group ( $P = .003$ ). No other differences were found.

**Discussion/Conclusion:** The increased PSV in the MCA, but not in the ICA or VA, suggested a direct impact of HVLA on cerebral circulation, causing vasoconstriction and higher systolic velocity. Conversely, the decreased systolic BP suggested systemic vasodilation. These preliminary data suggest cervical HVLA has a different effect on cerebral and systemic vasculature. More studies with larger sample sizes are necessary to determine systemic effects of HVLA on the human body.

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## A Qualitative and Quantitative Analysis of Suboccipital Release on Heart Rate Variability

**Introduction/Background:** Heart rate variability (HRV) describes variations in heart rate from beat-to-beat. Previous studies have described its correlation with health outcomes related to vagal tone and the autonomic nervous system (ANS). Osteopathic manipulative treatment (OMT) has demonstrated benefits for ANS function.

Low HRV is associated with negative outcomes (stress, disease, etc.); elevated HRV is associated with improved health (increased parasympathetics, reduced mortality).

**Objective:** To characterize ANS effects of suboccipital release (SR), an OMT technique, chosen for its association with the vagus nerve using HRV metrics.

**Methods:** Single group within-subject design with 5-minutes of pre and post OMT measurement is advised in published literature. HRV data on medical school faculty, staff, and students was collected and analyzed using Firstbeat Bodyguard 3 electrocardiogram devices and Kubios HRV software in private clinical examination suites. SR treatment for evaluated somatic dysfunction was performed for 2 minutes by trained OMS II students supervised by osteopathic physicians board certified in neuromuscular manipulative medicine. HRV variables related to vagal tone include root mean square of successive differences (RMSSD), percentage of successive normal sinus RR intervals more than 50 ms (pNN50), high frequency (HF), Parasympathetic Index (PNSI), and Sympathetic Index (SNSI). These variables were chosen based on published recommendations. Repeated measures t-test was used to assess mean HRV variations post-OMT. Outliers were removed using  $\alpha=0.05$ .

**Results:** SR showed significant ( $p<0.01$ ) increase in vagal tone related HRV variables compared to baseline.

**Conclusions:** SR may increase vagal tone, but more research is needed to characterize clinical impact. Future opportunities involve addressing limitations including what the optimal treatment duration time is to evoke the largest effect. Comparison to other HRV studies is also warranted.

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### Turning Heads: A Review of OMT in Whiplash-Associated Disorders

**Introduction/Background:** Whiplash-associated disorders (WAD) constitute a spectrum of symptoms encompassing neck pain, headache, dizziness, and more. WAD significantly impacts patients' lives with chronic pain and disability.<sup>1</sup>

**Objective:** Study participants included 33 Peruvian women from the city of Iquitos, Peru who were seen by MSUCOM during their annual medical outreach trip. Participants were required to be 18 years or older, have a history of one or more CS, and have LBP beginning after CS. After initial measurements, patients underwent

5 minutes of myofascial release to SC incision site. Pain changes in low back and incision site were assessed with 1-10 pain scale. Lumbar ROM changes were assessed by iPhone goniometer application. Scar mobility changes were assessed by use of adheremeter.

**Results:** This study showed a statistically significant improvement in LBP, incision site pain, scar mobility, and in lumbar flexion ROM ( $<.001$ ). Only lumbar extension at T12 and S1 improved non-significantly (.245 and .283, respectively). No adverse events were observed.

**Conclusion:** This study provides statistically significant data supporting the use of myofascial release as a means of treating post-CS LBP and related sequelae. This is likely related to anatomic relationships between the abdomen and lumbar spine. More research is needed to further elucidate these results.

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### Post Isometric Muscle Energy at the Cervical Spine (OA, C1, C2) Increases Vagal Tone as Quantified by Heart Rate Variability Metrics

**Introduction/Background:** Introduction/Background: Osteopathic manipulative treatment (OMT) benefits on autonomic nervous system (ANS) function can be quantified using heart rate variability (HRV).<sup>1</sup> HRV measures variation in beat-to-beat intervals reflecting ANS activity.<sup>2</sup> Low HRV is associated with stress, pain, and chronic diseases.<sup>3,4</sup> Elevated HRV is linked with optimal health and reduced mortality.<sup>2</sup>

**Objectives:** To determine whether post-isometric muscle energy (MET) targeting the cervical spine at atlantooccipital joint (OA), C1, and C2, chosen for association with the vagus nerve, improves HRV variables related to vagal tone.<sup>5,6</sup>

**Methods:** Single group within-subject design is recommended in the literature, and selection bias mitigated through strict exclusion criteria with participants from the same general population.<sup>7-14</sup> Exclusion criteria included self-reported heart failure, myocardial infarction, hypertension, asthma, diabetes, arrhythmias, smoking, systolic blood pressure >150mmHg or <90mmHg. Inclusion criteria included medical school students and faculty. Five-minute measurements of pre and post MET using a Firstbeat Bodyguard3 electrocardiogram sensor with thirty-three healthy participants, adequate for 80% power to detect a large effect.<sup>15</sup> Evaluated somatic dysfunctions at OA, C1, and C2 were treated using MET by osteopathic physicians trained in Osteopathic Neuromusculoskeletal Medicine. Vagal tone-relevant HRV variables include root mean square of successive differences

(RMSSD), percentage of successive normal sinus RR intervals more than 50 ms (pNN50), high frequency (HF), Parasympathetic Index (PNSI), and Sympathetic Index (SNSI).<sup>7</sup> Repeated measures t-test analyzed mean HRV differences after OMT. Outliers were removed using 0.05 significance level.

**Results:** Post MET on cervical spine (OA, C1, and C2) showed significant ( $p<0.01$ ) increase in vagal tone related HRV variables compared to baseline.

**Conclusions:** MET targeting OA, C1, and C2 may increase vagal tone evident by enhanced HRV. Future directions address limitations including following duration of effect.

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### Effects of OMT on Blood Glucose and Insulin Sensitivity in Adult Male Rats

**Introduction/Background:** Blood glucose (BG) homeostasis is maintained via the autonomic nervous system, thoracolumbar diaphragm, abdominal lymphatic system, pancreas, liver, and adrenal glands. Our proof-of-concept study demonstrated the feasibility of performing osteopathic manipulative treatment (OMT) on adult rats. We hypothesized that osteopathic manipulation to the above areas in rodents will affect BG levels. Based on pilot data we also hypothesized that using isoflurane anesthetic affects blood glucose.

**Methods:** Two groups of 9 male rats were fed either a normal chow diet or a high-fat diet (HFD) to induce obesity and insulin resistance. Their weight and BG levels were monitored biweekly.

The rats were anesthetized using isoflurane. The treatment group received OMT (rib raising, diaphragmatic doming, and prevertebral ganglia, suboccipital, and thoracic outlet release). Sham group received a light touch. Control group received no treatment. BG was measured using a glucometer on blood from the tail pre-treatment and 5 and 15 minutes post-treatment. Paired t-testing was utilized to determine a significant difference in BG.

**Results:** Among HFD rats, BG levels increased at 5 and 15 minutes post-treatment. The percent change in BG from pre- to 15 minutes post-treatment was significantly higher than that from pre- to 5 minutes post-treatment ( $p < 0.001$ ,  $T = -4.50$ ).

**Conclusions and Discussion:** We found that blood glucose significantly increases in HFD rats with more time post-treatment. We recognize isoflurane may have a confounding effect, as time post-treatment directly correlates to isoflurane exposure. A larger population is needed to assess both acute and long-term effects of OMT on insulin sensitivity and BG homeostasis. Study limitations included rodent sex, age, weight, anesthesia usage, and

sample size. Future studies will use both males and females to account for size and temperament differences accompanying sex.

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### Stressbusters: Investigating the Effects of OMT on Stress Management in Medical Students

**Introduction/Background:** Recognizing that first-year osteopathic medical students often face high stress rates and burnout, primarily due to their demanding curriculum, our team conducted an IRB-approved study where we hypothesize that regular, weekly sessions of OMT can lead to a reduction in cortisol levels.

**Objectives:** Explore if regular osteopathic manipulative treatments (OMT) can reduce stress in first-year osteopathic medical students.

**Methods:** Our study involved 2 randomized groups of students: one received no treatment (control), and the other received OMT treatment with techniques geared to modulate the sympathetic and parasympathetic nervous systems in order to affect cortisol level changes. In order to measure stress, we collected weekly salivary cortisol samples at the same time in the afternoon each session and used changes in optical density (OD) as measured via ELISA.

Data analysis from the cortisol immunoassay revealed a significant decrease in weekly cortisol levels in the treatment group, with an average weekly OD change of 0.0215,  $c(SD = .0243)$ , compared to -0.0044 ( $SD = .0061$ ) in the control group. We used a twotailed, unpaired t-test and a U test for statistical analysis. The t-test showed a p-value of 0.0497, and the U test showed a p-value of 0.0317, both indicating a significant decrease in cortisol levels in the treatment group.

**Conclusion:** Our results suggest that targeted OMT can impact cortisol levels, and we encourage medical students to utilize OMT for stress management. We acknowledge the limitations of utilizing single measurements of cortisol, albeit with controlling time of collection. This is a pilot study aimed at establishing the plausibility of whether stress biomarkers can be affected by sympathetic regulation via OMT. ■