Spring 5-12-2017

A Comparison of Three Manipulative Therapy Techniques: CranioSacral Therapy, Muscle Energy Technique, and Fascial Distortion Model

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Introduction

Manual therapies are used in many different healthcare settings including physical therapy, occupational therapy, chiropractic, massage therapy, and osteopathic medicine. Traditional medicine focuses on the principles of evidence-based medicine that is guided by high quality randomized control trials to evaluate the effectiveness of an intervention for a group of people suffering from similar problems. Though this method is effective for evaluating treatments involving pharmacological interventions, manual therapies and interventions can be more difficult to evaluate using these criteria. Because of the difficulties encountered in designing high quality experiments involving manual therapies, there is a noticeable lack of high-quality evidence used to support use of these treatments. This leads many healthcare practitioners who use these manual therapies to rely on evidence-informed medicine instead of evidence-based medicine (Fryer, 2011). According to Fryer (2011) evidence-informed medicine is the "process of integrating research evidence when available but including personal recommendations based on clinical experience, while retaining transparency about the process used to reach clinical decisions".

Fryer (2011), further argues that there are downsides to relying solely on evidence-based medicine for treatment of patients and that "may unintentionally limit practice." He supports the idea of balancing clinical evidence with clinical experience and states that "a treatment effective for the majority may not always be effective for an individual." However, evidence and research are still very important aspects of choosing an effective treatment for a patient. According to Zegarra-Parodi (2016) evidence can "support the patient care process and enhance practice so optimal clinical outcomes and quality of life are achieved." It seems that the question does not involve if you should use evidence but more *how* you should use it to provide the best treatment for an individual.

Taking all of this into account is necessary when evaluating the evidence available supporting a treatment. The following discussion looks into one aspect to take into consideration when choosing a treatment - the evidence and research available - to evaluate the use of three different manual therapies used clinically: Craniosacral Therapy, Muscle Energy Technique, and Fascial Distortion Model.

CranioSacral Therapy

According to Upledger, Grossinger, Ash, and Cohen (2008), CranioSacral Therapy (CST) is “a gentle, hands-on method of whole-body evaluation and treatment that may have a positive impact on nearly every system of the body.” CST uses only about five grams of pressure to evaluate the central nervous system by testing the ease of motion and the quality of rhythm of cerebrospinal fluid pulsing within membranes. Cerebrospinal fluid is a fluid produced by the choroid plexus between the subarachnoid space throughout the brain and spinal cord. It has a role in immunological protection and mechanical protection. Specific CST treatments are employed to release restrictions or imbalances in sutures, fasciae, membranes, and other tissues. The cerebrospinal system is explained using a semi-closed hydraulic system as a pressure model to explain the miniscule movements of bones and tissues. The constant filling and reabsorption of the fluid pushes on bones and tissues. These movements (expansion and narrowing) cycle about six to twelve times per minute. Dr. John Upledger developed this method with other scientists through research that used Dr. Sutherland’s work as a basis in 1975 to 1983 (Upledger, et al., 2008).

The whole body is affected by the CST rhythm and a practitioner evaluates the amplitude, quality, rate, and symmetry at different locations on the body. This evaluation helps to find the primary area of dysfunction instead of focusing on symptoms. Gentle traction of the myofascial system and "arcing" (mechano-electrical monitoring by palpation) also facilitate this search. CST often involves noticing not just the abnormalities of the rhythm, but also complete lack of rhythm (Upledger, et al., 2008).

Treatment involves a gentle hold at any area of the body and wait for a release that can involve heat release, pulsing, muscle twitching, blinking, gurgling from the digestive system, softening of tissues, and changes in breathing patterns. Emotional releases can also accompany a physical release. Gentle touch is key in this treatment because once the touch becomes too heavy, the response of the patient's body moves from craniosacral or visceral to neuromuscular tension and stress patterns, in essence switching therapeutic modes (Upledger, et al., 2008). To an observer, CST appears to be simply the practitioner placing hands on the body and holding them there for a while. The patient usually appears to be quite relaxed sometimes even asleep. Physical and emotional releases can often be observed.

CST classes can be taken by anyone. However, to practice CST most states require a hands-on license. There are two different certification levels, techniques and diplomate. Both require an open-book essay exam, a closed-book proctored exam, and a practical / oral exam, and proof of a licensed healthcare professional. Techniques certification requires completion on CST 1 and CST 2 classes, and 75 ten-step protocol sessions. Diplomate requires completion of Advanced CST 1, a preceptorship, five case-history write-ups, and six hours of CST presentation or a published article on CST (www.upledger.com).

CranioSacral Therapy Research

Of the three manual therapies studied in this research, CST had the largest quantity of research available, especially up to date research. However, like all other manual therapies, CST research has its problems regarding the quality of the research. The difficulties of blinding researchers and participants leads to the majority of the research being heavily biased which negatively affects the quality of the studies. With only low quality evidence available, conclusions cannot be thoroughly drawn.

A couple of systematic reviews have been conducted. All used different research databases and had different inclusion criteria, but all were unable to provide support of using CST clinically. Backstrom (2000) not only looked at CST intervention and health outcomes, but also the pathophysiology of the craniosacral system. Thirty-three studies were used in the review. Seven studies showed a positive relationship between CST and health outcomes but had the lowest grade of evidence due to poor quality. One showed a negative relationship between CST and health outcomes. Many studies had very low reliability with a range of 0.02 to 0.20 of intraclass correlation coefficients. Twenty-two studies compared craniosacral dysfunction and pathophysiology. There were nine studies that support cranial bone minute movements and eleven studies that supported cerebrospinal fluid flow in a pulse-like manner. However, none of the twenty-two studies showed that cranial bones can be manually moved by CST or that CSF can be manipulated by CST. In 2012, two different systematic reviews were performed. Ernst found that several new randomized control trials had been published since the 2000 systematic review, but deemed two of them “fatally flawed” due to design flaws and unblinding. The other studies were also too flawed to provide adequate support for CST. Ernst also pointed out the flaws of the biological assumptions of CST using evidence from a couple studies including research by Downey (2006) that found no significant differences between baseline and distraction suture separation at any load, including force applied to cranial bones similar to that applied in CST (P >0.05). Ernst states that "there is insufficient evidence to suggest that CST has therapeutic effects beyond a placebo." Jäkel and von Hauenschild (2012) found that CST can improve pain and quality of life or general well-being in a systematic review that included seven studies. According to the standards of this review, most of the evidence was of moderate quality. It is mentioned that as compared to the systematic review by Ernst (2000), the quantity of studies has not improved, but the methodology of using more double blinded randomized control trials has improved. They concluded that, though methodology has improved providing increased support for the use of CST clinically, more research needs to be conducted to obtain more solid evidence.

There have been more studies published since these systematic reviews were performed. All of these studies are very well designed and have appropriate blinding and good control groups. Haller, Lauche, Cramer, Rampp, Saha, Ostermann, and Dobos (2016), used a double-blind randomized control trial study to assess the effects of CST on 54 patients with chronic neck pain. Measures of pain intensity, pain on movement, pressure pain sensitivity, functional disability, health-related quality of life, well-being, anxiety, depression, stress perception, pain acceptance, body awareness, patients' global impression of improvement, and safety were taken directly after treatment (week eight) and at a three month follow up (week 20). Pain intensity was significantly better in the CST group than the manual sham group at both week eight (P = 0.001) and week 20 (P = 0.003). At week eight, both pressure pain sensitivity and body awareness were significantly improved. In addition, at week 20 the CST group was significantly better than the sham group in measures of pain on movement, functional disability, physical quality of life, anxiety, and patients’ global movement. The use of a manual sham group allows for a double blind design that eliminates bias. This elimination of bias contributes to the high quality design and provides very good evidence for the use of CST clinically in patients with chronic neck pain.

Castro-Sánchez, Lara-Palomo, Matarán-Peñarrocha, Saavedra-Hernández, Pérez-Mármol, and Aguilar-Ferrándiz (2016) also published a randomized controlled trial involving CST and patients with chronic low back pain. Sixty-four patients with chronic low back pain were randomly divided into the CST group (received ten sessions) or the control group (received ten sessions of classic management). Classic massage protocol included techniques of soft tissue massage on the low back: effleurage, petrissage, friction, and kneading. Disability, pain intensity, kinesiophobia, isometric endurance of trunk flexor muscles, lumbar mobility in flexion, hemoglobin oxygen saturation, systolic blood pressure, diastolic blood pressure, hemodynamic measures, and biochemical estimation of interstitial fluid were measured at baseline, after treatment, and one month follow-up. There were no statistically significant differences between groups for disability ($p = 0.060$). However, patients receiving craniosacral therapy experienced greater improvement in pain intensity ($p \leq 0.008$), hemoglobin oxygen saturation ($p \leq 0.028$), systolic blood pressure ($p \leq 0.029$), serum potassium ($p = 0.023$) level, and magnesium ($p = 0.012$) than the control group.

Girsberger, Bänziger, Lingg, Lothaller, and Endler (2014) studied the effects of CST on the autonomic nervous system by observing heart rate variability in 31 patients with subjective discomforts using a cross-over design. Pre and post measurements of heart rate variability using standard deviation and total power showed a significant increase ($P < 0.05$, $P < 0.01$) in both parameters. While the control period did not show a significant increase. However, there were no significant differences between the control and experimental period (P >0.05). No changes in low frequency power/ high frequency power (sympathetic-vagal balance) were found in either period. There was a significant decrease in heart rate (P <0.01) after the experimental period compared to after the control rest period. The researchers concluded that CST had a favorable effect on autonomic nervous activity.

Elden, Östgaard, Glantz, Marciniak, Linner, and Fagevik Olsén (2013) studied the effect of CST in combination with standard treatment (counseling and information on pelvic girdle pain) versus standard treatment alone in 123 pregnant women with pelvic girdle pain. Pain intensity, sick leave, function, health-related quality of life, unpleasantness of pain, and assessment of the severity of pelvic girdle pain were measured. The group receiving both CST and standard treatment had significant improvement in morning pain, symptom-free women, and function over the group just receiving standard treatment. No other measures were significantly different.

Overall, there is a significant positive shift in the amount of quality evidence supporting the use CST clinically in recent years. The collective evidence from five years ago was obviously not enough to provide support for using CST, as was suggested by all the systematic reviews included in this research. However, the use of a manual sham control group has led to the ability to blind both researchers and participants in recent studies, which helps eliminate both researcher and participant bias leading to higher quality studies available. Currently, the evidence base for CST seems to be evolving from little to no evidence to moderate evidence to support its use clinically.

Muscle Energy Technique

According to Chaitow (2001), Muscle Energy Technique (MET) "uses careful positioning of an area of the body, followed by isotonic and isometric contractions of muscles to strengthen or relax hypertonic muscles". The practitioner controls the amount of force, direction, and duration of the movement. The practitioner also controls the movement of the joint, soft tissues, or limb to a different position occurs after or during the cessation of the contraction. Unlike many manual therapies that use a high velocity low amplitude approach, MET is more close to a low velocity variable amplitude approach (Chaitow, 2001). According to Chaitow (2001), elements of MET must always include: identification of a resistance barrier, use of isometric contraction, and response to that contraction which appears to facilitate easier movement to a new barrier. During the isometric contraction, the golgi tendon organ activation concurrently results in direct inhibition of agonist muscles. At the same time, a reflexive reciprocal inhibition takes place at the antagonistic muscles. During relaxation, agonist and antagonist muscles continue to be inhibited. This inhibition allows the joint to be moved further into the restricted range of motion.

MET was developed in the 1960s by osteopathic physicians T.J. Ruddy and Fred Mitchell Snr. Further refinements were applied by Karel Lewit, Vladimir Janda (Chaitow, 2001), and Fred Mitchell Jnr (Fryer, 2011).

One of MET's main objectives is to induce relaxation of hypertonic musculature by active contraction following the stretching of the muscle. This is similar to many other stretching systems applied by therapists. MET joins postisometric relaxation (latent hypotonic state of a muscle after isometric activity) and reciprocal inhibition (when one muscle is contracted, its antagonist is inhibited) methods with isokinetic techniques (direct contraction is resisted and overcome by the practitioner; involves stretching and/or breaking down of fibrotic tissue). MET uses a spectrum from mild isometric contractions that hardly involve active contraction to total strength contractions (Chaitow, 2001).

To an observer, MET appears to be the practitioner assisting the patient perform a stretch by either helping them to stretch further or providing resistance to the stretch. The patient usually has to expend some energy to get past the resistance provided by the practitioner. It is a very active treatment for both the practitioner and the patient.

MET classes are available from a wide variety of providers. Some require a manual therapy license, others do not. However, a manual-therapy license is required to practice MET. Many medical licenses including Chiropractors, Physical Therapists, Athletic Trainers, Occupational Therapists, Osteopathic Physicians, Medical Doctors, and Licensed Massage Therapists have a license to conduct manual-therapy.

Muscle Energy Technique Research

MET, like all other manual therapies, presents difficulties in finding quality research. The difficulty of blinding participants and researchers combined with difficulties developing an adequate control group are shown in the vast majority of the studies observed. MET also has a more unique difficulty of almost always clinically being used as part of a treatment package. This adds a complicated layer of determining the effect of MET treatment alone versus the effects of MET in combination with other modalities. Though there are a multitude of studies involving MET, the majority involve Gary Fryer, who has conducted many studies and written various professional reviews of MET.

In a Cochrane systematic review, Franke, Fryer, Ostelo, and Kamper (2016) found insufficient evidence to support MET as a successful treatment for low back pain. Their research included 12 different randomized controlled trials with a total sample of 500 participants. All of the studies were small (n = 20 - 72), only reported short-term outcomes, and were all evaluated to be at high risk of bias except one study. Comparisons across studies were made after dividing the studies according to acute or chronic low back pain and control group. Meta-analyses and GRADE assessment were performed and showed low-quality evidence that MET issued additional benefit compared to, or added to, other therapies on short-term pain outcomes. The researchers were unsurprised by the difficulty of finding quality research using only MET as a treatment because, clinically, MET is usually applied in an integrated approach with other manual and non-manual modalities (Franke, et al., 2016). The researchers also commented on the difficulty of applying valid blinding to practitioners and participants in nearly all manual therapy studies, which ultimately is a requirement for evidence to be evaluated as a low risk for bias (Franke, et al., 2016).

MET was found to be successful in improving glenohumeral joint (GHJ) range of motion in baseball players with a single treatment according to Moore, Laudner, Mcloda, and Shaffer (2011). Pre and post intervention GHJ horizontal adduction and internal ROM were measured in baseball players randomly assigned to MET for GHJ horizontal abductors (n = 19), MET for GHJ external rotators (n = 22), or control (n = 20). The MET for horizontal abductors had a significantly greater increase in GHJ horizontal adduction ROM post intervention compared to control ($P = 0.011$) and a greater increase in internal rotation ROM post intervention compared to both the MET for external rotators group ($P = 0.020$) and the control group ($P = 0.029$). No significant differences were found among the groups for any other variables (Moore, et al., 2011).

According to Koh and Seffinger (2016), MET is also a useful tool for long-term improvement in lateral epicondylitis when compared to corticosteroid injections (CSI). A total of

82 participants were randomly assigned to the MET group or the CSI group. Measurements of mean pain-free grip strength, mean pain scores (using VAS), and Disabilities of the Arm, Shoulder, and Hand (DASH) self-reported questionnaire scores were taken at baseline, six, 26, and 52 weeks. MET group received MET two times a week for four consecutive weeks and the CSI group was injected with one mL of triamcinolone acetonide (four mg/mL) plus one mL of 1% lidocaine (10 mg/mL), one cm distally from the lateral epicondyle. Compared with baseline scores, mean pain-free grip strength scores in the MET group were significantly lower than the CSI group at six weeks ($P = 0.005$) but higher at 52 weeks ($P = 0.007$). Mean pain scale scores were significantly higher in the MET group than the CSI group at six weeks ($P = 0.004$) but were significantly lower at 26 and 52 weeks ($P = 0.016$ and $P = 0.01$, respectively). There were no statistically significant differences between the groups in their DASH self-reported questionnaire scores. As a short-term treatment to reduce pain and return strength CSI is better suited than MET, but in the long-term MET is the better option to manage chronic lateral epicondylitis (Koh & Seffinger, 2016).

Fryer (2011) assesses MET using an evidence-informed approach instead of an evidence-based approach to evaluate MET clinical use for assessment of the spine and pelvis, treating dysfunctions of the spine and pelvis, and increasing muscle length. By applying biomechanical concepts with results of published studies, Fryer suggests that MET is plausibly an effective modality to treat pain, promote hypoalgesia, range of motion, improve lymphatic flow, reduce edema, and increase muscle extensibility but appropriate speculation and additional studies are needed. Fryer stresses the importance of combining clinical expertise with evidence-based research (2011). Fryer (2000) also discusses the importance of critical examination of MET at this time. He argues, “Many of the diagnostic tests used with this approach are not supported by a sound rationale." Fryer stresses the need for MET to be reevaluated. This appears to be consistent with the Cochrane systematic review (Franke, et al., 2016). Though Fryer (2000) criticizes the assessments involved with MET, he recognizes MET's therapeutic action. He offers a different biomechanical mechanism involving changes in connective tissues with post-isometric relaxation rather than the current explanation involving neurological mechanisms. He believes that MET needs revision in its practice and teachings and "to validate by research the theoretical basis and clinical efficacy of this popular technique to ensure its reputation and credibility for the future" (Fryer, 2000).

Since the critical appraisal of MET, Fryer has been involved in research using MET treatment for hamstring altered flexibility, suboccipital tenderness, gross trunk range of motion, contraction duration of atlanto-axial joint. These studies are very well designed, using researcher blindness whenever possible, large sample sizes, accurate statistics, and consistent control groups.

Ballantyne, Fryer, and McLaughlin (2003) found a significant increase in the range of motion at the knee ($p < 0.019$) with one application of MET whereas the control group (patients lie on the table for the same allotted time with no treatment) had no significant change. Hamilton, Boswell, and Fryer (2007) found no significant differences in pressure pain thresholds of the occipito-atlantal joint for asymptomatic patients between patients receiving high-velocity, low-amplitude manipulation (HVLA), MET, and a sham treatment control group. Within-group tests showed significant changes at 5 minutes post treatment in both the HVLA ($P < 0.01$) and the MET group ($P < 0.05$) but not the control group ($P = 0.35$). The MET group also had a significant change at the 30-minute interval ($P< 0.03$) but not in the HVLA or control group (Hamilton, et al., 2007). Lenehan, Fryer, and McLaughlin (2003) found a single application of

MET applied to the thoracic spine in the direction of restricted rotation to increase range of active trunk rotation ($p < 0.0005$) in asymptomatic patients as compared to a control group (patients enter room and sit on table but do not receive treatment). There was no significant improvement on the non-restricted side in either groups. Fryer and Ruszkowski (2004) found the five second isometric contraction MET showed significant improvements in rotation of the atlantoaxial joint ($P = 0.04$) over the control group. However, the 20-second isometric contraction MET did not show significant improvements over the control group. Finally, Smith and Fryer (2008) found that both MET with a 30 second post-isometric stretch phase and MET with a three second post-isometric stretch phase were effective in increasing hamstring extensibility which was measured using active knee extension after an initial application of MET and sustained improvement in a second application of MET one week later.

Hamstring strength and flexibility were also observed in a study by Choksi and Tank (2016) that found MET to be effective at improving hamstring strength and flexibility in patients with knee osteoarthritis. The study included 120 patients with unilateral involvement knee osteoarthritis who were randomly assigned to the MET group or the control group (not defined by author). The MET group received treatment five days a week for three weeks that included both conventional treatment and MET, while the control group received only conventional treatment over the same timeline. Hamstring flexibility was measured using the active knee extension test (AKE) and quadriceps strength was measured using the Delorme boot. Both pretest and posttest measurements were taken. Both groups showed significant improvement in hamstring flexibility and quadriceps strength from pretest to posttest scores ($p < 0.05$, and $p < 0.05$), and the MET group had more significant improvement in both measures than the control group ($p < 0.05$, and $p < 0.05$). The MET combined with conventional treatment was the more effective treatment as compared to conventional treatment alone (Choksi & Tank, 2016).

A few studies have compared MET to static stretching and a variety of control groups. Shadmehr, Hadian, Naiemi, and Jalaie (2009) found that both the static stretching group and the MET group significantly improved the shortness of hamstring muscles in women measured by passive knee extension test. There was no significant difference between groups. Mahajan, Kataria, and Bansal (2012) also found MET and static stretching to be significantly more effective at reducing pain intensity and increasing active cervical range of motion than conventional physiotherapy, with no significant differences between MET and state stretching groups.

Overall, there is a moderate amount of evidence from well-designed studies to support the clinical use of MET, mostly thanks to the recent research performed by Gary Fryer. Since his criticism about the lack of quality studies available in 2000, many new higher quality studies have been published. It is also important to note that clinically MET is typically used in conjunction with other techniques (Fryer, 2011). According to Fryer (2011), in several clinical trials that involved using MET in conjunction with other techniques pain and disability were significantly reduced. These studies contribute to the evidence supporting the use of MET as part of a "treatment package". More research is always needed to provide up to date support for the technique. Also more studies comparing MET to other similar treatments should be investigated in the future.

Fascial Distortion Model

Fascial Distortion Model (FDM) is a hands-on treatment model developed by Dr. Stephen Typaldos, DO, since 1991. It targets soft tissue and musculoskeletal injuries based on six different impairments to connective tissue. These include triggerbands, continuum disorders, cylinder distortions, herniated triggerbands, folding distortions, and tectonic fixations. A comprehensive physical assessment focusing on the patient's descriptions and body language to help guide the practitioner to the treatment. Treatment involves using force through a small surface area of the provider (usually the distal pad of the thumb) on the specific fascial area to be treated (Capistrant, 2013).

Triggerbands represent the most common impairment and are visually like seams that display a linear path and are associated with a burning or pulling pain. They are twisted bands of fibers and are usually presented by patients using one or two fingers in a sweeping or up and down motion. Treatment involves following the whole path to untwist or unfold fascia (Capistrant, 2013).

Continuum disorders manifest at attachment sites and transition zones between ligaments, tendon, or tissues, and bone. They are presented by patients as pain in one spot. They are common in plantar fasciitis and sprained ankles. Treatment includes applied force to transition fascia back to the bone (Capistrant, 2013).

Cylinder Distortions are more complicated and involve superficial circular fascia become tangled due to the combination of traction and compression forces with twisting or rotational forces. Patients have difficulty locating and presenting these distortions and often have a variety of different symptoms. They may squeeze an area that hurts not at a joint. Treatment involves untwisting the fascia (Capistrant, 2013).

Herniated Triggerpoints involve the breaching or bulging of deep tissues through the fascial plane. Patients present a very localized pain usually pointing with one or two fingers to a specific location. The pain is described as a deep ache. Treatment involves pushing the protruding tissue below the fascial plane. This problem is permanent unless treated (Capistrant, 2013).

Folding distortions occur at joints usually from severe pushing or pulling forces and decrease the protection mechanism against these forces. Fascia unfolds and then improperly refolds. Patients present with pain deep in a joint and often place their hand over the joint. The treatment is to take the fascia in the direction of the initial insult and take the folds out before it extends again. This problem is permanent unless treated and often multiple folding distortions can occur at one joint (Capistrant, 2013).

Tectonic fixations present when the fascial surfaces have lost their ability to glide. They are associated with stiff, fixated joints and a loss of range of motion. Treatment is manual pumping to move synovial fluid in the joint and applied force to encourage fascia to slide (Capistrant, 2013).

To an observer, FDM is quite interesting to watch. The practitioner usually uses a great amount of force from their whole body directed to the patient through the practitioner's thumb. Depending on the type of distortion, the thumb may stay in one place or travel along a line. The patient is usually in great pain, wincing and sometimes screaming because it hurts so much. Typically, the patient has red marks or bruising after the treatment but often immediate pain relief or increase in range of motion right after treatment.

To be able to practice FDM, a practitioner must attend a FDM principles course and then attend a seminar. Seminars are open to anyone who is licensed to do manual therapy including:

Chiropractors, Physical Therapists, Athletic Trainers, Occupational Therapists, Osteopathic Physicians, Medical Doctors, and Licensed Massage Therapists. Seminar information can be found at https://www.fascialdistortion.com/.

Fascial Distortion Model Research

Of all the manual therapies included in this research, FDM has the least amount of published studies available. The three studies available also have low quality designs. All of the research for FDM that is available publicly and published are included in this assessment. In all of the following studies, FDM was shown to improve pain and flexibility in a variety of impairments including tibial stress syndrome, chronic hamstring tightness, and frozen shoulder. Case studies (not published in a peer-reviewed journal) also show individual improvement in patellar dislocations and fibromyalgia.

According to Schulze, Finze, Bader, and Lison (2014) FDM is a potentially effective method for the treatment of medial tibial stress syndrome (MTSS) (shin splints). In a case control study, 32 patients used the visual analogue scale (VAS) to measure pain and were scored on the rate of maximum painless exercise tolerance. They were then treated with FDM on the crural fascia and were reassessed. Treatment was continued until full exercise tolerance or painlessness was achieved averaging 6.3 days on average. VAS pain score was significantly reduced ($P < 0.001$) from 5.2 to 1.1 as was exercise tolerance ($P < 0.001$) which moved from seven to two points (Schulze, et al., 2014).

Range of motion and flexibility is another area in which FDM may show significant improvement. Baird, Shumate, Tancredi, Cayce, and Wibbenmeyer (2014), conducted a study using 30 participants with current chronic hamstring tightness. Sit-and-reach test measurements were gathered before and after treatment to establish hamstring flexibility. A 15% increase in flexibility was achieved after a single FDM treatment (Baird, et al., 2014). No statistical data was performed on the data of this study.

Frozen shoulder was also shown to be treated quickly and efficiently with FDM. Fink, Schiller, and Buhck (2012) used a randomized single-blind controlled trial to assess the efficacy of FDM compared to manual therapy. Sixty patients were randomly assigned to receive either FDM or 'conventional' manual therapy (according to author) and were matched across groups in all outcome parameters, which included shoulder mobility, pain (using VAS), raw force and function (using Constant-Murley and DASH scores). Both groups showed significant improvement in all outcome parameters. However, FDM group had significantly more improvement, which presented at a significantly faster rate. The abduction ability (FDM = $150.2 \pm 37.2°$ and MT = $124.1 \pm 38.6°$) and ultimate improvement in abduction (FDM = 59.4°, 64% more than baseline and MT = 25.9°, 27% more than baseline) was significantly better in the FDM group as compared to the manual treatment group ($p < 0.01$). Raw force, functional handicap, and pain also showed the FDM group to have a significantly better result than the MT group, though the FDM group more frequently reported pain during the treatment (21/27 vs. 10/27, $p < 0.01$).

The following two case studies also show the effectiveness of FDM in individual instances of a patellar dislocation and fibromyalgia. However, these articles were not published in a peer-reviewed journal and therefore have not been edited and scrutinized by other medical scientists. These factors need to be taken in consideration when analyzing the overall scientific evidence supporting the use of FDM.

According to Capistrant (n.d.), a 14-year old female ballet dancer stumbled and twisted her knee, which caused her supporting leg to twist and dislocated her patella. She was unable to reduce the patella and unable to bend her knee. Emergency room evaluation provided manual therapy to reduce the patella. Orthopedic recommendation was to use crutches for seven to 10 days and then begin rehabilitation for three to six weeks. FDM assessment and treatment was used on the patient within 24 hours of the injury. Knee range of movement was 5 to 10 degrees of flexion and zero degrees of extension and pain was a 5/10. FDM assessment and body language of the patient indicated a triggerband along the medial and lateral aspect of the patella and continuum disorder at several specific areas on the inferior margin of the patella. A five-minute FDM treatment produced an immediate full ROM of the knee with flexion of 100 degrees and extension of zero degrees. During one week and one month follow-ups, the patient reported that she was able to dance without pain (Capistrant, n.d.).

According to Perkins (n.d.), FDM was successful in treating pain and restoring range of motion in a 62-year-old female with right axilla pain following a mammogram performed two weeks previously. The patient had a diagnosis of fibromyalgia syndrome for 12 years using pregabalin and duloxetine to stabilize. Upon physical exam, there was no axillary or supraclavicular lymphadenopathy and distal neurosensory exam was normal. Shoulder ROM was full to 180 degrees abduction and 90 degrees external rotation bilaterally with pain specific in the right posterior axilla. Internal rotation was to left T5 and limited to right T7. Cervical rotation was limited to 80 degrees but symmetric with full cervical flexion and extension. Using FDM assessment a painful one-centimeter nodule in the posterior axilla was treated using a subscapularis herniated triggerpoint. Instant pain relief occurred and full range of motion was restored immediately. Two week follow up showed continued resolution without recurrence (Perkins, n.d.).

Overall more research is needed to support using FDM clinically using an evidence-based model. The FDM research studies show the common problems of all manual therapy research, including potential for biased research due to inability to have both researcher and participant blinding, and difficulty establishing a quality control group. FDM may be more difficult than CST or MET when developing a quality control group due to the nature of the high amount of force used for treatment. FDM also lacks a quantity of research. The small number of studies available is hardly a sufficient number to provide evidence-based support of the clinical use of FDM.

Unlike CST and MET, there were no studies available explaining the physiological basis of FDM and little information could be found regarding the specific mechanism of the treatment of the fascial tissue.

Discussion and Conclusion

When considering the evidence component of evaluating clinical use of manual therapies of CST, MET, and FDM, there is a substantial lack of high quality research available to provide support at this time. This is likely due to several factors involving the complexities of conducting experiments with manual therapies using a pharmacological methodology. Historically, researcher and participant blinding to treatment or control groups has been very difficult to establish. Manual therapies do not easily lend themselves to the application of placebos. Unfortunately, blinding is an important component in eliminating bias in research studies and contributes crucially to the quality of the research. New methods of applying control “sham” treatment groups have helped to aid this problem. Future research will likely contain more high quality studies using these new methods. Nevertheless, there will still be limitations. Different practitioners practice manual therapies differently and patients may respond better to certain practitioners. Also, most manual therapies correct pain and pain is a very different experience for different individuals. There are many things that factor into how an individual feels pain and all these factors cannot possibly all be controlled for. This stresses the importance of treatment of an individual, not a group.

Another important factor to consider is the history of clinical evidence available. MET has been around the longest (1960s) of the three manual therapies and had very little evidence and research studies available until Gary Fryer made note of this in 2000 and since has published several studies contributing the bulk of the evidence available today. CST has also been around awhile (1970-80s) and had very little evidence pre-2013. The development of the sham control has allowed for the majority of the high quality evidence to have been published quite recently. FDM is the newest manual therapy of the three (1991) and has the least amount of research available and the least amount of high quality research available. This may be due the fact that it has not been around as long or the possibility that the nature of therapy itself with large amounts of force applied may add to the difficulty of establishing a good control group with participant blinding.

Solely evaluating the quality research available for these therapies, there is moderate support for CST, moderate support for MET, and minimal support for FDM use clinically. However, it is important to remember that when using an evidence-informed approach, other aspects besides research are important to consider when determining the best treatment for an individual patient.

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