



Dr. Chestnut's Research Review

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Chiropractic Adjustments Resolve Pain by Restoring Biomechanical and Neurophysiological Function

Bialosky et al. (2009) The Mechanisms of Manual Therapy in the Treatment of Musculoskeletal Pain: A Comprehensive Model. *Manual Therapy* 14(5):531-538.

This is a review paper written by physical therapists (PTs) and PT/PhDs who are openly recognizing that the mechanical force from adjustment/SMT “initiates a cascade of neurophysiological responses from the peripheral and central nervous system which are then responsible for the clinical outcomes.”

However, many of the statements made in this review are shockingly inaccurate and portray a very elementary, or perhaps deliberately misrepresentative, understanding of the literature regarding the effects of SMT/adjustment, and certainly a misrepresentation of the core chiropractic hypotheses. It is almost as if the authors are trying to misrepresent previous hypotheses with straw men which they then refute in an attempt to appear more evidence-based or scientific. As you read this review keep in mind that it was written in 2009 and keep in mind what you have read in my previous reviews of studies and papers published in the peer-reviewed literature prior to this paper, but inexplicably ignored by these authors.

Specifically keep in mind that the foundational identifying tenets of the chiropractic hypothesis regarding the effects of both VSC/joint dysfunction and adjustment/SMT has ALWAYS been that structure and function, or biomechanics and neurology, are in an indissoluble neurophysiological union. To suggest otherwise is disingenuous.

Abstract

“Prior studies suggest manual therapy (MT) as effective in the treatment of musculoskeletal pain; however, the mechanisms through which MT exerts its effects are not established. In this paper we present a comprehensive model to direct future studies in MT. This model provides visualization of potential individual mechanisms of MT that the current literature suggests as pertinent and provides a framework for the consideration of the potential interaction between these individual mechanisms.”

“Specifically, this model suggests that a mechanical force from MT initiates a cascade of neurophysiological responses from the peripheral and central nervous system which are then responsible for the clinical outcomes. This model provides clear direction so that future studies may provide appropriate methodology to account for multiple potential pertinent mechanisms.”

“Available evidence suggests manual therapy (MT) as effective in the treatment of musculoskeletal disorders including low back pain (Childs et al., 2004; Licciardone et al., 2003), carpal tunnel syndrome (Akalin et al., 2002; Rozmaryn et al., 1998), knee osteoarthritis (Deyle et al., 2000), and hip osteoarthritis (MacDonald et al., 2006).”

“Moreover, recent studies have provided even stronger evidence when participants are classified into sub-groups (Childs et al., 2004; Cleland et al., 2006). Despite the literature supporting its effectiveness, the

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mechanisms of MT are not established leading to a National Institutes of Health (NIH) call to specifically address this shortcoming (Khalsa et al., 2006).”

“A better understanding of the mechanisms of MT is necessary for several reasons. First, recent evidence suggests successful outcomes in MT are dependent on identifying individuals likely to respond rather than identification of a specific lesion. Subsequently, clinical prediction rules based on clusters of signs and symptoms have been proposed to identify responders to MT (Flynn et al., 2002; Cleland et al., 2007).”

“While helpful in directing clinical practice, an explanation is lacking as to why such patterns of signs and symptoms predicts successful clinical outcomes. Subsequently, the biological plausibility of current clinical prediction rules may not be established leading to concern for chance associations rather than causation.”

“A second benefit of the identification of MT mechanisms is the potential for increased acceptance of these techniques by health care providers. Despite the literature supporting the effectiveness of MT in specific musculoskeletal conditions, health care practitioners at times provide or refer for MT at a lower than expected rate (Bishop & Wing, 2003; Jette & Delitto, 1997; Li & Bombardier, 2001). The lack of an identifiable mechanism of action for MT may limit the acceptability of these techniques as they may be viewed as less scientific. Knowledge of mechanisms may promote more appropriate use of MT by healthcare providers.”

**Note that this has NEVER been a reason for lack of referral for drugs, injections, or surgeries! This is just one of many excuses used to maintain a monopoly of cultural authority and reimbursement for medical care or interventions used in conjunction with, rather than instead of, medical care.*

“MT likely works through biomechanical and/or neurophysiological mechanisms. A limitation of the current literature is the failure to acknowledge the potential for a combined effect of these mechanisms. For example, prior studies have noted individual biomechanical (Coppieters & Butler, 2007; Gal et al., 1997) and neurophysiological effects (DeVocht et al., 2005; Dishman & Bulbulian, 2000; Suter et al., 1999; Vicenzino et al., 1998) associated with MT; however the potential interaction of these effects is frequently overlooked.”

This is COMPLETELY ERRONEOUS! Chiropractors have been discussing the biomechanical, structural, AND neurological components of VSC for decades as well as the biomechanical, structural, and neurological effects of chiropractic adjustment/SMT.

“A consideration of the interaction between biomechanical and multiple potential neurophysiological effects necessitates a comprehensive model to synthesize the current literature and direct future research.”

Proposed Model

“We propose the following model which provides a compilation of the existing mechanistic literature of MT as a framework for interpreting current and conducting future mechanistic research (Figure 1). Briefly, this model suggests a mechanical stimulus initiates a number of potential neurophysiological effects which produce the clinical outcomes associated with MT in the treatment of musculoskeletal pain.”

“Biomechanical effects are associated with MT as motion has been quantified with joint biased MT (Colloca et al., 2006; Gal et al., 1997) and nerve biased MT (Coppieters & Alshami, 2007; Coppieters & Butler, 2007); however, the direct implication on clinical outcomes is questionable. First, only transient biomechanical effects

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are supported by studies which quantify motion (Colloca et al., 2006; Gal et al., 1997; Coppieters & Butler, 2007; Coppieters & Alshami, 2007) but not a lasting positional change (Tullberg et al., 1998; Hsieh et al., 2002).

This is a faulty conclusion. The fact that changes in motion are not synonymous with a lasting positional or alignment change is irrelevant. If motion can be restored (biomechanical change) which, as anyone familiar with the literature knows, also involves changes to scar tissue adhesions (structural change), changes to inflammatory mediators (biochemical change), and concomitant changes to nociception and proprioception input into the peripheral and central nervous system (neural change). These changes together also result in subsequent neural and hormonal and structural changes which occur in direct and indirect response to these SMT elicited changes.

“Second, biomechanical assessment is not reliable. Palpation for position and movement faults has demonstrated poor reliability (Seffinger et al., 2004; Troyanovich et al., 1998) suggesting an inability to accurately determine a specific area requiring MT.”

Another refuted conclusion. Palpation for position may not be reliable (or valid for that matter) but this has NEVER been a goal of chiropractic palpation. The goal of chiropractic palpation is to determine quality and quantity of motion (restriction) and the presence of allodynia or hyperalgesia (tenderness). Further, when palpation is standardized and the assessor confirms the presence of tenderness with the patient the reliability of palpation increases exponentially. The validity and reliability of palpation are now well established and, as point of fact, the clinical findings of restriction and tenderness as determined by palpation are considered the MOST VALID and RELIABLE clinical indicators regarding both the clinical need and the site (segment) for SMT/adjustment.

“Third, MT techniques lack precision as nerve biased techniques are not specific to a single nerve (Kleinrensink et al., 2000) and joint biased technique forces are dissipated over a large area (Herzog et al., 2001; Ross et al., 2004).”

A completely absurd and unfounded conclusion exposing a significant lack of knowledge and understanding of segmental motion unit neurophysiology. First of all, why would MT need to be specific to a single nerve? Ridiculous, unless of course you are still in the dark ages and talking about the foot on a garden hose model, which by the way, nobody is in the peer-reviewed literature at the time this article was written (2009) had been claiming for decades (if ever).

“Finally, studies have reported improvements in signs and symptoms away from the site of application such as treating cervical pain with MT directed to the thoracic spine (Cleland et al., 2005; Cleland et al., 2007) and lateral epicondylitis with MT directed to the cervical spine (Vicenzino et al., 1996).”

Clearly these authors have no concept of the fact that SMT can affect central mediation of pain, or that adjusting the thoracic spine affects joints that have longitudinal spinal muscles that also cross the cervical spine thus, based on Hilton's Law, adjusting the thoracic spine can affect a segmental motion unit that impacts the cervical spine.

“Collectively, the literature suggests a biomechanical effect of MT; however, lasting structural changes have not been identified, clinicians are unable to reliably identify areas requiring MT, the forces associated with MT are

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not specific to a given location and vary between clinicians, choice of technique does not seem to affect outcomes, and sign and symptom responses occur in areas separate from the region of application.”

Let me address these false statements one at a time. First, lasting changes to scar tissue adhesions have been identified. Second, clinicians are able to reliably identify areas requiring SMT, if they use standardized palpation to determine restriction and allodynia, third, the forces associated with SMT are may not be consistent but this is likely totally irrelevant, the only relevant question is whether or not any given force is adequate to break up scar tissue adhesions and/or restore motion and/or initiate changes to nociceptive and proprioceptive input, fourth, the fact that different techniques can elicit similar results is also irrelevant, the relevant question is whether or not different techniques involve adequate force or stimulation to elicit changes to motion and/or neurology, and fifth, the fact that there are sign and symptom responses in areas separate from the area of SMT is also irrelevant if a biologically plausible explanation exists as to why (Hilton's Law, etc as I mention above).

“The effectiveness of MT despite the inconsistencies associated with a purported biomechanical mechanism suggests that additional mechanisms may be pertinent. Subsequently, we suggest, that as illustrated by the model, a mechanical force is necessary to initiate a chain of neurophysiological responses which produce the outcomes associated with MT.”

It is incredibly misleading of these authors to put forward the idea that their hypothesis that the effects of SMT involve both biomechanical/mechanistic and neurological components is, in any way, novel. As I stated at the beginning of this review, the foundational identifying tenets of the chiropractic hypothesis regarding the effects of both VSC/joint dysfunction and adjustment/SMT has ALWAYS been that structure and function, or biomechanics and neurology, are in an indissoluble neurophysiological union. To suggest otherwise is disingenuous.

Neurophysiological Mechanism

“The proposed model accounts for the complex interactions of both the peripheral and central nervous system which comprise the pain experience. Current mechanistic studies of MT in humans are frequently unable to directly observe the central or peripheral nervous system.”

Why do these authors not cite the Song et al. (2006) or Haavik and Murphy (2007) papers I reviewed in October and November 2021, respectively? These authors appear to have deliberately ignored landmark studies from chiropractic researchers. Perhaps because these chiropractic researchers have been stating that the effects of SMT include both structural and functional (biomechanical and neural) components for years? My goodness Dishman was talking about this in JMPT in 1985!!

Peripheral mechanism

“Musculoskeletal injuries [including joint immobility] induce an inflammatory response in the periphery which initiates the healing process and influences pain processing. Inflammatory mediators and peripheral nociceptors interact in response to injury and MT may directly affect this process. For example, (Teodorczyk-Injeyan et al., 2006) observed a significant reduction of blood and serum level cytokines in individuals receiving joint biased MT which was not observed in those receiving sham MT or in a control group. Additionally,

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changes of blood levels of β -endorphin, anandamide, N-palmitoylethanolamide, serotonin, (Degenhardt et al., 2007) and endogenous cannabinoids (McPartland et al., 2005) have been observed following MT.”

“Finally, soft tissue biased MT has been shown to alter acute inflammation in response to exercise (Smith et al., 1994) and substance P levels in individuals with fibromyalgia (Field et al., 2002). Collectively, these studies suggest a potential mechanism of action of MT on musculoskeletal pain mediated by the peripheral nervous system for which mechanistic studies may wish to account.”

It is not clear what these authors mean by, or how they define, soft tissue biased MT (SMT) or mechanical or neurological biased SMT. These authors, though they do at least cite some references regarding the effects of SMT, appear to have arbitrarily categorized different types of, and thus theories of, SMT. The problem is they offer no explanation or references for such categorization.

What this paper reveals to me, and why I chose to review it, is the vast difference between the amount of knowledge and familiarity with the SMT literature, and how differently SMT is perceived, between physical therapy and chiropractic. Chiropractic, almost certainly because its primary focus is SMT, is clearly far more advanced in understanding and delivery of SMT. Just compare this paper to those I have reviewed in the last few months, and those I will review in the coming months. The contrast is stark and I hope makes the reader understand that the claim that chiropractors are the practitioners with the most knowledge, expertise, and training in SMT and, in fact, spinal healthcare, is objectively and provably true and not just a subjective opinion.

Spinal mechanisms

“MT may exert an effect on the spinal cord. For example, MT has been suggested to act as a counter irritant to modulate pain (Boal & Gillette, 2004) and joint biased MT is speculated to “bombard the central nervous system with sensory input from the muscle proprioceptors (Pickar & Wheeler, 2001).” Subsequently, a spinal cord mediated mechanism of MT must be considered and is accounted for in the model. Direct evidence for such an effect comes from a study (Maliszka et al., 2003b) in which joint biased MT was applied to the lower extremity of rats following capsaicin injection. A spinal cord response was quantified by functional MRI during light touch to the hind paw. A trend was noted towards decreased activation of the dorsal horn of the spinal cord following the MT. The model uses associated neuromuscular responses following MT to provide indirect evidence for a spinal cord mediated mechanism. For example, MT is associated with hypoalgesia (George et al., 2006; Mohammadian et al., 2004; Vicenzino et al., 2001), afferent discharge (Colloca et al., 2000; Colloca et al., 2003), motoneuron pool activity (Bulbulian et al., 2002; Dishman & Burke, 2003), and changes in muscle activity (Herzog et al., 1999; Symons et al., 2000) all of which may indirectly implicate a spinal cord mediated effect.”

Supraspinal mechanisms

“Finally, the pain literature suggests the influence of specific supraspinal structures in response to pain. Structures such as the anterior cingulate cortex (ACC), amygdala, periaqueductal gray (PAG), and rostral ventromedial medulla (RVM) are considered instrumental in the pain experience. (Peyron et al., 2000; Vogt et al., 1996; Derbyshire et al., 1997; Iadarola et al., 1998; Hsieh et al., 1995; Oshiro et al., 2007; Moulton et al., 2005; Staud et al., 2007; Bee & Dickenson, 2007; Guo et al., 2006). Subsequently, the model considers potential

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supraspinal mechanisms of MT. Direct support for a supraspinal mechanism of action of MT comes from (Malisza et al., 2003a) who applied joint biased MT [what is joint biased MT??] to the lower extremity of rats following capsaicin injection. Functional MRI of the supraspinal region quantified the response of the hind paw to light touch following the injection. A trend was noted towards decreased activation of the supraspinal regions responsible for central pain processing. The model accounts for direct measures of supraspinal activity along with associated responses such as autonomic responses (Moulson & Watson, 2006; Sterling et al., 2001; Vicenzino et al., 1998) (Delaney et al., 2002; Zhang et al., 2006), and opioid responses (Vernon et al., 1986) (Kaada & Torsteinbo, 1989) to indirectly imply a supraspinal mechanism.”

Limitations of Proposed Model

“The model is intended to be applicable to all forms of MT. While the biomechanical application of joint biased, soft tissue biased and nerve biased MT are different, the related neurophysiological responses are similar and adequately encompassed within the model given the current state of knowledge.

Again, NO DEFINITION of joint biased, soft tissue biased, or nerve biased MT or SMT?? The authors never define these terms or even provide any explanation of how or why they use the terms? Further, the model they propose is simply a compilation of the different effects of SMT or MT, which, has been the foundation of the chiropractic model of both VSC and Adjustment/SMT for DECADES!

“The proposed model provides a platform to empirically test hypotheses related to different biomechanical and neurophysiological effects specific to types of MT, an area that is currently lacking in the literature. The proposed comprehensive model is intended to explain the mechanisms of MT on musculoskeletal pain. MT has a postulated role in the treatment of disorders of other body systems such as asthma (Balon & Mior, 2004) and high blood pressure (Plaugher & Bachman, 1993); however, those effects are beyond the scope of the current model. Finally, this model is strictly intended to guide research questions regarding the mechanisms of MT. A body of literature already exists suggesting the effectiveness of MT. The proposed model is intended to compliment and provide underlying explanations to the existing body of literature suggesting the effectiveness of MT.”

I'm not sure why these authors cannot put together the very simple idea that moving a motion segment, by definition, involves all components of a motion unit including the muscles, joint capsule, tendons, ligaments, muscles, proprioceptors, nociceptors, and all associated afferent nerve pathways, affected brain areas, and associated efferent pathways and autonomic and hormonal changes. SMT stimulates proprioceptors that pre and post-synaptically inhibit nociception (and thus potentially pain) at the spinal cord, proprioception can also stimulate descending pain inhibition pathways in the spinal cord and in the brain, proprioception can also result in autonomic and hormonal and biochemical changes that can reduce pain. Further, SMT can resolve scar tissue, resolve inflammation, and restore segmental motion which can then also chronically produce more proprioception and less nociception. SMT also restores sensory-motor pathways and which, when distorted, can also be a source of pain. Dishman outlined this in his 1985 JMPT paper and Seaman outlined this in INTRICATE DETAIL in his 1997 and 1998 JMPT papers which I reviewed in my Sept 2021 Research Review.

I'm just not sure why these authors are pretending that anyone else that studies a particular aspect of SMT thinks that whatever aspect is being looked at in a particular study design, is claimed to be the sole impact of

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SMT. This is not a fair representation of the literature. Yes, there are some researchers that have tried to limit the effects of SMT to pain, ironically and absurdly as they also claim that SMT has no neural component, but this is based much more on politics than science. The science is clear, the effects of motion unit dysfunction/VSC and therefore of SMT which resolves motion unit dysfunction/VSC, are multifaceted and certainly involve all the aspects of VSC as originally put forward in the chiropractic literature 40 years ago.

This paper, to me, represents an attempt to misappropriate the original foundational models that chiropractic had been espousing for decades. To quote the authors regarding what they claim is their “new model”, “Specifically, this model suggests that a mechanical force from MT initiates a cascade of neurophysiological responses from the peripheral and central nervous system which are then responsible for the clinical outcomes.”

To claim this as their novel hypothesis for physical therapy is akin to China coming to North America and planting a flag and claiming it as their own because they claim they just discovered it – or, for a real-life example, for Britain coming to North America, or Spain to South America, and making such claims.

The truth is that, in 2009 when this paper was written, Physical Therapy, and physical therapists, were faced with the unenviable position of having virtually no evidence-based interventions, having ridiculed chiropractors for focusing on SMT, and now being confronted with the harsh reality that incorporating SMT was their only hope of having an evidence-based intervention. So, physical therapy was moving toward looking at the entire neurophysiological spectrum regarding the effects of VSC/SMT in order to bring scientific credibility to SMT at a time when many chiropractic researchers chose to focus entirely on pain and claim there was no neural component to chiropractic. Good grief!

I think it is important to note that physical therapists have realized that looking at the neurophysiological aspects of SMT in a way that mimics the foundational chiropractic models of VSC/adjustment is, indeed, the best strategy to scientifically legitimize SMT. Something many chiropractic researchers and schools could learn from!

We are in the midst of a tremendous opportunity with respect to making the public and our patients realize the central importance of maintaining baseline health vs treating sickness. Never before has this undeniable truth been so obviously apparent. The COVID-19 pandemic is a syndemic of a current chronic illness pandemic and a novel respiratory illness. The chronic illness pandemic is a chronic unhealthy lifestyle pandemic, it is a pandemic of deficient baseline health. Medicine has no answer for improving baseline health. YOU DO!!

Happy 2022 everybody, stay the course, keep practicing evidence-based chiropractic and lifestyle. What you offer provides patients the best possible chance to improve baseline neuromusculoskeletal and overall health and immune function which, in turn, provides the best chance to deal with COVID-19 or any other health challenge. Healthy people are not threatened by COVID-19, sick people are. The only way to get and stay well is to Eat Well – Move Well – Think Well® and the evidence-based chiropractic and lifestyle protocols provide the most evidence-based clinical intervention protocol to get patients to Eat Well – Move Well – Think Well®.

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Read and practice well my esteemed, evidence-based, ethical, learned expert chiropractic colleagues.

Talk to you next month.

Dr. C.