Published in final edited form as:
J Electromyogr Kinesiol. 2012 October ; 22(5): 643–647. doi:10.1016/j.jelekin.2011.11.014.

Basis for spinal manipulative therapy: A physical therapist perspective

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Abstract

Physical therapists internationally provide spinal manipulative therapy (SMT) to patients with musculoskeletal pain complaints. SMT has been a part of physical therapist practice since the profession's beginning. Early physical therapist clinical decision making for SMT was influenced by the approaches of osteopathic and orthopedic physicians at the time. Currently a segmental clinical decision making approach and a responder clinical decision making approach are two of the more common models through which physical therapist clinical use of SMT is directed. The focus of segmental clinical decision making is upon identifying a dysfunctional vertebral segment with the application of SMT to restore mobility and/or alleviate pain. The responder clinical decision making approach attempts to categorize individuals based on a pattern of signs and symptoms suggesting a likely positive response to SMT. The present manuscript provides an overview of common physical therapist clinical decision making approaches to SMT and presents areas requiring further study in order to optimize patient response.

Keywords

Physical therapy; Spinal manipulation; Manual therapy; Pain

1. Introduction

Physical therapists internationally provide spinal manipulative therapy (SMT) to their patients. In the United States, SMT is a required component of the physical therapist entry level education process and a part of standard physical therapist practice (Guide to Physical Therapist Practice Second Edition, 2001; A Normative Model of Physical Therapist Professional Education: Versino, 2004). Physical therapists typically include SMT within a comprehensive treatment approach in combination with therapeutic exercise (range of motion, flexibility, strengthening) and physical modalities (moist heat, electrical stimulation, ultrasound). SMT is provided for musculoskeletal complaints in physical therapist practice. The focus of the physical therapist assessment is typically upon determining, "the impact of musculoskeletal conditions on function at the level of body system (with emphasis on the

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Conflict of interest

We acknowledge we have no conflict of interest or financial involvement with any commercial organization that has a direct interest in any matter included in this manuscript.

movement system) and the level of the whole person (disability)" (American Physical Therapy Association, 2009). Interventions, including SMT, are then generally applied with the intention of improving impairments related to pain, range of motion, strength, and function. The following commentary will provide a brief history of the use of SMT by physical therapists. Next, we will provide an overview of physical therapist clinical decision making approaches to the use of SMT. Finally, we will discuss future areas of focus as the physical therapy profession moves forward as a provider of SMT.

2. History

Physical therapists became registered as a professional organization in Britain in 1894 and the United States in 1921 with physical therapy schools established in New Zealand, Australia and the United States prior to World War 1. The application of manual techniques by physical therapists including SMT traces back to this time and is described in the profession's early literature (Paris, 2006). The clinical use of SMT by physical therapists was historically influenced by medical doctors and osteopaths with early physical therapist training in SMT provided by physicians to allow for referral of patients to these trained practitioners. Specifically, educators of the American and British Schools of Osteopathy provided training to physical therapists in SMT during the 1920s (Huijbregts, 2010; Pettman, 2007). Additionally, orthopedic physicians such as James Mennell, James Cyriax, and Allan Stoddard heavily influenced the physical therapy clinical decision making approach to SMT. Physical therapists such as Freddy Kaltenborn, Geoffrey Maitland, Stanley Paris, Gregory Grieve, David Lamb all trained under or were influenced by these orthopedic physicians (Paris, 2006, 2000). These men along with others were instrumental in bringing the osteopathic and orthopedic clinical decision making approaches to physical therapy practice and in adapting these approaches in ways unique to physical therapists.

3. Physical therapist clinical decision making for SMT

The mechanisms through which SMT alters musculoskeletal pain are unknown; however current evidence suggests an interaction between mechanical factors (i.e. movement and forces) and associated neurophysiological responses to these mechanical factors (Bialosky et al., 2008; Pickar, 2002). A physical therapist clinical decision making approach to SMT is guided by both mechanical and neurophysiological considerations. Traditionally, physical therapist clinical decision making approaches to SMT are segmental with an emphasis on identifying a dysfunctional vertebral level and applying SMT to restore motion and/or alter pain. More recently a trend has emerged towards identifying signs and symptoms of an individual likely to respond favorably (i.e. experience positive clinical outcomes) to SMT.

3.1. Segmental clinical decision making

SMT is associated with force and movement to the spine (Gal et al., 1997; Herzog et al., 2001). Physical therapists have historically relied upon a biomechanical philosophy as one basis for the clinical use of SMT both as directed by early physician mentors and after incorporating their own unique clinical decision making approaches. For example, Freddy M. Kaltenborn, a Norwegian physical therapist applied arthrokinematics to manual therapy with assessment based upon perceived abnormalities in translatory, compressive, and distractive joint mobility. Kaltenborn suggested limitations in range of motion were associated with stereotypical deficits in translatory movement of the joint surfaces based upon their shape (convex–concave rule) (Kaltenborn et al., 1999). Restoration of joint surface translation through the application of manual therapy forces was surmised to result in improved range of motion and other favorable clinical outcomes (Kaltenborn et al., 1999). Similarly, Stanley Paris, a physical therapist from New Zealand, theorized loss of joint motion results in degenerative changes (Paris, 2000) and advocated SMT for the treatment of joint dysfunction in order to restore joint mobility and range of motion (‘PARIS MANUAL’ Paris, SV. Introduction to Spinal Evaluation and Manipulation, Seminar Manual. University of St. Augustine, 1999). Collectively these clinical decision making approaches advocated the assessment of individual joints with SMT applied to restore specific movement losses.

The mechanical effect of SMT is associated with neurophysiological responses related to changes in pain sensitivity (Bialosky et al., 2009; Fernandez-Carnero et al., 2008). In addition to mechanical restriction related to joint mobility, the physical therapist clinical decision making approach to SMT is also guided by neurophysiological responses to the thrust related to changes in pain, range of motion, and muscle function. For example, Geoffrey Maitland, an Australian born physical therapist, incorporated arthrokinematic assessment with an emphasis on pain response to passive movement (Maitland et al., 2005). Maitland’s clinical decision making approach includes SMT interventions of varying magnitudes of translatory, compressive, and distractive forces to the joints with the goal of alleviating pain (Maitland et al., 2005). Furthermore, New Zealand born physical therapist Brian Mulligan introduced the concept of mobilization with movement in which translatory forces are applied to the joints during active movements with the goal of alleviating pain during movement (Mulligan, 2010). Similarly, Australian born physical therapist Brian Edwards emphasized assessment of range of motion and pain response during combined biomechanical movements to guide the use of manual techniques including SMT (Edwards, 1979). Collectively these clinical decision making approaches incorporate biomechanical assessment of individual joints with an emphasis on neurophysiological mechanisms related to pain response in both the assessment and intervention stages.

3.2. Limitations of the segmental clinical decision making

The traditional physical therapist clinical decision making approaches are dependent upon identification of specific joint dysfunction related to loss of motion or hypersensitivity to pain followed by the application of a specific SMT to restore joint motion and/or alleviate pain response. This model is dependent upon accuracy in determining a dysfunctional vertebral motion segment; however, the literature suggests poor reliability of the assessment techniques. For example, poor to fair inter-rater reliability for spinal mobility testing has been observed (van et al., 2005; Seffinger et al., 2004) and these findings are not improved with training, experience or discipline (Seffinger et al., 2004; Billis et al., 2003). Additionally, the traditional clinical decision making approach necessitates the correction of a specific dysfunction with a specific technique; however, SMT is not specific to a given segment (Kulig et al., 2004; Lee and Evans, 1997). Specifically, the force of SMT is spread over multiple segments (Herzog et al., 2001) and the cavitation (or pop) frequently accompanying these interventions often occurs at segments other than the intended site (Ross et al., 2004). Furthermore, the chosen technique does not correspond to clinical outcomes. For example, clinical outcomes are similar for SMT of varying mechanical parameters (Cleland et al., 2009) and whether the specific SMT is determined by examination findings or randomly chosen (Chiradejnant et al., 2003). Collectively, these studies suggest a general biomechanical effect of SMT as opposed to an effect specific to a targeted segment. Furthermore, these studies suggest improved clinical outcomes correspond to the application of SMT rather than a specific segmental clinical decision making approach. SMT is an effective intervention for some individuals with musculoskeletal complaints (Chou and Huffman, 2007) despite these inconsistencies suggesting the possibility of a more general mechanism and non- segmental clinical decision making approach.

3.3. Responder clinical decision making

A more recent development in clinical research into manual physical therapy is classification a (2000; Rushton and Moore, 2010). Classification may be warranted because many clinical conditions for which SMT is applied are heterogeneous but lack definitive indicators of pathology. For example, an anatomic cause of low back pain is identifiable in the minority of cases (Koes et al., 2006; Chou et al., 2007). Subsequently, studies of interventions for these conditions often result in a heterogeneous sample and null findings or small effects (Fritz et al., 2007). Classifying individuals likely to respond to a given intervention provides a more homogeneous sample with the potential for findings of larger magnitude and greater clinical relevance (Delitto, 2005). Similarly in clinical practice, classification allows physical therapists an opportunity to provide SMT to individuals likely to respond positively.

Clinical prediction rules have been advocated for use in identifying responders to SMT (Cleland et al., 2007; Flynn et al., 2002). Clinical prediction rules incorporate findings from the entire clinical evaluation including history and examination, to improve the accuracy of the patient’s diagnosis and prognosis (McGinn et al., 2000). For example, a clinical prediction rule for individuals with low back pain likely to respond rapidly to SMT found 5 variables of significance. (1) pain duration of less than 16 days, (2) fear avoidance beliefs work subscale score of less than 19, (3) hip internal rotation on one side of at least 35 degrees, (4) lumbar spine hypomobility, and (5) pain not extending below the knee (Flynn et al., 2002). The likelihood of experiencing a significant improvement in clinical outcomes was dramatically improved in individuals meeting 4 of the 5 clinical prediction rule criteria. Subsequently, clinicians can expect a much greater success rate if they use SMT on patients meeting the clinical prediction rule. Furthermore, treatment efforts may be better served by considering other interventions for patients not meeting the clinical prediction rule.

Clinical prediction rules specific to SMT have been developed for individuals with neck pain likely to respond positively to thoracic (Cleland et al., 2007) or cervical SMT (Tseng et al., 2006); individuals with shoulder pain likely to respond favorably to thoracic SMT (Boyles et al., 2009); and individuals with patellofemoral pain likely to respond favorably to lumbopelvic SMT (Iverson et al., 2008). Current mechanistic models for SMT suggest an interaction between biomechanical and neurophysiological mechanisms (Bialosky et al., 2008; Pickar, 2002). Additionally, clinical outcomes related to rehabilitation interventions likely result from factors related to the patient, the treating clinician, and the patient (Whyte and Hart, 2003). A responder clinical decision making approach considers multiple potentially relevant factors to direct the use of SMT. For example, the previously mentioned clinical prediction rule for individuals with low back pain likely to respond positively to lumbar SMT (Flynn et al., 2002) includes both bio-mechanical factor (lumbar spine hypomobility and hip internal rotation range of motion) and a psychological factor (fear avoidance beliefs). The benefit of clinical prediction rules is the organization of signs and symptoms to identify individuals likely to respond positively to SMT. Reliance is not on individual tests and measures of questionable reliability and validity as is the case with segmental clinical decision making. Rather, a pattern is developed indicative of an individual likely (or unlikely) to respond positively to SMT. The physical therapist must decide whether other interventions would be more appropriate or whether other factors suggest a likely benefit from SMT in patients not meeting the clinical prediction rule (Stanton et al., 2011).

3.4. Limitations of the responder clinical decision making

A major limitation of the clinical classification is the black box approach (Whyte and Hart, 2003). Specifically, while classification assists in identifying individuals likely to respond to

SMT, the mechanism behind their response is unknown. Subsequently, relevant predictor variables may be missed due to failure to include them in the initial analysis and variables identified as relevant may be indicative of a general positive prognosis (Hancock et al., 2009). Clinically problematic is the potential for lack of individual fit within the limited scheme of a specific system or redundancy in classification (Stanton et al., 2011).

McGinn et al. (2000) proposes a 3-step process when developing a clinical prediction rule: (1) creating the rule, (2) validating the rule, and (3) determining the clinical impact of the rule. Clinical prediction rules developed from derivation studies or studies without control groups are potentially indicative of individuals with a favorable general prognosis rather than prognostic for a specific intervention (Hancock et al., 2009). Furthermore, factors included in the derivation studies cannot be assumed to remain predictive in the absence of validation studies. In one instance, the clinical prediction rule for individuals with low back pain likely to respond to SMT (Flynn et al., 2002) was validated in later studies (Childs et al., 2004; Cleland et al., 2009). Conversely, a clinical prediction rule for thoracic SMT for individuals experiencing cervical pain (Cleland et al., 2007) was not validated in a follow up trial (Cleland et al., 2010). Subsequently, clinical prediction rules require validation in a separate sample using a randomized control trial design. Recent systematic reviews of clinical prediction rules for physical therapy found only 1/10 included studies taken to a validation study (Beneciuk et al., 2009) and no clinical impact studies (Haskins et al., 2011). Subsequently, the use of clinical prediction rules for decision making requires further study (Haskins et al., 2012).

4. Future directions

A priority for future research is determining the mechanisms of SMT. A better understanding of the mechanisms through which SMT alters pain may provide better a priori variable selection for identifying factors likely prognostic for individuals expected to respond favorably to SMT and a better understanding of the biological plausibility of significant variables. The mechanisms of SMT are likely related to an interaction between biomechanical factors and associated neurophysiological responses (Bialosky et al., 2008; Pickar, 2002). Neurophysiological responses to SMT include immediate changes in pain sensitivity (Bialosky et al., 2009; Fernandez-Carnero et al., 2008), afferent discharge (Colloca et al., 2003; Pickar and Kang, 2006), motor activity (Dishman et al., 2008; Herzog et al., 1999), and somatosensory evoked potentials (Haavik-Taylor and Murphy, 2007; Taylor and Murphy, 2010) suggesting potential mechanisms related to changes in central nervous system response or processing of afferent input. Studies have quantified isolated mechanical (Gal et al., 1997) and neurophysiological (Colloca et al., 2000; Dishman and Bulbulian; 2000; Herzog et al., 1999) effects of SMT; however, the interaction of these effects has not been extensively studied. For example, the influence of the speed, force, or direction of an SMT upon the related neurophysiological response requires further investigation. Segmental clinical decision making for SMT emphasizes assessment and treatment of specific vertebral dysfunction; however, current evidence suggests the effectiveness of SMT regardless of the type of technique provided in the appropriate patient (Cleland et al., 2009). Further studies are needed to clarify these findings and will assist clinicians in determining whether the specific mechanical parameters and location of SMT are relevant or whether simply providing a thrust to the proper patient is adequate.

5. Conclusion

SMT has been a part of physical therapy since the start of the profession. Early physical therapist clinical decision making for SMT was heavily influenced by the attitudes of osteopathic and orthopedic physicians. Physical therapist have embraced these methods and developed their own. Physical therapist clinical decision making for SMT traditionally emphasized a segmental approach in which SMT was applied to restore mobility and/or alleviate a painful response in a dysfunctional vertebral level. More recently, some physical therapists have turned towards clinical decision making considering individuals likely to experience a positive response to SMT. Future studies should focus on the mechanisms of SMT and specifically the interaction between the mechanical effect and resulting neurophysiological mechanisms. A better understanding of the mechanisms of SMT should result in more efficient application of these interventions by clinicians and improved patient outcomes.

Acknowledgments

This manuscript was written while JEB received support from Rehabilitation Research Career Development Program (5K12HD055929-02) and MDB and SZG received support from the National Center for Complimentary and Alternative Medicine (5R01AT006334).

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