Special issue on spine neuromuscular control

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Why do a special issue on spine neuromuscular control?

Chiropractic research capacity in Canada, the United States and throughout the world has undergone tremendous development over the past 15 years. Unique to Canada is that chiropractors who are also full-time researchers, play an important role not simply in chiropractic teaching institutions (Université du Québec à Trois-Rivières and Canadian Memorial Chiropractic College), but they have also been integrated into more than a dozen research intensive universities throughout the country. Several of such researchers have expertise in biomechanics, motor control and neurophysiology.[1]

The chiropractic profession, especially in Canada, has supported the development of research, firmly believing that basic science, innovation and professional development are intertwined. Given the increasing number of chiropractic researchers in these closely related fields of fundamental research, the Journal of the Canadian Chiropractic Association (JCCA) invited a number of chiropractic clinician-scientists to submit their most recent and innovative work to a special issue dedicated to spine neuromuscular control. In this unique issue of the JCCA, the often uneasy and perhaps cloudy relationship between basic and applied chiropractic research will be explored, with a particular focus on spine neuromuscular control mechanisms.

Spine neuromuscular control has remained a topic of interest throughout chiropractic's history. In the early years of the profession, communication between the central and the peripheral nervous systems, as well as the afferent and efferent control mechanisms between the central nervous system and the spinal joints were key features of the chiropractic theories.[2] As illustrated in the following quotation, Verner's (1941)[3] views of the possible mechanisms governing spinal function were, in the early 1940s, not too far from our contemporary understanding of spinal neuromuscular control.

> *"Anatomical disrelation may be perpetuated through the somatic reflex arc, in some people. For example, a contracted muscle may irritate its own afferent nerve, which in turn may stimulate its own motor nerve. Thus the contraction may be perpetuated indefinitely in some people."*

Based on the anatomy and physiology knowledge of the time, and since chiropractic was primarily theory driv-

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en during its early years, several ideas and theories were put forward regarding its mechanism. Only one final step needed to be taken: conduct research that could test the different theories and the related hypotheses.

When compared to other health professions, research is relatively new to chiropractic and I (MD) have once suggested that its value resides mostly in the credibility and recognition gained by engaging, as a profession, in the act of research.[4] In 2014, we can undoubtedly state that the chiropractic profession has firmly tackled the challenge of engaging in research. Chiropractic researchers have made significant contributions to our understanding of spine neuromuscular control. The goal of the present JCCA special issue is to introduce and highlight contemporary research in the field of spine neuromuscular control and other related topics. By focusing on research areas related to our profession, and by showcasing the work of chiropractic researchers and their collaborators, we hope that clinical scientists, field practitioners and patients will discover (or rediscover) the breadth of expertise developed throughout the last decade as well as the most recent advances in fundamental and applied chiropractic research.

What will you find in this special issue of the JCCA?

The contents of the present issue represent the spectrum of approaches to research. The central theme is approached from methods including case studies, animal models, experimental studies, treatment interventions and narrative reviews.

The muscular response to both injury and spinal manipulative therapy (SMT) is explored. Mang, Siegmund, and Blouin induce whiplash and consider the role of a startle response using electromyography (EMG) outcome measures. The muscle impact from facet joint dysfunction is evaluated by Reed, Pickar and Long. Pagé, Nougarou, Dugas and Descarreaux consider the muscle response associated with mechanically delivered SMT in humans, while Cao and Pickar look at the muscle response from an animal model utilizing mechanically delivered SMT.

A distinction should be made that the mechanically delivered SMT was not from devices intended for immediate commercial use, but rather they are robotic laboratory-based systems that can deliver precise and consistent force, amplitude/depth of thrust and duration of thrust. Consistency of the characteristics of the thrust is essential in order to isolate the variability of the findings to that of the body's response to the intervention. An alternate approach to the ones mentioned in this issue would be to have a mechanical model, upon which a clinician manually thrusts, so the only variability measured is that of the clinician. If the thrust were manually delivered to an animal or human patient, or if the instrument was a "hand held" device, the approach would measure the combined variability of the thrust delivery coupled with the variability of the response of the body. A method to tease out the significance of that combined variability in a non-thrust style of spinal manipulation was utilized by Gudavalli and Cox. They compared the force output of experienced versus novice performers, which is a both recruitment and testing approach seen frequently in motor learning literature. Using "real time" or concurrent feedback, another approach utilized in motor skill learning, they comment on the factors that improve in the novice performer.

The present issue of this journal may serve as a tool for learning. The narrative review articles may stimulate individual practitioners, educational institutions, or researchers to consider different therapeutic or measurement approaches. In his review, Bruno clarifies issues of contention related to stabilization exercises, presents strategies to identify patients most likely to respond to interventions, and presents protocols for clinicians or educators to consider. Passmore, Murphy and Lee present the rationale and formula for employing a neurophysiological technique demonstrated to measure changes associated with chiropractic intervention.

This issue acknowledges that altered body mechanics, beyond muscular changes, can also impact the autonomic nervous system and sensory processing. Whiplash is a rapid flexion-extension event explored by Mang, Siegmund, and Blouin that occurs in less than seconds. In their study the authors investigated the recruitment of axial and appendicular muscles along with autonomic responses and showed that responses to whiplash-like events involves both a descending recruitment pattern of axial and appendicular muscles and increased sympathetic responses. Enix, Scali and Pontell describe the anatomical relationship of musculature and the spinal cord. The spinal distortion caused by scoliosis and observed changes in body sway and impaired sensory processing was identified by Pialasse and Simoneau to be worthy of further investigation. Perhaps that investigation of scoliosis in the future could utilize the technique of measuring sensory changes

using somatosensory evoked potentials described in the review by Passmore, Murphy and Lee.

It is our hope that the contents of this issue are used as a resource for education, and as a catalyst to inspire future research in spine neuromuscular control. Such scientific exploration may further facilitate our understanding of chiropractic intervention, its mechanisms, and the potential ailments that may respond to care.

References:

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