Asia-Pacific Chiropractic Journal

Manual Muscle Testing:

The Chiropractic profession's physical sign of the Motor Neuron's 'Tone'.

A DD Palmer wish-fulfilment like no other

Scott Cuthbert

Narrative: All Chiropractors would appreciate that the founder, DD Palmer, stated in the frontispiece to his 1910 textbook that '*Chiropractic is founded on tone*'.

This seemingly straightforward proposition has been given different meanings, more recently by Chiropractors with advance academic studies wanting to grant the phrase an almost mystical meaning of Universal Intelligence culminating in Innate Intelligence. Nowhere is this more pronounced than in Stephenson's '33 Principles'.

In this paper I show that the muscle system is '*the most exposed part of the nervous system*' and as such we can, through Manual Muscle Testing as refined within AK Protocols, create a window into the functioning and dysfunctioning of the neuromuscular system as it affects health and well-being.

Chiropractic applied kinesiology assesses alterations in the human sensory-motor continuum and it achieves this based on sound principles without the need for appeal to mystical universal forces. We cannot make meaningful statements at all about an assumed 'real universe', or 'deep reality' or 'first mover' or 'Universal Intelligence' underlying this world and the neuro-musculoskeletal systems within our patients

Indexing Terms: Chiropractic; AK; Applied Kinesiology; human sensory-motor continuum; Stephenson.

Introduction

It must be remembered as an essential fact of Chiropractic practice that 40-50% of the male human being's weight is muscle, with the female being 30-40%. A basic premise taught to every Chiropractic student is that '*muscles move bones*'.

The motor component of the nervous system is not a discreet anatomical system but rather an organisation that spans the entire organism. The muscle system is, as both Goodheart and Janda said, '*the most exposed part of the nervous system*'.

> What is the implication of these facts for Chiropractic practice?

> *... This kind of pre-20th and 21st century spiritualisation of the Chiropractic concept of our founder's 'tone' in the nervous system (an 'act of faith' responsible for 'alterations in tone') is no longer necessary, and need not be used as the very foundation stone of either modern nor traditional Chiropractic concepts for the sources of alterations in 'Tone' in our patients...'*

It should be remembered by all chiropractors everywhere as well that there are manual muscle tests involving the specific segmental spinal myotomes and from the cranial nerves and lowest sacral nerves.

Within the development of Chiropractic history, the response of a particular muscle to resistance applied by a trained Chiropractor was first proposed by George J Goodheart Jr, and to be a summation of ALL the excitatory and inhibitory inputs of the anterior horn motoneurons, such that a failure of the muscle in the test can be linked to a dysfunction of the nervous system. (1)

In other words, AK has been proposed to be a study of alterations in tone and alterations in an immediately measurable portion of functional neurology. Muscle changes evaluated by the manual muscle test (MMT) are suggested to be reflective of a change in the peripheral or central nervous systems, and treatment is considered to be effective only if it is directed at the correct neural disruption restoring muscle tone and strength; and this is usually immediately. (2)

DD Palmer described this fact as being a part of the very essence of the Chiropractic subluxation. In his earliest writings on Chiropractic philosophy, he says 'The premise of Chiropractic is straight forward; subluxed vertebrae compromise the nervous system, modulating tone and the resultant state of well-being'. Variants of this idea are found throughout the medical literature of the 16th through 19th centuries and the Chiropractic literature of the 20th and 21st century. (3)

The motor neurons are subject to inhibitory and excitatory influences, primarily from descending impulses from the higher centres and from peripheral influences arising from different sensory receptors and proprioceptors. Proprioceptors provide information about internal mechanical events, while exteroceptors (vision and hearing) provide information about the environment.

It's important to note that the dendritic surface area (the receptive area) of each motor neuron is quite extensive, taking up approximately 97% of the total surface area of the cell. (4) This fact serves to highlight the extent of inputs to motor neurons.

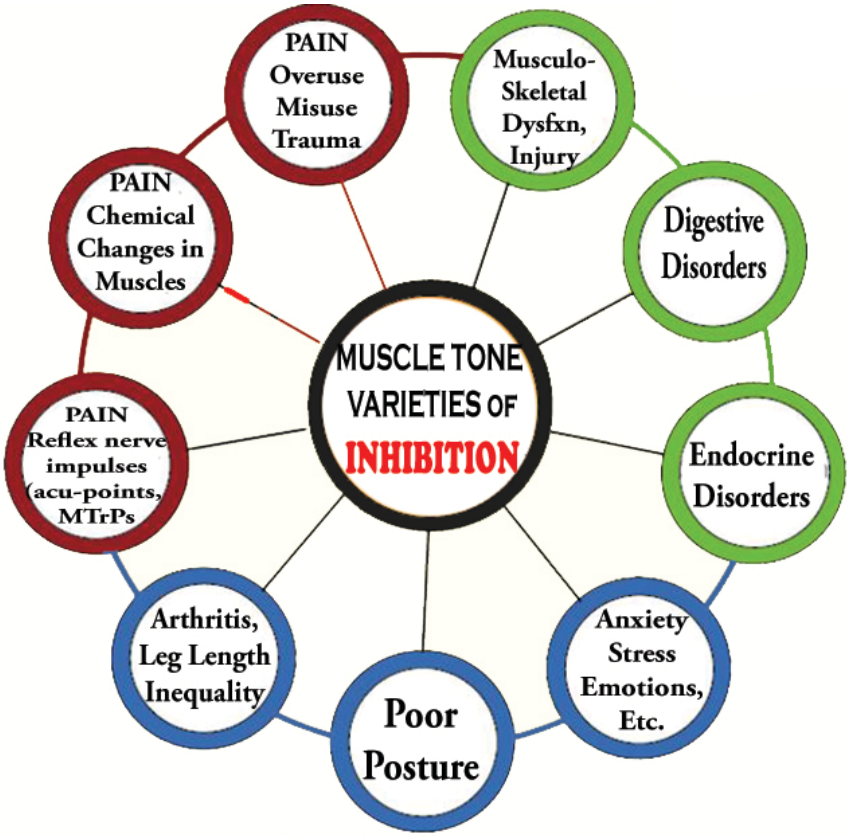
> Chiropractic applied kinesiology assesses alterations in the human sensory-motor continuum in motor neuron tone like no other system on earth.

Caruso and Leisman fortunately provided concrete evidence that the classifications of muscles as weak or strong as determined by the examinations of the applied kinesiologist are both objective and reproducible with experience and training. These researchers looked at patterns of force, timing, and movement for over 700 muscle tests with sophisticated, specially designed equipment. They used simple mathematical applications to find potential patterns of force and displacement that would correspond to patterns of '*weak*' or '*strong*' muscle tests obtained from volunteers. The result was the creation of a model that was not only able to clearly discriminate between '*strong*' and 'weak' muscles, but also was accurate 98% of the time for fully trained practitioners in applied kinesiology. (5)

But what distinguishes AK is its emphasis upon tonal alterations and proprioceptive responses of the muscle to this broad variety of sensorimotor stimulations and/or challenges. This paper claims that AK manual muscle testing is the fulfilment of DD Palmer's Chiropractic vision, which suggested that derangements in neural activity and neurological tone occur from '*traumatism, poison and auto-suggestion*'.

Important also to remember that all palpation encounters muscles before bones, so is palpation detecting subluxations or disturbed muscle tone or both? Muscle tone is a physiological response, not an anatomical structure. AK has provided a technology for applying DD Palmer's far broader approach to the detection of aberrations in tone everywhere in the patient.

The breadth that AK has introduced into the Chiropractic profession is immense. For instance when improper nerve activity adversely influences an organ or gland, it can be observed by testing a specific muscle or muscles associated with the organ or gland. Pain generates reflex changes in muscle tone and it does not matter whether the painful source is a subluxated joint, inflamed visceral organ or gland, a muscle, tendon or ligament, each of these sources of altered and measurable muscle function (aberrations in DD Palmer's TONE) can be diagnosed with manual muscle testing methods.



The Wheel of Muscle Tone:
Body-Wide Reflector of Central Nervous System Dysfunctions

Must a metaphysical principle underlie our specific Chiropractic biology and physical measurements of neural tone?

McDowall (along with several other notable Palmer Chiropractic scholars around the world) (6) have recently written PhD theses and papers on Chiropractic's and DD Palmer's early life, concepts and work, and suggested that Palmer's concept of '*tone*' was as much a metaphysical concept as a physical one. In these authors' opinion, neurological tone is the way that a '*Universal Intelligence*' (or '*Holy Spirit*' from their own individual and cultural ideas of the deity, and imputably, these were DD Palmer's too) communicates with tissue cells.

Also that '*Universal Intelligence*' works through all human beings to realise Chiropractic's physiological realities (anthropomorphism) for their lives. (7) '*Tone*' in this view is merely a manifestation, the expression in biological life of a supra-human transmission system which speaks through '*Innate Intelligence*', and this manifests in our patients as alterations in '*tone*', the Chiropractic precursor of dis-ease.

> This kind of pre-20th and 21st century spiritualisation of the Chiropractic concept of our founder's 'tone' in the nervous system (an 'act of faith' responsible for 'alterations in tone') is no longer necessary, and need not be used as the very foundation stone of either modern nor traditional Chiropractic concepts for the sources of alterations in 'Tone' in our patients. This act of faith need not be offered at this time in our history, in order to assure its believer and practitioner that an almighty and Universal force is at work in both the doctor and the patients we examine and treat.

If our Chiropractic doctors expect their patients to get well, this has some effect on the patient; if the doctor expects the patient to remain sick or not to recover, this also has an effect. Universal Intelligence '*believers*', like Christian Science practitioners and other '*faith-healers*' could not remain in business if such self-fulfilling prophecies did not work out significantly often, statistically, in a variety of Chiropractic illnesses and settings, sometimes even very serious illnesses.

However modern science has become uncomfortable and disapproving of a theological explanation creating, undergirding, and supporting our integrated Chiropractic and biological methods. We cannot make meaningful statements at all about an assumed '*real universe*', or '*deep reality*' or '*first mover*' or '*Universal Intelligence*' underlying this world and the neuro-musculoskeletal systems within our patients; nor some '*true reality*', etc. apart from ourselves and our own nervous systems and our own invented instruments of measurement.

Other more secular historians and anthropologists of Chiropractic and DD Palmer, like Wardwell and Keating, suggest that the concept of '*tone*' is indeed the key for Palmer's vision of Chiropractic's diagnostic challenge and its solution for patients. The idea that alterations in neuron tone represents a fundamental reality for our dis-eased or sick patients should now, in modern life, become an expected regularity in our ideas about the universe.

It's far more possible that today the laws of nature and the cosmos are no longer mere epiphenomenon of a '*Universal Intelligence'* responsible for all biological life on earth, but instead that the constituent organisms of our cosmos and our planet have their own laws of nature. The manual muscle test measures these disturbances in motor neuron '*tone*' like no other tool in the physician's arsenal, as this paper seeks to demonstrate.

The seven variations in measurable, altered and diminished muscle tone

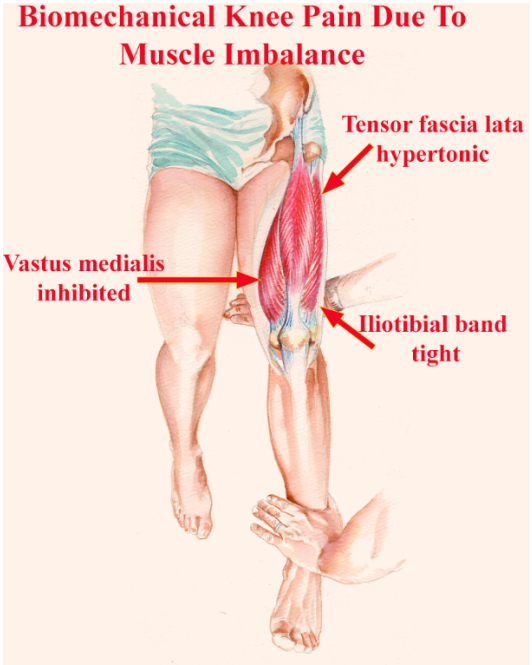
Homewood quotes DD Palmer: '*Life is the expression of tone*'. That sentence is the basic principle of Chiropractic. This says that normal muscle tone indicates good health, while disturbed sensory and autonomic and muscle tone indicates disturbed health. Disturbed tone disturbs structure. This remains a fundamental premise of Chiropractors around the world, whether they measure this aspect of the patient's function or not.

Muscle inhibition is a complex clinical phenomenon, created by inhibition to the alpha- and gamma motor neurons. The '*feel*' or '*tonal quality*' of each muscle's causative inhibitory impulse is

different, causing different levels of strength impairment, and clinicians can detect these causes with experience.

There are 7 broad categories of functional alterations in muscle tone that result in muscle inhibition that may be detected with the MMT. They are as follows:

1. Tightness weakness develops when a muscle is chronically shortened and eventually loses strength (i.e., the *psoas*). Janda has reported that even when a muscle appears to be tight or stiff, some decrease in muscle strength occurs. Brooks confirms that chronically contracted muscles are weaker than muscles with a normal length. (8) Leahy, the founder of Active Release Technique® says it simply 'When a muscle is tight it tends to weaken and when a muscle is weak it tends to be tight'. (9)
2. Stretch weakness occurs if a muscle is perpetually placed in a lengthened position so that the muscle spindles become desensitised to stretch. (10, 11)
3. Fatigue weakness: Patients with acute or chronic conditions will often complain of feeling that their joints or muscles are weak and that they fatigue easily. Increasing fatigue in a muscle shows a nearly linear relationship with declining median power frequency and the decline in strength of a muscle, i.e. increasing fatigue of a muscle produces increasing weakness. This experience of muscle weakness may occasionally persist long after the pain has been alleviated and repair seems to be fully resolved. (12) Skeletal muscles are essential components of the neuromuscular protective mechanisms that provide shock absorption for all the joints in the body. Coordinated joint movement and muscle activity control joint loading in order to ensure that the loads applied across the joint are dissipated harmlessly. For example, when the body's weight is loaded onto the lower limb at heel strike during the normal gait cycle, knee flexion is brought about by eccentric quadriceps contraction and cushions knee loading, dissipates the load, and minimises stress on the joint. (13, 14) Impairment of neuromuscular protective mechanisms (decreases in tone called muscle inhibition) will expose the joint to jarring stresses with loading.



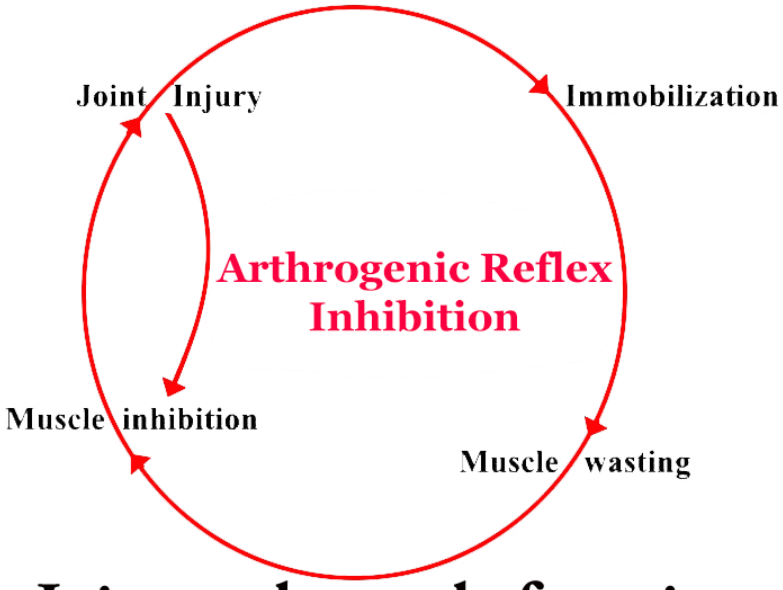
4. There is sound biological reason for muscle inhibition being immediately related to pain and dysfunction. Forceful muscle activation will raise the intra-muscular as well as the intra-capsular pressure of the joint(s) the muscle crosses and may lead to further damage to these tissues. (15, 16)

   At least two processes could be responsible for these decreases in tone or motor force losses. In the neuromusculoskeletal dimension, a reflex mechanism reduces the gain of the spinal motoneurons in response to joint damage. This is often called arthrogenic inhibition or failure of voluntary activation. Arthrogenic weakness has been found to occur commonly when nociceptive afferent barrage from a joint or ligament causes reflex inhibition. Examples are the *vastus medialis* after injury of the anterior cruciate ligament or meniscus or *gluteus maximus* weakness when a sacroiliac dysfunction is present. (17, 18, 19)

   As Vladimir Janda proposed in 1964 in his college thesis paper, in sacroiliac strains, the ipsilateral *gluteus maximus* will test weak. Tone tied to muscle and somatic disorder, once again. (20)

   In cases with osteoarthritis of the knee, many studies have demonstrated that *quadriceps* muscle weakness is a more important determinant of pain and disability than radiologic changes in the bone and cartilage. (21) Hurley suggests that muscle dysfunction may have an unappreciated involvement in the pathogenesis of osteoarthritis generally. Interestingly, many researchers have demonstrated a significant increase in hamstring muscle strength and '*tone*' immediately following sacroiliac joint correction. These researchers had noted a high correlation between hamstring muscle dysfunction and anterior tilt of the innominate bones, associated with sacroiliac dysfunctions. They concluded that mobilising the sacroiliac joint reduced the tilt of the innominate bone, thereby improving undue stress on the previously elongated *biceps femoris* muscle. Hoskins & Pollard (22) also found that Chiropractic treatment to the lumbopelvic joints and sacroiliac joint played a positive role in treating and preventing hamstring injury in Australian Rules footballers. Restoring tone for athletes is a well-known recipe for improved performance.

5. Osteoarthritis (OA) weakness has been associated with muscular inhibition and loss of motor neuron tone in many studies. A systematic review (23) of the clinical literature has examined two leading hypotheses for the cause of exercise related osteoarthritis:
   5.1. wear and tear of the articular cartilage and
   5.2. muscle dysfunction.
6. Arthrogenic muscle weakness is the result of joint subluxations that produce both a localised and a remote loss of muscle force, reduced endurance and potentially muscle wasting. (12, 24) Arthrogenic weakness occurs when nociceptive afferent barrage from a joint or ligament causes reflex inhibition of the associated muscles. Again, alterations in sensory tone matched by alterations in motor tone.



Joint and muscle function always in combination

7. Myofascial trigger point (MTrP) weakness occurs when a muscle cannot fully activate all of its contractile fibres because of the presence of a trigger point. This is also considered the most common source of muscle dysfunction in the world, and so detecting this muscle inhibition or loss of tone and correcting its causative factors may prove to be a highly important aspect of every Chiropractor's success. The importance of this observation, that motor dysfunction and particularly muscle inhibition are present in muscles housing MTrPs cannot be over-estimated. The weakness results from reflex motor inhibition and may occur without atrophy of the affected muscle, emphasising Travell's insight that the MTrP is directly influenced by the CNS and vice versa. Investigators have reported on the effects of MTrPs on muscle activity using newer online computer analysis of EMG amplitudes. These reports indicate that MTrPs not only influence the muscle in which they reside, but that their influence can be transmitted through the CNS to other muscles. (25)

   According to Simons et al, '*the motor effects of MTrPs may be the most important influence they exert, because the motor dysfunction they produce may result in overload of other muscles and spread the MTrP problem from muscle to muscle*'.

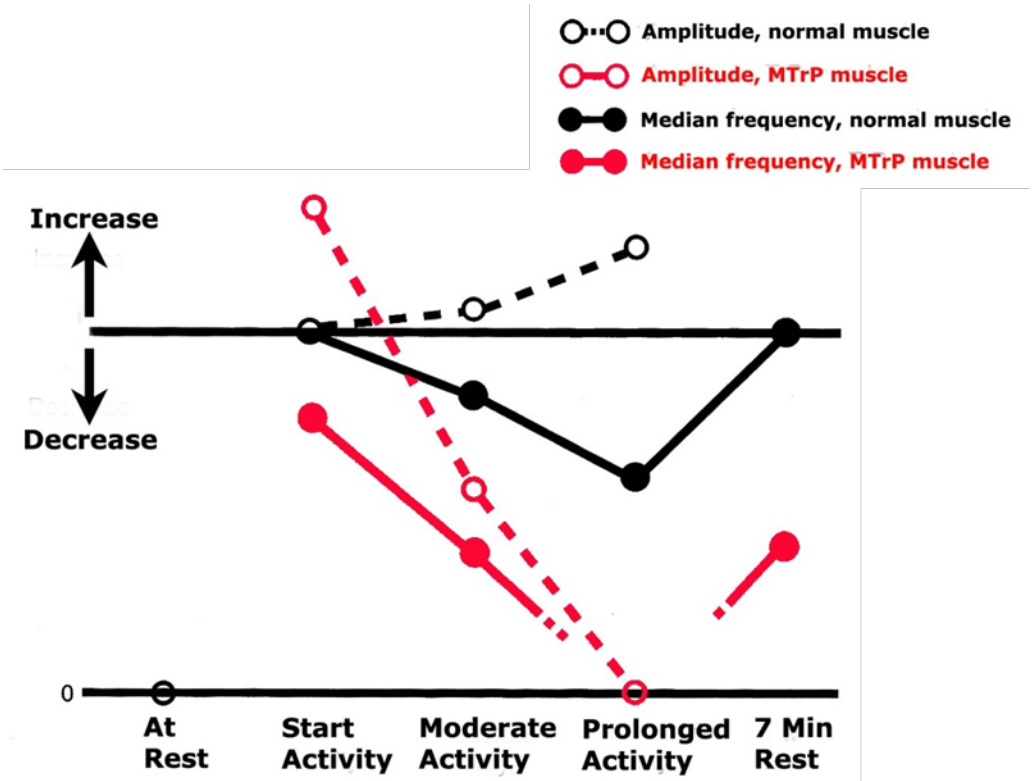


Figure 2.3. Comparison of surface electromyographic response to fatiguing exercise of normal muscle (*black lines*) and muscle with active myofascial trigger points (*red lines*). The averaged amplitude (*open circles*) and mean power frequency (*solid circles*) of the electromyographic record from the muscle with trigger points start out as if the muscle is already fatigued and show that the muscle reaches exhaustion more quickly (and is slower to recover) than normal muscle. These changes are accompanied by accelerated fatigue and weakness of the muscle with trigger points.

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Simons et al (25) also suggest that the weakness resulting from MTrPs must be evaluated both statically and dynamically, confirming the suggestion of Goodheart for the diagnosis of MTrPs in AK, using the '*muscle stretch reaction*'. In static testing, a single muscle is being evaluated as the patient attempts a voluntary contraction, and the process is under cortical control. In dynamic testing, which involves muscular effort before or after a functional movement (as in the muscle stretch reaction followed by the manual muscle test) where a degree of coordinated muscular effort is required, there is a greater degree of '*vulnerability to reflex inhibition*' involving trigger points.

It should be remarked that muscle inhibition has been proven to be associated with low back and spinal pain, one of the Chiropractor's major areas of concern.

Briefly, the following data emerges from the literature concerning the muscular inhibitions co-present in patients with chronic low back pain (CLBP):

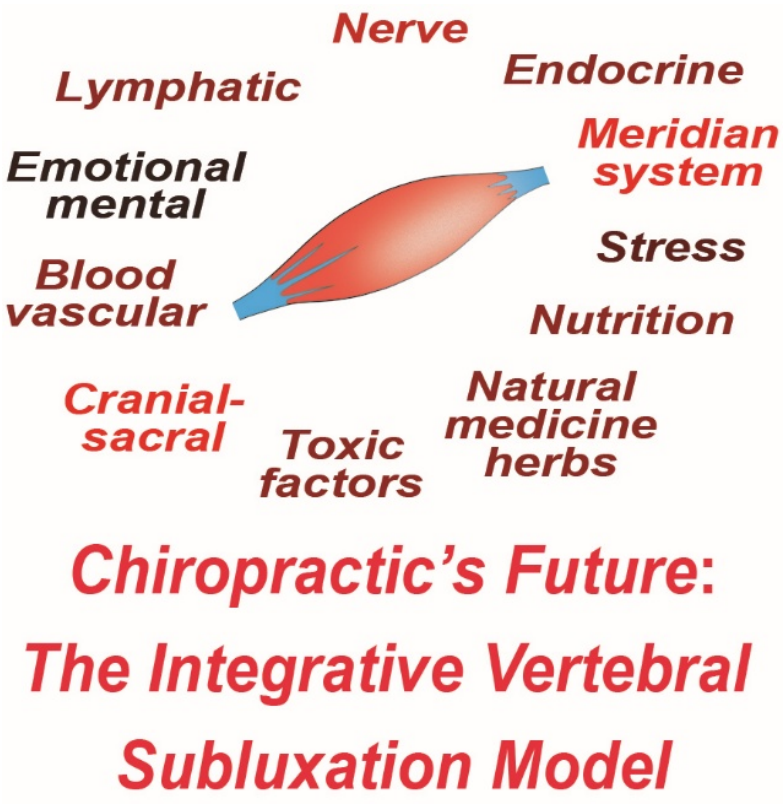
- Reduced force of contraction: Force losses in trunk muscles occur in acute and CLBP patients. (27, 28)
- Reduced range of motion frequently due to muscle inhibition: Loss of flexion-relaxation response in the spinal muscles during flexion in patients with CLBP. Extensor activation prevents full forward bending. (29)

- Individuals with high pain-related fear had smaller excursions of the lumbar spine for reaches to all targets at 3 and 6 weeks, but not at 12 weeks following pain onset. (30) Smaller stride lengths. (31)
- Reduced velocity of muscle contraction: Individuals with high pain-related fear had smaller peak velocities and accelerations of the lumbar spine and hip joints, even after resolution of back pain. (30) Walking velocity significantly lower in LBP patients. (31)
- Decreased endurance of muscles: Increased fatiguability trunk muscles in patient with CLBP.
- Alterations in timing of muscular contraction: Impaired postural control of the lumbar spine is associated with delayed trunk/abdominal muscles response times in CLBP patients.
- impaired reaction time: Compared to healthy controls, persons with LBP exhibited a reduced ability to adapt trunk-pelvis coordination and spinal muscle activity to sudden changes in walking velocity. Finally, slower reaction time in LBP patients.

Muscles may work well during a general MMT of a muscle group which does not isolate the muscle effectively, but the same muscle may not contract at all during a movement for which it is the prime mover. (17)

The ability for the Chiropractic clinician to detect these aberrations in motor neuron tone (from so many differing factors), and to track down these individual factors in every patient's presentation leads to far greater success.

Duffy (32) highlights this relationship by changing the term from a viscerosomatic to a musculovisceral reflex. The linkage between the musculoskeletal system and specific organs and glands through the segmental arrangement of the CNS allows the physician to associate seemingly unrelated areas of the muscular system to a visceral organ in a holistic approach to patient care. To approach the patient in this way means that the physician considers the interrelationship of seemingly unrelated structures and systems; it fosters the integrative clinical approach for which Chiropractic's applied kinesiology is renowned.

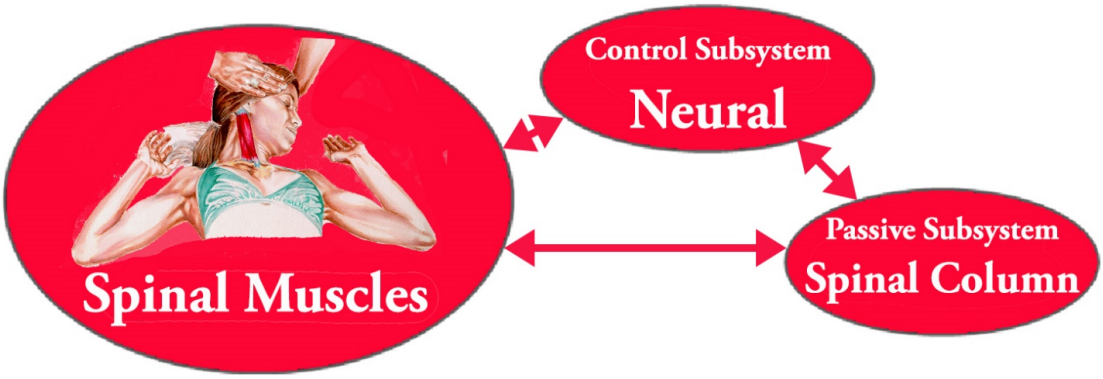


The measurable factors that alter motor neuron tone in Chiropractic patients around the world

This kind of integrative Chiropractic also demonstrates on a daily basis that subluxations producing alterations in muscle and nerve tone and function arise from at least 3 areas of concern, which comprise chemical and mental elements in addition to structural. (1, 2, 3, 17, 32, 33) It is able to recognise, for instance, how nutritional, (34 - 43) hormonal, (34 - 37, 44, 45) and emotional (4 6- 49) elements influence neural function as reflected by an established muscle tone testing protocol (52 - 55) whose reliability and validity are established. (50, 51)

Chiropractic AK addresses disturbances in neurological tone because Chiropractic care can improve our proprioceptive ability, (56) change the way the brain sends specific messages to our muscles, improve our visual acuity and visual field size; improve reaction times and speed of performance, improves our brain's processing capacity, and of course increases our muscle strength and reduces our fatigue. (57 - 61)

If we are not capable of diagnosing this fundamental problem in patients, we are missing a fundamental component of their dysfunctions in neurological tone, making the treatment of complex neuromusculoskeletal disorders that much more difficult.



The Chiropractic subluxation involves not only altered biomechanics, but also motor control errors and local as well as remote muscular dysfunction that are part of the nervous system's response to pain. Several hundred studies have shown that musculoskeletal and musculovisceral disorders and pain produce diminishment in muscle and nerve tone, the detection of which makes the MMT invaluable and essential in Chiropractic clinical practice. (32)

Assessing the function of muscles with the MMT pre- and post-treatment can assess the benefit of a chosen Chiropractic intervention: does the treatment improve or worsen the patient's muscle function and tone? This assessment process is the basis of applied kinesiology (AK) and a family of associated techniques that investigate muscle and nerve tone dysfunction using the MMT.

THAT is both the kind of assessment and treatment to the TONE OF LIFE that DD Palmer sought for the Chiropractic physician of the future. (62) AK returns Chiropractic's focus to holistic neurological balance, permitting such major determinants of health as nutrition and stress to become integrated within the chiropracTOR's basic philosophy and practice. (63)

For this reason over 1 million clinicians around the world (64) and over ½ the Chiropractic profession – uses, whether consciously or not, the unifying manual muscle testing Chiropractic system that unites DD Palmer's comprehensive vision and modern Chiropractic practice in the world today.

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Revolutionary Healers Who Made The Science of Tone Manifest

Dr. George J. Goodheart, Jr. & Dr. D.D. Palmer

Founder & Developer

TEXT-BOOK OF THE SCIENCE, ART AND PHILOSOPHY

OF

CHIROPRACTIC

FOR STUDENTS AND PRACTITIONERS

BY

D. D. PALMER

THE ONE WHO DISCOVERED THE BASIC PRINCIPLE OF CHIROPRACTIC, DEVELOPED ITS PHILOSOPHY, ORIGINATED AND FOUNDED THE SCIENCE AND ART OF CORRECTING ABNORMAL FUNCTIONS BY HAND ADJUSTING, USING THE VERTEBRAL PROCESSES AS LEVERS

FOUNDED ON TONE

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FOUNDED ON TONE

The measurement of "Neuro-muscular Tone" with Applied Kinesiology is not a deviation from chiropractic -- it is its fulfillment

About the author

Scott Cuthbert, BA, DC practices in the city of Dauin on the island of Negros Oriental in the Philippines and is the Associate Editor with the *Journal*.

He has served on the Board of Directors of the *International College of Applied Kinesiology USA*. Dr Cuthbert is the author of three textbooks on applied kinesiology (in addition to 15 *Index Medicus* and over 50 peer-reviewed research papers) on Chiropractic approaches to functional health problems. *Images courtesy of David S. Walther, DC, with permission.*

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