Dynamic Chiropractic

CHIROPRACTIC TECHNIQUES

Shared Mechanisms Between Computer-Assisted Mechanical Adjusting and Contemporary Acupuncture?

David Salanki, DC

Can contemporary acupuncture provide clues to the mechanisms responsible for pain relief provided by computer-assisted mechanical adjusting instruments, and clarify whether certain mechanical frequency combinations are superior to others for modulation of acute peripheral pain?

Over the past decade, contemporary acupuncture has grown to become a well-respected modality for effective modulation of pain. It is used by many chiropractors alongside integrative chiropractic treatment approaches to assist in the management of many common acute peripheral pain conditions. Over the same time frame, instrument-based chiropractic adjusting approaches have grown in popularity within the chiropractic profession, to the point where more than half of all practicing chiropractors routinely use some form of adjusting instrument in their practices. As this trend continues, the irresistible allure associated with the latest technology-packed computer-assisted adjusting approaches mushroom as a greater percentage of practicing chiropractors adopt these very advanced analysis / treatment tools in their practices.

In addition to the obvious role computer-assisted mechanical adjusting instruments play in spinal treatment and adjustment, these tools provide expanded interventional choices for a wide range of associated acute and chronic pain disorders. Theses include extremity adjustment and mobilization, myofascial trigger-point therapy, soft-tissue-release approaches, IVD disorders, mechanoreceptor stimulation and Golgi tendon therapy. As more and more chiropractors move to adopt this technology, it is imperative that we establish sound scientific rationale (beyond vague references to subluxation and mobilization) for its use, including defining mechanisms involved in acute and chronic pain modulation.

An impressive and well-established research basis supports both the clinical effectiveness and neurophysiological mechanisms activated with contemporary needle acupuncture. Since many of the clinical indications / responses seem similar at the tissue level for both acupuncture and mechanical peripheral simulation provided by computer-assisted adjusting technology, we need to ask ourselves if contemporary acupuncture theory may assist us in developing an effective model to explain mechanisms responsible for acute and chronic pain relief when using computer-assisted mechanical instruments.

1. What Are Some of the Known Clinical Responses & Mechanisms Behind Contemporary Acupuncture?

A great deal is known about mechanisms of contemporary acupuncture for neuromodulation of pain. When we look at acupuncture from a purely neurophysiological perspective, it can be defined as a

simple peripheral nerve stimulation technique. For example, contemporary acupuncture theory as taught by me and others in the contemporary medical acupuncture program at McMaster University no longer considers acupuncture points as singular anatomical entities, but rather a combination of varying nerve fibers and their specialized receptors.

In contrast to traditional Chinese acupuncture and TCM philosophy, contemporary acupuncture downplays the concept of meridians and specific acupuncture points in favor of a more simplified neurofunctional description. Consequently, *contemporary medical acupuncture* can be defined as "the insertion of fine solid needles over specific neuroreactive sites for purposes of normalizing autonomic, sensory and/or motor neuroregulatory responses."

Acupuncture triggers certain local and systemic neurological responses. These include an increase in local perfusion, relaxation of local muscle tension, and descending inhibitory responses including the release of specific pain-relieving neuropeptides such as endorphins, GABA and serotonin. Acupuncture is also known to neuromodulate central hormonal and endocrine responses.

Neuromodulation and neuroactive sites are fundamental to understanding mechanisms of contemporary acupuncture. *Neuromodulation* is the property of the nervous system to regulate its own activity in response to exogenous or endogenous stimuli. We see this continually in the body as responses such as vasoconstriction of skin vessels in response to cold reflex, or relaxation of an antagonist with contraction of an agonist.

A *neuroreactive site* can be thought of as any area of the body where there is somatic innervation. Since somatic fibers are found in spinal and peripheral nerves that innervate muscles, joints and skin, neuroreactive sites are found over the entire surface of the body – although some are more potent sites of stimulation than others. Sympathetic nerves innervate arterial networks of the skin. Therefore, neuroreactive sites also have some sympathetic vascular innervation.

Needle stimulation directed toward specific proprioceptive targets found within receptor-rich environments activates three specific spinal gate control mechanisms: sensory, locomotor and autonomic. Consequently, acupuncture results in normalization of sensory-motor integration, normalization of vasomotor tone, as well as improved perfusion of locally affected tissues.

2. Which of the Known Responses to Acupuncture Might Be Activated by Needle Insertion and Computer-Generated Mechanical Stimulation?

Whether we stimulate a peripheral sensory nerve using an acupuncture needle or through a percussive impulse generated by computer-assisted mechanical adjusting instrument, it is highly probable that many of the same mechanisms come into play. Gillette (1987) speculated that 40 types of mechanoreceptive endings in the superficial and deep paraspinal tissues could be activated by chiropractic adjustment including proprioceptors, low-threshold mechanoreceptors and high-threshold nociceptors.

Many of the mechanoreceptive endings mentioned, including Ruffini end organs, Golgi end organs, Pacinian corpuscles, muscle spindles and Golgi tendon receptors, are well-known and commonly used neuroreactive targets for needle stimulation in contemporary acupuncture.

In addition, a number of authors including Chaitow, Travell & Simons, and Melzack & Wall talk about proprioceptive reporting mechanisms to the CNS. Fascia and skin are innervated by a rich variety of

sensory receptors including Pacinian corpuscles, Ruffini organs, small myelinated free-nerve endings (A delta or mechanoreceptors), as well as unmyelinated free-nerve endings and C fibers that carry pain.

We could well define *computer-assisted mechanical treatment* as: "the application of pulsed percussive forces at specific frequencies over specific neuroreactive sites for purposes of normalizing autonomic, sensory and/or motor neuroregulatory responses." Three common empirical observations are seen following acupuncture and computer-assisted adjusting approaches: 1) decreased pain; 2) increased strength of inhibited muscles; and 3) increased local blood circulation.

How might computer-generated pulsed mechanical stimulation reduce pain? The widely accepted neurological mechanism that has been credited for the positive effects noted with various instrument-based approaches relates to the mechanical stimulation of large-diameter afferent fibers. Stimulation of these large-diameter, slow-conduction fibers modulates pain by silencing the activity of the smaller, faster-conduction nociceptive (pain-carrying) C-fibers. By modulating both nociceptive and proprioceptive afferents, activation of sensory fibers modulates activity of nociceptive fibers, resulting in decreased pain and sensory function normalization.

How can we explain the normalization of inhibited muscle strength and decrease in muscle hypertonicity that we see almost instantly following application of computer-generated pulsed mechanical stimulation? Similar to mechanisms mentioned above, neuromodulation of proprioceptors alters the activity of motor neurons, resulting in decreased segmental muscular tonus and increased strength of inhibited muscles.

Can increased local tissue perfusion also be attributable to computer-generated pulsed mechanical stimulation – and by what mechanism? It seems pulsed mechanical stimulation modulates regional autonomic components of pain by restoring circulation, a perpetuating factor in regional chronic pain-sympathetic hyperactivity.

3. What Does Contemporary Acupuncture Tell Us About Where Best to Apply Stimulus to the Nervous System for Optimum Response?

Contemporary acupuncture theory describes that the best effects from acupuncture are achieved through stimulation at three sites:

- Local peripheral segmental levels (affected muscles and joints or their relevant nerves)
- Paravertebral musculature at relevant segmental somatic levels (dermatome, myotome, sclerotome)
- Relevant segmental autonomic levels (reflex vascular areas in distal aspects of extremities)

Based on this, where should we best apply computer-instrument-generated mechanical forces to optimize clinical response? Logic would say applying single or multiple percussive forces over painful and affected joints and local structures would make most sense. Clinical experience supports this suggestion. Receptor-rich structures such as muscle bellies, muscle-tendon junctions, teno-periosteal attachments, joint capsules, ligaments, neurovascular bundles, motor points and fascia yield very good response.

We should also consider the treatment of paraspinal muscles and structures at spinal levels segmentally linked to the dysfunction. For example, consider treatment of mid- to lower-cervical and

upper-thoracic paraspinal structures in cases involving median nerve entrapment at the wrist. These regions are desirable targets since they modulate both segmental and segmental autonomic reflex activity related to the problem region.

Stimulation of segmental autonomic reflexes further reinforces positive response to treatment. Stimulation of the first dorsal interosseus muscle of the hand or foot, or other strong reflex systemic regulatory areas distal to the elbow and distal to knee, are particularly useful when treating more chronic functional problems.

Moving Forward

When assessing the value of computer-assisted mechanical adjusting instrumentation for different clinical applications, it is imperative to understand variables involved, including force, frequency and duration, direction of application, location and rationale for its application.

To make the claim that one instrument is superior to another makes the assumption that certain optimum forces and/or pulsed frequency combinations are more clinically useful than others. It further assumes that we have reached full understanding of how each of these instruments interacts with the human nervous system, influencing the neurophysiology of the pain experience.

At this point in the evolution of chiropractic science, we are not yet there. Consequently, research needs to address questions like these head on. These are promising areas for future investigation and research and answers will surface as we continue to unravel the complexity surrounding the effects of mechanical peripheral simulation provided by computer-assisted adjusting technology.

Resources

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