Dynamic Chiropractic

CHIROPRACTIC (GENERAL)

Why We Need to Fix the Mechanoreceptors (Part 1)

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Last year, I lectured on fascial manipulation (FM) to the certified athletic trainers for the Arizona Diamondbacks Major League baseball team. I began the presentation with the statement that while they may be the experts in stretching, strengthening and training athletes, if they do not fix mechanoreceptors, they will be training uncoordinated muscles and can expect injury recidivism.

Mechanoreceptors around skin, joints, muscles, tendons, fascia, joint capsules, and ligaments are stimulated by physical deformation of tissue occurring with motion and changes in position. If normal deformation (stretch, compression) of these mechanoreceptors is inhibited, their sensory impulses to the central nervous system will be altered, resulting in abnormal efferent feedback to the muscles from the CNS. In other words, an incoordination of the supplied tissue will occur.

Treatment Pearls: Why Mechanoreceptors Matter

This aspect with regards to the treatment of musculoskeletal problems must be understood. Spinal adjustments, strengthening, stretching, vibratory systems, taping and exercises all stimulate proprioceptive activity, but there is a strong possibility that if mechanoreceptors are limited in their ability to be deformed, all that is accomplished by these methods is a temporary proprioceptive stimulation, rather than a permanent restoration of the receptors.

With regards to somatic (bodily) sensations, mechanoreceptors are necessary for reporting cutaneous, thermal, muscle, joint and pain information. Let's focus primarily on the proprioceptors of the muscular system that represent a particular type of mechanoreceptor responsible for sensing limb position and movement.

Our bodily movement and reaction to changing activities depend on proprioceptive responses. It is thought that the principal kinesthetic (the sensation of movement or strain in muscles, tendons and joints; muscle sense) receptor in our body are muscle spindles, with some skin receptors providing additional information.[1]

Kandel[2] states that joint receptors play little, if any role in postural sensations of joint angle, and that muscle spindles provide the most information. This was particularly demonstrated after hip replacements: Movement sense remained intact, even though all capsular and ligamentous components containing joint receptors were removed.[3]

Joint receptors were more active at end-range. The primary activity of spindle cells is to signal changes in the length of muscles and as the muscles cross the joints, information about the angle and position of the joints are transmitted to the CNS. By way of this reporting system, the CNS also senses changes in muscle tone (stiffness), movement, loss of normal elasticity and rate of change of muscle length.

According to Kandel,[2] the spindle cells, rather than joint receptors, play the most important role in postural sensations of joint angle. Other important receptors are the Golgi tendon organs (report on force of muscle contraction), Pacinian corpuscles (vibration) and Ruffini endings (skin stretch). Pacini and Ruffini also are able to register joint mechanical deformation and angle changes.

One of the most relevant discoveries in the world of anatomy over these many years is that muscle spindles, the chief proprioceptive cell affecting our muscles, are not in the muscle, but in the fascia surrounding the muscle and its muscle bundles.[4]

Fascia is known to slide over the loose connective tissue that separates it from muscle components. A principal component of loose connective tissue, hyaluronic acid (HA), has been found to increase in concentration and entangle, preventing the gliding of the fascia over the muscle.[5]

Mechanoreceptors and Spindle Cell Function

As stated above, a mechanoreceptor is stimulated when it is deformed, but when it is restricted in fascia that is unable to glide, it follows that it is unable to stretch, which is critical for the function of the spindle cell. The necessity of deformation of this cell can be explained by describing the function of the spindle cell.

Editor's Note: In part 2 of this article (September issue), Dr. Hammer details the function of muscle spindle cells; explains how altered spindle feedback results in altered stimulation to the muscles, resulting in altered function; and outlines the beneficial effects of stimulating proprioceptive spindle cell activity.

References

1. Gandevia SC, Proske U. The proprioceptive senses: their roles in signaling body shape, body position and movement, and muscle force. *Physiol Rev,* 2012;92:1651-1697.
2. Kandel ER, Schwartz JH, Jessell TM, et al. *Principles of Neural Science, 5th Edition*. Appleton & Lange, 2013.
3. Grigg P, Finerman GA, Riley LH. Joint-position sense after total hip replacement. *J Bone Joint Surg* (U.S.), 1973;55:1016-1025.
4. Stecco C. *Functional Atlas of the Human Fascial System*. Elsevier, 2015.
5. Stecco C, Stern R, Porzionato A, et al., Hyaluronan within fascia in the etiology of myofascial pain. *Surg Radiol Anat*, 2011;33:891-896.

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