Dynamic Chiropractic

CHIROPRACTIC TECHNIQUES

How to Increase Proprioception and Improve Your Clinical Outcomes, Part 1

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Proprioception comes from the Latin word *proprius*, meaning "one's own," and is defined as "position sense or knowing where the body is in space." This is accomplished by function of the afferent proprioceptive receptors to supply the cerebral cortex with a sense of joint position. Lately, there has been much written and said regarding proprioceptive training, especially as it relates to core training to maintain health and prevent disease and accidents among the general population.

The effect of proprioception on athletes and its use in rehabilitation and complete recovery from injury cannot be underestimated. There are far-reaching implications of this concept that include increasing performance and preventing injury and re-injury. For these reasons, it is important to understand not only what proprioception is, but also how receptors are damaged and how to retrain these receptors for optimal physical functioning.

Basic movement patterns such as gait, muscle coordination and firing patterns involve the integration of complex neuromuscular and musculoskeletal systems intimately associated with the proprioceptive receptors. Proprioception is an essential criterion for normal function since coordinated movement permits the body to adapt to large structural adaptations without injury. Uncontrolled movement or improper adaptations to uneven terrain can lead to potentially injurious movement patterns.[1] These abnormal patterns do not allow the body to absorb force normally or dissipate loads through the musculoskeletal system in a normal fashion.

Instead, abnormal forces are not dissipated and the effects over time could cause increased postural stress and tissue overload, resulting in a high degree of tissue stress and strain that could contribute to overuse injury. Another example of ineffective afferent messaging is an athlete who participates in their sport with an incompletely/poorly healed ankle injury. It is well-known that this individual will be more susceptible to future ankle injuries that might be more severe than the original injury.

It is possible to have neuromuscular coordination impaired from central nervous system damage. However, it is more likely to have dysfunction as the result of damage to the sensory receptors such that they are no longer able to provide enough position sense information to produce an efficient and appropriate motor response. Position sense, or proprioceptive input, originates from receptors located in the muscles, tendons, joint capsules and deep tissues. It is common to classify proprioceptors into muscle proprioceptors, joint and skin proprioceptors, and labyrinthine and neck proprioceptors.

Some receptors report rapid changes in acceleration and tension, while other receptors adapt slowly and sense static placement of the joints over time. Collectively, these receptors relay a steady stream of input regarding static and dynamic joint positions in space.

Muscle spindles are considered the most important receptors for kinesthetic awareness.[2] These proprioceptors include the muscle spindle and Golgi tendon organ. These afferent fibers relay input concerning dynamic changes in muscle length, as they are very sensitive to stretch via primary afferents.

Joint and skin proprioceptors, including Meissner's corpuscles, are located superficially in the skin and respond rapidly to transient movements of the skin between 5 Hz and 40 Hz.[3] Pacinian corpuscles are found deeper in the subdermal layer of the skin. Pacinian corpuscles respond quickly to high-frequency transient movements of the skin between 60 Hz and 300 Hz.[4] It is believed that these mechanoreceptors connect to the cortex and modify activity of the limbs. Joint and skin receptors also facilitate the vestibular apparatus to stabilize the extremities during gait by stimulating the necessary muscles to contract more forcefully and efficiently.

Coordinated messages from efficient proprioceptive receptors provide the central nervous system with a constant flow of sensory information regarding body position and movements. After being filtered in the central nervous system, these receptors cause an effective muscular response. With repetition, these movements are fine tuned and result in well-coordinated motion.

The significance of foot proprioception was demonstrated by O'Connell and Gardner[5] when one group of individuals was blindfolded and suddenly dropped from an elevated chair onto a gymnasium floor. The subjects with intact proprioceptors were able to regain their balance when contacting the floor. A second group of subjects had their proprioceptors impaired by soaking their feet for 20 minutes in ice water. These individuals were not able to support themselves after being dropped and collapsed onto the gym floor.

When the second group of individuals' feet hit the floor, the extension reflex response of the lower extremity did not occur due to impaired feedback from the lower extremity afferent proprioceptive system. It is of clinical significance to note that shoes which inhibit abduction of the digits, such as pointed dress shoes, may also inhibit the positive supporting reaction, as demonstrated in the previous example.[1]

Once the clinician develops an appreciation of the delicate balance between afferent and efferent discharges, it should be clear that slight impairments in the proprioceptive system can and will detrimentally affect the appropriate motor response. This situation may result in injury, as the muscular reaction to a given stimuli may occur too late to protect the joint.[1] It has been shown that individuals with recurrent ankle sprains usually present with proprioceptive deficits, not strength deficits as has been commonly understood.[1] More subtle defects in proprioception may be responsible for disruptions in rhythmic limb movements associated with gait, and an inability to attain high velocities and acceleration during gait. There also may be an increase in conscious involvement during gait.

As abnormal patterns emerge, conscious effort must be made in an attempt to decrease postural stress and bring about more normalized movement patterns. A simple, yet effective method to assess the proprioceptive system response may be Romberg's test. Freeman originally described a modified Romberg's test.[6] The patient is instructed to stand on one leg with eyes open and closed. If the patient cannot maintain balance for 10 seconds, then the proprioceptive system is malfunctioning.[7]

Any number of clinical conditions can lead to a disruption of the proprioceptive system, such as peripheral neuropathy or posterior column disease. Much more common causes of proprioceptive dysfunction are trauma or repeated microtrauma, such as can be seen with a biomechanically malfunctioning foot. Theoretically, these injuries destroy proprioceptive afferents and may produce injury due to impaired muscular stabilization.[1]

It is interesting to note that it is also possible that the proprioceptive system may be damaged secondary to decreased output from periarticular proprioceptors surrounding hypomobile joints.[8] These hypomobile joints can also produce tissue tension that can lead to an alteration of the progression of forces through the plantar portion of the foot.

Hiss states that hypomobile joints interfere with pivoting and balancing movements and over time may eventually reprogram this abnormal pattern into the central nervous system.[8] An effective treatment for this condition is to restore normal range of motion on a joint interface level. Restoring specific joint play and increasing flexibility and range of motion to the dysfunctional joints can be accomplished by skillfully delivering appropriate manipulative techniques at the correct time during the healing process.

References

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Part 2 of this article will discuss specific manipulative and other treatment strategies to improve proprioception.

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