

## Why Head Weight Training??

Brad Profitt, PT, DPT, DScPT, OCS, CFCE

Neck pain is a common impairment with most of the causes being unknown. This uncertainty makes it difficult to achieve an accurate diagnosis and therefore subsequent treatment is extremely challenging. Current studies indicate that one of the main problems with neck pain is that pain leads to impaired cervical spine proprioception. Proprioception tells us where we are in space. This function is extremely important for keeping us balanced, upright and our eyes on the horizon. The neck, the eyes and the ears are all connected via the cervical ocular and vestibular ocular reflexes (COR and VOR, respectively). This is one of the mysteries of the human body when understanding the complexity of its neurologic design.

What facts we currently know about neck pain; it has a global prevalence of 288.7 million cases and is one of the most disabling MSK conditions, neck pain is rated #4 in global contributors to Years Lived with Disability with many cases lead to chronic symptoms and producing high economic burdens. The main function of pain in the body is to prevent further tissue damage. There is a direct relationship between pain and decreased muscle activity, and specifically in the neck the deeper painful muscles activity moves to the more superficial muscles.

A recent study by Dieleman et. al., found in 2016 that when the diagnosis of neck and back pain are combined (Spine Related Disorders/SRDs), their cost tallied 134.5B dollars in annual insurer expense. That was the #1 expenditure out of 154 total conditions in 2016 in the US. When one considers not just the cost of care, but also lost time from work, the cost of neck related disorders is a huge problem in modern society. Additionally, we are becoming more and more dependent consumers of using portable cellular and video display screens. In 2013, the National Information Agency survey conducted in Korea found that the number of smartphone users is 24 million with an average of 4.1 hours of daily use. The issue with this usage is the neck posture required to view the screen is often in cervical spine flexion. This posture is often sustained (up to 4.1 hours/day) and thus produces changes in the cervical spine. It is well known that anterior head carriage produces changes in the bony position of the cervical spine, whereby the upper neck is in extension and the lower neck is in flexion based on arthrokinematics. These underlying bony positions impact the nature resting state of the directly attached muscles. A commonly reported condition from this posture is "upper cross syndrome" and this postural imbalance leads to abnormal loads of the cervical spine. It produces weak and overused neck muscles that are often difficult to rehab. The term in rehab for muscles found in a shortened state is active insufficiency and for a lengthened state, passive insufficiency. Regardless of the state of the muscle it is highly likely to lead to poor motor control within a very mobile part of the human body. Motor control is very important for maintaining stability of the cervical spine. Stability was described in the early 90's by Panjabi but has since been expanded upon. Historically, the term's structure and functional instability has been used to describe instability. The problem with the term functional instability is that it lacks definitive descriptive illustration of what is impaired. A more modern term of impaired motor control captures a more robust concept as it points towards proprioception loss leading to motor control deficits. In the simplest of terms, the central nervous system is not receiving sensory information into the system to improve its timing and control of muscle function back out to stabilize the segments of the spine.

When rehabbing the cervical spine, regardless of the situation (i.e., acute, or chronic pain, post trauma, degeneration), the small local muscle groups are difficult to rehab. The deep neck flexors have been the most researched, however it is only on one side of the cervical spine. Proper rehab around a joint is often best performed with activities that produce co-contractions. This term co-contraction means achieving activation around the entire joint. This type of contraction has a stabilizing function on the joint as it promotes circumferential muscle activation that reduces shear forces generated by other types of contractions. In the cervical spine there are 37 individual joints that one must consider, and those 37 joints work in synergy, hence it is impossible to isolate one joint with rehab. There are 20 paired muscles that act of the cervical spine to promote proper function and control mobility of the 37 joints. The cervical spine is basically a boney column within a tubal muscular sleeve that maintains a 10-13# head over the thorax. The sleeve of muscular sleeve is often imbalanced due to the postural demands of life as previously discussed. So how would a rehab professional restore balance? Head weighting is an option that makes anatomical and physiological sense based on the information just provided. Understanding the theoretical model for why is explained.

What is head weighting? It is the application of a circular weight that goes around the top of the cranium, much like a hat. This does several things, first it produces slight axial load and therefore joint compression. Joint compression is believed to produce sensory input via mechanoreceptors that in turn impact the motor control output. Proprioceptive sense (kinesthesia and/or joint position sense) is a somatosensory input is known to play an important role in body balance and motor control and head weighting influences this sense. Proprioceptors are found in the muscle spindle, the tendon, and the joint. In a study by Bhagat and Bhura it was found that joint distraction and compression both produced significant changes in the H-reflex which is an electrically evoked monosynaptic reflex and a measure of the final common pathway of motor output. This study serves to validate that motor output is impacted by joint compression facilitating proprioception. According to a study by Roijexon, Clark and Treleven it was stated that a well-functioning cervical motor control (CMC) system is essential to maintain balance during activities of daily living. The CMC receives sensory input from proprioceptive, vision and the vestibular system as previously noted via the COR and VOR. Proprioception is the only one that directly interacts with mechanical axial loading such as that of head weighting. Second, circular head weighting produces co-contractions about the cervical spine sleeve of neck muscles from joint compression via a head weight apparatus. This type of muscle contraction/activation is a very safe and effective option for the cervical regardless of the situation (i.e., acute, or chronic pain, post trauma, degeneration).

In summary, head weight training is a very effective and important component of the cervical spine rehab process. It is user friendly with easy donning and duffing. It is economically friendly with a relatively low consumer price point. It is easy to institute into a daily routine of life and can be worn as much or as little as one desires while performing normal household activities. Simply put, wear it while you live your life and strengthen and stabilize your neck.