Dynamic Chiropractic

WHIPLASH / NECK PAIN

What Are You Doing About Muscle Weakness?

PT. 2: CERVICAL SPINE

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A great deal of effort has been applied in chiropractic toward understanding and treating functional disturbances of the cervical spine, whether the cause of the dysfunction is trauma, as in whiplash dynamics, or of unknown etiology, as in many cervical-cranial syndromes. While considerable research has been conducted detailing the mechanical nature of the neck, the functional nature of cervical muscle action - responsible for the biomechanics and kinematics of the neck - is more limited. In the evaluation of patients with cervical disabilities, this lack of functional data regarding the strength of the cervical muscles is a serious compromise, since knowledge of this component of neck function is essential in understanding and evaluating deviations from normal.

Bailey considers that "the most significant of the anatomic structures providing stability to the cervical spine are the musculature and the firm bond between the bodies formed by the intervertebral discs."[1] The role of the muscles becomes even more important to chiropractors because of their integral control of spinal dynamics.

The muscles of the cervical spine comprise a closed kinematic chain. When one moves their neck, there must be organized facilitation and inhibition of muscles for proper function. The mechanism becomes even more complex with mandibular movements like chewing or talking. There must be interaction between the mandibular muscles and hyoid muscles while proper stabilization of the head's orientation in space is maintained.

The closed kinematic muscle chain of the cervical spine is a portion of the stomatognathic system. Proper function of this system is paramount for normal organization of muscle action in the neck. The excellent work of Thomas Myers (*Anatomy Trains*) proposes that dysfunctions of the "myofascial meridians" as far away as the bottom of the feet can create abnormal tensions in the neck to the top of the head.[2]

Normally, patterns of muscle activity and head motion are balanced. For various movements, sequences of muscle activity and head motion should be appropriate and symmetrical. The measurement of this functional muscular ability will provide a basis for a better understanding of neck function and allow us a method to evaluate neck dysfunction that complements our traditional methods of care for cervical disorders.[3]

As discussed previously, the evidence now shows with greater clarity than ever that inflammation or injury produces specifically identified inhibited muscles. Controlled clinical studies have shown that dysfunction and pain specifically in the cervical spine will produce inhibited muscles. These data indicate that the body's reaction to injury and pain is not increased muscular tension and stiffness; muscle inhibition is often more significant, as measured by several different methods of testing.

In 1920, Cyriax first described the relationship between muscle weakness (detected with a manual

muscle test or MMT) and headaches.[4] In 2008, an important literature review on neck muscle strength by Dvir ("Cervical Outcome Measures: State of the Art," published in a special issue of *JMPT*) confirmed, "Overall studies indicate that compared to normal subjects, patients suffering from neck-related disorders present with significant reduction in cervical strength."[5-11]

Jull has shown in many reports that patients with neck pain demonstrate reduced electromyographic activity of the deep cervical flexor muscles during performance of the craniocervical flexion test (a form of MMT).[12] It should be pointed out that the concurrent validity of the MMT (its comparison to other mechanical instruments of muscle strength testing) has also been found to be good. Many studies have favorably compared the findings of MMT with dynamometer and EMG tests.[13]

Prushansky and others have shown consistently cervical muscle weakness in chronic whiplash patients,[14] while Barton, et al., measured the strength deficits in patients with neck pain and showed that all force values were significantly lower in the neck pain population. Specifically for the deep neck flexor test, the peak force in the control group (mean = 45.3 +/- 17.6N) was reduced by 50 percent in neck pain subjects (mean = 22.4 +/- 13.1N) ($p = .004$).[15] Falla has similarly reported that both the sternocleidomastoid and anterior scalene muscles' strength was significantly reduced in patients with neck pain at 25 percent of maximum voluntary contraction ($p<0.05$).[16]

Edgerton, et al., showed altered muscle activation ratios of synergist spinal muscles during a variety of motor tasks in whiplash patients.[17] Their study showed that underactivity of agonists and overactivity of synergists was able to discriminate chronic neck pain patients from those who had recovered from neck pain with 88 percent accuracy. This paper describes for the neck what Lund, et al., have proposed globally for neck as well as other muscle imbalances, i.e., the pain adaptation theory.[18]

Recent studies by Nederhand, et al., have confirmed that cervical muscle dysfunction appears to be a general sign in diverse chronic neck pain syndromes, especially related to whiplash injuries.[19-20] This study suggests that the performance of the upper trapezius muscle is an invaluable diagnostic measurement in the evaluation of patients with chronic neck pain and chronic whiplash-associated disorders. The evaluation and treatment of upper trapezius muscle dysfunction should become a standard part of evaluation and therapy in neck pain patients.

To summarize: In patients with neck pain, the research has shown that muscle weakness is a very common causative factor. To fail to diagnose and specifically treat this component in your patients with neck pain will impede your therapeutic efforts.

Due to the comparatively high level of reliability and consistency of the MMT in the evaluation of neck muscle strength, using this test for clinical subjects with neck pain and neck muscle dysfunction is logical.[13,21] The MMT expands the scope of traditional EMG-type biofeedback.[22] In place of electrodes and mechanical sensors used in computerized devices, the MMT integrates the practitioner's sensory system as the sensor. The process is similar and in many cases identical to traditional EMG testing of active muscles.

The implications of this in regard to the diagnosis of mechanical neck pain and its responsiveness to chiropractic treatment are important for future research studies and for increased success in your treatment of patients with neck pain syndromes.

The MMT offers exciting potential for the study of mechanical neck pain and for evaluating potentially useful treatments for this common malady. A growing number of researchers report that cervical muscle weakness can be effectively restored using cervical manipulative therapy[23-25] and that correcting muscular dysfunction in the neck covaries with the resolution of the neck pain symptomatology in these reports.

No other system of chiropractic diagnosis has so extensively described the muscular etiologies and the corrective methods for neck muscle impairments as applied kinesiology (AK).[26-28] Even if you do not practice this method of clinical investigation, many of the approaches for identifying and correcting cervical muscle impairments described in AK should be of genuine value to you and your patients with neck pain. Functional muscle inhibition, as detected with the MMT, is a distinctively chiropractic diagnosis. It is unique in contemporary alternative practice in that it is considered to be central to the practice of physical diagnosis, yet it is not organic pathology. It is functional impairment.

Functional muscle inhibitions are present to a greater or lesser degree in most individuals with neck pain. The MMT makes it possible to diagnose this fundamental component of mechanical neck pain. Therefore, MMT should be part of your approach to the care of most patients who have muscle impairments in their overall clinical presentation. The MMT also confirms that you have addressed this problem appropriately.

General chiropractic treatment has been uniquely successful in improving cervical spine function. Improved understanding and effectiveness of this treatment have accompanied the MMT and AK examination of the cervical spine. It appears that with this system we are obtaining a better understanding of the neurologic ramifications caused by subluxations, fixations, and other types of dysfunction in the cervical spine, and how such disturbance can adversely affect function throughout the body.

References

1. Bailey DK. The normal cervical spine in infants and children. *Radiology*, 1952 Nov;59(5):712-9.
2. Myers TW. *Anatomy Trains: Myofascial Meridians for Manual and Movement Therapists*. Churchill Livingstone, Edinburgh, 2001.
3. Basmajian JV. *Muscles Alive - Their Functions Revealed by Electromyography, 4th Edition*. Williams & Wilkins Co., Baltimore, 1978.
4. Cyriax E. *On Weakness of the Posterior Cervical Muscles as a Cause of Headache*. Medical Press and Circular 1920, N.S. cviv:461-463.
5. Dvir Z, Prushansky T. Cervical muscles strength testing: methods and clinical implications. *J Manipulative Physiol Ther*, 2008 Sep;31(7):518-24.
6. Falla D, Jull G, Rainoldi A, Merletti R. Neck flexor muscle fatigue is side specific in patients with unilateral neck pain. *Eur J Pain*, 2004 Feb;8(1):71-7.
7. Falla D, Rainoldi A, Merletti R, Jull G. Myoelectric manifestations of sternocleidomastoid and anterior scalene muscle fatigue in chronic neck pain patients. *Clin Neurophysiol*, 2003 Mar;114(3):488-95.]
8. Vernon HT, Aker P, Aramenko M, Battershill D, Alepin A, Penner T. Evaluation of neck muscle strength with a modified sphygmomanometer dynamometer: reliability and validity. *J Manipulative Physiol Ther*, 1992 Jul-Aug;15(6):343-9.]
9. Silverman JL, Rodriquez AA, Agre JC. Quantitative cervical flexor strength in healthy subjects and in subjects with mechanical neck pain. *Arch Phys Med Rehabil*, 1991 Aug;72(9):679-81.
10. Ylinen J, Takala EP, Kautiainen H, Nykaenen M, Haekkinen A, Pohjolainen T, Karppi SL, Airaksinen O. Association of neck pain, disability and neck pain during maximal effort with

neck muscle strength and range of movement in women with chronic non-specific neck pain. *Eur J Pain, 2004 Oct;8(5):473-8.*
11. Vorro J, Johnston WL. Clinical biomechanic correlates of cervical dysfunction: Part 4. Altered regional motor behavior. *J Am Osteopath Assoc*, 1998 Jun;98(6):317-23.
12. Falla DL, Jull GA, Hodges PW. Patients with neck pain demonstrate reduced electromyographic activity of the deep cervical flexor muscles during performance of the craniocervical flexion test. *Spine*, 2004 Oct 1;29(19):2108-14.
13. Cuthbert SC, Goodheart GJ Jr. On the reliability and validity of manual muscle testing: a literature review. *Chiropr Osteopat*, 2007 Mar 6;15(1):4.
14. Prushansky T, Gepstein R, Gordon C, Dvir Z. Cervical muscles weakness in chronic whiplash patients. *Clin Biomech* (Bristol, Avon), 2005 Oct;20(8):794-8.
15. Barton PM, Hayes KC. Neck flexor muscle strength, efficiency, and relaxation times in normal subjects and subjects with unilateral neck pain and headache. *Arch Phys Med Rehabil*, 1996 Jul;77(7):680-7.
16. Falla D, Jull G, Edwards S, Koh K, Rainoldi A. Neuromuscular efficiency of the sternocleidomastoid and anterior scalene muscles in patients with chronic neck pain. *Disabil Rehabil*, 2004 Jun 17;26(12):712-7.
17. Edgerton VR, Wolf SL, Levendowski DJ, Roy RR. Theoretical basis for patterning EMG amplitudes to assess muscle dysfunction. *Med Sci Sports Exerc*, 1996 Jun;28(6):744-51.
18. Lund JP. et al. The pain-adaptation model: a discussion of the relationship between chronic musculoskeletal pain and motor activity. *Canadian Journal of Physiology and Pharmacology,* 1991;69:683-694.
19. Nederhand MJ, Hermens HJ, IJzerman MJ, Turk DC, Zilvold G. Chronic neck pain disability due to an acute whiplash injury. *Pain*, 2003 Mar;102(1-2):63-71.
20. Nederhand MJ, Hermens HJ, IJzerman MJ, Turk DC, Zilvold G. Cervical muscle dysfunction in chronic whiplash-associated disorder grade 2: the relevance of the trauma. *Spine*, 2002 May 15;27(10):1056-61.
21. Schmitt WH Jr, Cuthbert SC. Common errors and clinical guidelines for manual muscle testing: "the arm test" and other inaccurate procedures. *Chiropr Osteopat*, 2008 Dec 19;16(1):16.
22. Maffetone P. Manual Biofeedback. *J Altern Med Res*, 2009;1(3), in press.
23. Sterling M, Jull G, Wright A. Cervical mobilisation: concurrent effects on pain, sympathetic nervous system activity and motor activity. *Man Ther*, 2001 May;6(2):72-81.
24. Taylor HH, Murphy B. Altered sensorimotor integration with cervical spine manipulation. *J Manipulative Physiol Ther*, 2008 Feb;31(2):115-26.
25. Dishman JD, Burke J. Spinal reflex excitability changes after cervical and lumbar spinal manipulation: a comparative study. *Spine J*, 2003 May-Jun;3(3):204-12.
26. Goodheart GJ. *Applied Kinesiology Research Manuals*. Detroit: Privately published annually; 1964-1998.
27. Walther DS. *Applied Kinesiology, Synopsis, 2nd Edition*. Shawnee Mission, KS: ICAK USA; 2000.
28. ICAK-International and ICAK USA Web sites. "Applied Kinesiology Research and Literature Compendium" (www.icak.com/college/research/publishedarticles.shtml and www.icakusa.com/scientificresearch.php. Accessed March 30, 2009.]

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