Chiropractic Neurology Research Brief

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Part I: Consequences of Abnormal Cervical Lordosis

Introduction

The forward arching curvatures of the 7 cervical and 5 lumbar vertebrae are called lordosii (lordosis - singular). The importance of the preservation of the neck curve is discussed here. An abnormal cervical lordosis can produce pathological consequences as determined by numerous studies. They suggest that a lessening, straightening (military spine) or reversal (kyphosis) of the curve is responsible for generating abnormal weight-bearing loads, sheering stresses and muscular strains on the cervical spinal tissues which lead to pain and premature degeneration.

The best method of analyzing the cervical lordosis is with lateral cervical x-rays. Additional flexion and extension views which are included in a 7-view cervical series are beneficial and should be requested so the biomechanics of the cervical spine is best understood. Chiropractic neurologists believe that a normal cervical lordosis is an important factor in maintaining the integrity of the cervical spine AND general health of the patient. Here's how.

Normal Cervical Lordosis

Normal values for cervical lordosis have been established in the scientific literature. Gore et al. (1) assessed lateral cervical radiographs of a random sample of 200 asymptomatic people. Measuring the lordotic angle formed by Ruth Jackson's cervical stress lines (2) along the posterior vertebral bodies of C2 and C7 (lines drawn, on the x-ray plate, atop the back of the C2 cervical vertebra extending downward to meet a line drawn along the back of the C7 cervical vertebra extending upward), they found an average lordosis of 21.3 degrees. Owens and Hoiris studied radiographs of normal 113 subjects and found an average lordosis of 22.3 degrees (3).

Harrison et al. (4) presented an ideal model of the sagittal cervical spine to test the validity of the model by comparing predicted lordotic values to average lordotic values measured from lateral radiographs of 400 subjects. The model successfully predicted the segmental (angle between each vertebra) and absolute (angle between C2 and C7) lordotic values of the 400 subjects with an average error of five percent. The mean absolute value of cervical lordosis of the 400 subjects was 34 degrees. Interestingly, a subgroup of 252 subjects who did not have cervicocranial symptoms also had a mean cervical lordosis of 34 degrees.

According to the spinal model, the ideal cervical lordosis with a height-to-length ratio in the Delmas (5) normal range (.95) is 42 degrees. The Harrison study appears to carry more weight in terms of determining the average range of normal cervical lordosis because of the size of the study and the model valided. The authors recommend a normal average lordosis of 34 degrees and an ideal normal lordosis of 42 degrees (6).

Bone Remodeling/Disk Pathology

Osteophytes are created from abnormal loading of bone as determined by Wolff's Law (7). Forward head posture and kyphotic deformities of the cervical spine have been shown to shift the downward gravitational load of the head from the posterior elements (articular pillars i.e. articular facets) anteriorly more onto the vertebral bodies. For reference, the normal curvature of the thoracic is in the opposite direction of the cervical spine's lordosis). Bone models have shown that shifting the load of the head anteriorly to the vertebral bodies increases the stress on the vertebra 6 to 10 times greater than the normal lordosis (8, 9). Sustained cervical loading onto the vertebral bodies is associated with a negative surface charge, osteoblastic activity, and abnormal bone deposition (10). This, likely, explains the process of osteophytic formation and the development of osteoarthritis.

In a separate study, researchers found a statistically significant increased incidence of anterior vertebral body osteophytes and end plate sclerosis in subjects with lesser degrees of lordosis. End plates are vertebral body surfaces that contacts the disc and sclerosis is excess calcium deposition.

"When data of the subjects in the two oldest age groups were analyzed separately", the authors state*, " the average cervical lordosis for subjects with moderate or severe intervertebral narrowing averaged 17 degrees compared with 27 degrees for those with lesser or no intervertebral narrowing (1)."*

Forward head posture and kyphotic deformities increased loading onto the anterior vertebral elements can also be detrimental to the intervertebral disk (annulus). Asymmetrical loading of intervertebral disks can generate stress concentrations in the outer annulus and grounded substance of the disc or nucleus pulposis. Some authors speculate that asymmetrical disk loading can lead to annular tears, herniation and degeneration (11).

Spinal Cord Tension

It has been shown that flexion of the cervical spine induces tension into the cervical spinal cord, nerve roots, and brainstem, including cranial nerves V-XII (12, 13). Conversely, cervical extension causes relaxation of these tissues (12). Breig states that increased tension in the spinal cord might be a primary mechanism leading to neurologic dysfunction (12). Cervical kyphotic deformities from sustained flexion of the cervical spine (constantly looking downward) have the potential to create adverse tension in the central nervous system (CNS) and compromise its function. Kyphotic deformities have

the ability to compromise nerve tissue by reducing blood flow through the transverse pial vessels of the spinal cord. Neck kyphosis also increases cerebrospinal fluid and intramedullary pressure causing ischemia and reduced perfusion of the cord and supporting tissues. Spinal cord ischemia could invariably lead to the interruption or failure of both afferent and efferent impulse conduction (14). This, in turn, can result in a loss of somatosensory and neurogenic motor-evoked potentials (15, 16). Kyphotic deformities that create mechanical tension in the CNS could not only adversely affect nerve function, but could severely compromise systemic health, as well. This gives cause to a chiropractic dictum that good spinal health is necessary for good general health.

Headache

A loss of the normal cervical lordosis has been associated with chronic headaches. Vernon et al. evaluated cervical radiographs of 47 consecutive patients with muscle contraction/tension-type headache and common migraines. Using 25 degrees as the lower limit of normal lordosis, the study concluded that, *"For the total group, 77 percent of all subjects and 89 percent of females exhibited a marked reduction, absence or reversal of the normal cervical lordosis (17)."*

In another study, Nagasawa et al. (18) assessed the cervical lordosis of 372 patients with muscle-contraction/tension-type headache and compared them to 225 normal control subjects. The authors determined the lordosis using the Cervical Spine Curvature Index (CSCI) developed by Ishihara (19). In clinical terms, the CSCI indicates the amount of lordosis, i.e., the smaller the index, the straighter (hypolordosis) the cervical spine. The CSCI of the control group was 19.4 percent. The CSCI of the 372 headache sufferers was 14.6 percent. This study concluded that straightening of the cervical lordosis may play a role in the generation of tension-type headache.

Clinical Significance

There are clear indicates that a reduction, straightening or reversal of the normal cervical lordosis can have a detrimental effect on the structural health of the cervical spine and the creation of cervicocranial symptoms. The restoration of the cervical lordosis is becoming an important clinical outcome in healthcare. Chiropractic neurologists are qualified to correct such deformities.

In Part Two: Conservative methods to restore cervical lordosis.

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Mark Saracino, Board Certified Chiropractic Neurologist
Diplomat American Chiropractic Academy of Neurology
(adjacent to the Valley Forge Convention Center and Radisson Hotel)
1150 First Avenue, suite 120
King of Prussia, Pennsylvania 19406 1341

voice 610 337 3335
fax 610 337 4858
www.ACNB.org
Mark.Saracino1@juno.com
www.DrSaracino.com
(see back issues at "Health Information" link)