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SCIENTIFIC

PHYSICAL THERAPY

Advanced glycation end products contributes to the pathogenesis of osteoarthritis

By

Didrik J. Sopler Ph.D., L.Ac.

New research shows that pentosidine an advanced glycation end product accumulates in articular cartilage with age.[1]

Increased pentosidine concentrations are associated with inflammatory conditions and contributes to the pathogenesis of osteoarthritis.

Advanced glycation end products occurs when glucose and protein react with each other forming glycosylated protein.

This is tissue destructive and these reactions are more common in patients with dysfunction of the glucose-insulin metabolism. Insulin resistance and diabetes are two conditions where the patients have an abnormal glucose-insulin metabolism.

Patients with insulin resistance or diabetes are known to have increased levels of systemic inflammation. This is not only because of increased glycosylated protein, but to a large extent due to insulin which trigger inflammatory cytokines.

In this issue:

It is interesting however that advanced glycation end products has been documented to be involved in the pathophysiology of osteoarthritis. This is another good reason to recommend patients to follow a low glycemic index diet which should include important micronutrients, fiber and essential fatty acids to help normalize their biochemistry.

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Reference

1. Senolt L, Braun M, Olejarova M, Forejtova S, Gatterova J, Pavelka K. Increased pentosidine, an advanced glycation end product, in serum and synovial fluid from patients with knee osteoarthritis and its relation with cartilage oligomeric matrix protein. *Ann Rheum Dis. 2005 Jun;64(6):886-90.*

OGI and NASA

By
Ola Grimsby, Specialist in Orthopedic Manual Therapy

In 1997 the author of our most popular histology text; Alan Hargens, PhD was the keynote speaker at our annual Competency Forum. As the principal investigator in gravitational research at NASA-Ames, he discussed the musculoskeletal adaptation to space and exercise measures for long duration space travel.

When Dr. Hargens moved back to San Diego to continue his research at UCSD, he invited the OGI to participate in his research on the effect of microgravity on astronauts. I was extremely impressed with his research project, the methods, the available equipment and his team of scientific assistants. Unfortunately, my schedule did not allow me the necessary time to pursue this challenge, so I extended the invitation to other OGI instructors. Jojo Sayson committed to interact with Alan Hargens on my behalf, and the cooperation between the two turned out to become very successful.

Jojo's enthusiasm, his work capacity, his skill, courage and curiosity proved to be a valuable contribution to Alan's staff. The last 3-4 years Jojo has been working to develop a harness and an exercise unit for intervention with the back pain commonly experienced by astronauts under microgravity. Jojo and Alan have authored a comprehensive article to be published by NASA-Ames this year, and Jojo is currently preparing the necessary education as astronaut to be able to test the equipment in space.

In January he participated in a flight to the Stratosphere to experience 10 zero-G at 34,000 feet over the Gulf of Mexico, to practice movements under microgravity conditions. See the attached picture.

As an OGI instructor you can be proud to position yourself as a team player on the cutting edge of science and exploration. On behalf of us all, I would like to congratulate Jojo with his achievements and express our gratitude and admiration for helping to bring the OGI to space.

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Abstract

Evidence-Based Medicine for the Treatment of Cervicogenic Headache and Whiplash Associated Disorders

By
Brent Harper, PT, DMT, DPT, OCS, FAAOMPT

Evidence-Based Medicine for Cervicogenic Headache
Coinage of the term "cervicogenic headache" is attributed to Sjaastad.[1,2,3] From 1983 to 1987, he and his colleagues[1,2,3] conducted a series of studies dealing with cervicogenic headache, something described as a variant of the chronic paroxysmal headache. The diagnosis of cervicogenic headache included a tendency towards unilateral pain accompanied by autonomic symptoms and provoked by head and neck movements, especially forward flexion. The researchers described the head pain as nonclustering and episodic, originating from the neck and spreading to the head. Furthermore, the neck pain should respond to a root or nerve blockade. Sjaasted suggested cervicogenic headache may be due to an entrapment of the occipital nerve or to a C2-C3 rhizopathy. Sjaasted acknowledged there is significant potential to have overlap between cervicogenic, tension, and common migraine headaches.

This definition of cervicogenic headache was challenged. In response to the critics Sjaastad, Fredriksen, and Pfaffenrath[4] provided diagnostic criteria on cervicogenic headache on the behalf of The Cervicogenic Headache International Study Group. They defined cervicogenic headache as "a unilateral headache, but it may also be bilateral ('unilaterality on two sides'). The duration of the solitary attack, or an exacerbation, varies, from a few hours to a few weeks. In the initial phase, the headache is frequently episodic; later, it often becomes chronic and fluctuating in its symptomatic presentation. Symptoms and signs referable to the neck are essential, such as reduced range of motion in the neck, mechanical precipitation of attacks or exacerbation, etc. 'Migrainous' symptoms, like nausea and photophobia are, when present, generally not marked. A positive response to appropriate anesthetic blockades is essential. No specific radiological abnormalities have been identified." [4(p442)] They further described the minimal requirements for the diagnosis of cervicogenic headache to be:

(I) Symptoms and signs of neck involvement:
  (a) precipitation of head pain, similar to the usually occuring one:
    (1) by neck movement and/or sustained awkward head positioning, and/or:
    (2) by external pressure over the upper cervical or occipital region on the symptomatic side
  (b) rectriction of the range of motion (ROM) in the neck
  (c) ipsilateral neck, shoulder, or arm pain of a rather vague nonradicular nature or, occasionally, arm pain of a radicular nature

(II) Confirmatory evidence by diagnostic anethetic blockades. Point (II) is an obligatory point in scientific works.

(III) Unilaterality of the head pain, without sideshift. For scientific work, point (III) should preferably be adhered to.

"It is considered that the combination of (I)(a)…and (II) secures (proves?) the diagnosis. Presence of the other points under (I), (1b), and (1c) utterly fortifies the diagnosis." [4(p443)] The authors wrote cervicogenic headache could be clinically differentiated with reasonable certainty from other headaches. They reported, "it is not a 'disease' or 'entity'… but a reaction pattern." [4(p444)] The authors did not give a specific tissue as the pain generating mechanism, suggesting this type of headache may come from structures located in the upper, middle, or even lower cervical segments. They concluded, "Cervicogenic headache may be viewed as a sort of final common pathway for several pain-generating disorders in the neck" [4(p444)]

Thus, the clinical characteristics of cervicogenic headache include: unilateral pain primarily, may be bilateral (less frequent), usually side consistent (present at same region), with pain localized to occipital, frontal, temporal, or orbital regions, restricted neck ROM, precipitating factor of neck movement and/or sustained awkward head positioning, precipitation factor of external pressure over the upper cervical or occipital region on symptomatic side, intermittent attacks of pain, lasting hours to days (may be constant with attacks of pain superimposed), moderate to severe intensity, and the pain is generally deep, non-throbbing.[4-5]

Difficulty concerning the clinical manifestation of cervicogenic headache arises due to potential associated signs and symptoms such as: nausea, vomiting, double or blurred vision, difficulties swallowing, and dizziness. The diagnostic challenge occurs because the headaches usually occur in pairs. In other words, a cervicogenic headache is often present with a migrainous or tension type headache. It is important to recognize classical migraine comprises approximately 10% of patients with migraine, yet it dominates the discussion of headache and has driven headache terminology. [5,6,7]

The current evidence-based research on cervicogenic headache patients suggests it benefits greatest from manual therapy (mobilization and manipulation) in conjunction with exercise. [8] Unfortunately, there is a lack of quality studies on the efficacy

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of cervical spine manipulation[9,10,11,12]. Several studies[13,14,15,16] supported manipulation as efficacious for neck pain. Manipulation[17,18] was supported as beneficial for those suffering from cervicogenic headache as defined by the International Headache Society (IHS). Manipulation was more beneficial when compared to mobilization in a couple of studies.[19,20] Mobilization in conjunction with exercise was supported as beneficial[21]. Manipulation to the thoracic spine was also supported as beneficial[14]. Manipulation in conjunction with exercise was beneficial.[20] The use of manipulation combined with exercise,[18,20,21,22] rather then each alone, had the most significant short-term and long-term benefits. Manipulation, including high-velocity low-amplitude manipulation and mobilization, was beneficial[20] for those who met the criteria of Sjaasted, et al.[4] Thus, to ensure the most optimal outcomes over both short and long-term for those suffering from cervicogenic headache, the research supports the use of cervical manipulation, which includes mobilization and manipulation, in combination with exercise.

Conclusion Cervicogenic Headache

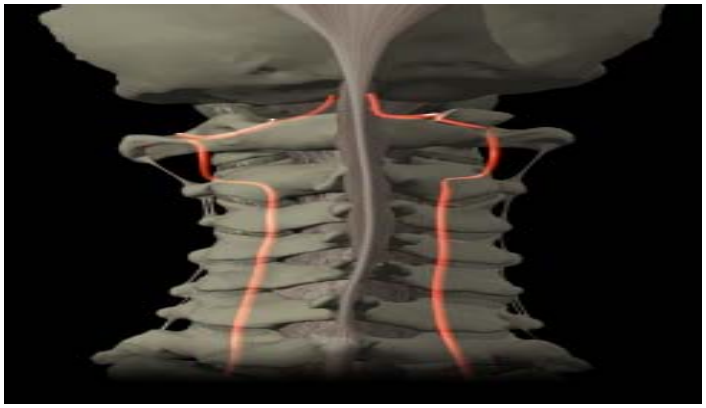
The evidence in current literature suggests treatment for cervicogenic headache include mobilization and/or manipulation in combination with exercise. Treatment should include manual therapy, mobilization and/or manipulation, primarily to the upper cervical spine (initially the OA to C3 segments) and secondarily to the upper thoracic spine (secondary T1 to T4 segments). Exercise should accompany the manual therapy (manipulation/mobilization) with the exercises addressing the deep neck flexors, the scapular musculature (suggestive of with/without neck motion), and mobilizing exercises for the cervical and thoracic spine. There continues to be a need for quality, randomized clinical trials to support evidence-based treatment.

Evidence-Based Medicine for Whiplash

The Quebec Task Force (QTF) Classification of Whiplash Associated Disorders (WAD) (Table 1) was developed to help guide research and treatment.

QTF Classification Grade	Clinical Presentation
0	No complaint about neck pain. No physical signs.
I	Neck complaint of pain, stiffness or tenderness only. No physical signs.
II	Neck complaint. Musculoskeletal signs including: Decreased range pf movement. Point Tenderness.
III	Neck complaint. Musculoskeletal signs including: Decreased or absent deep tendon reflexes. Muscle weakness. Sensory deficits.
IV	Neck complaint and fracture or dislocation.

Table 1: Sterling[23]



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This classification system has been criticized as too simplistic, primarily in WAD grade II, and because the guidelines were promoted and accepted without scientific validation. Whiplash patients in all grades have demonstrated altered cervical muscular recruitment patterns as shown "by increased activity in the superficial neck flexor muscles at the lower stages of the cranio-cervical flexion test."[23(p63)] Altered patterns of recruitment have also been demonstrated in the shoulder girdle musculature. Kinesthetic disturbances have been noted with joint repositioning errors and postural control. Increases have also been noted in generalized sensory hypersensitivity, possibly due to changes with the central pain processing mechanisms. Chronic WAD is characterized by disturbances in the motor systems, the sensory system, and with increased levels of psychological distress. Sterling[23] has proposed a new classification system for WAD, but it is beyond the scope of this paper.

Current literature has added the characteristic of more accessory musculature with repeated upper extremity movements to the description of WAD Grade II patients.[24] Cervical muscle dysfunction in patients with chronic WAD Grade II has not been found to be related to a specific trauma mechanism. Cervial muscle dysfunction appears to be a general sign in diverse chronic neck pain syndrome.[25] Jull[26] found higher muscle activity in the superficial neck flexors in WAD (whiplash group) when compared to an asymptomatic group in staged test of cranio-cervical flexion ($p<0.0001$). WAD 23 +or- 1.3 mmHg control & asymptomatic 28 +or- 1.7 mmHg control ($p<0.0001$). Barnsley, et al[27] studied chronic neck pain after whiplash with a double-blind, controlled study using diagnostic blocks. They found cervical zygapophysial joint pain was the most common source of chronic neck pain after whiplash with the most painful zygapophysial joint identified in 54% of patients (95% CI, 40-68%). The most common levels were C2-3 and C5-6.

The evidence-based treatment for WAD favors an active approach, primarily for WAD grades I to III.[28] (McClure, et al) Shnable[29] found early mobilizing exercises were superior to immobilization. Rosenfeld, et al[30] demonstrated that treatment involving McKenzie principles (active sub maximal movements combined with Mechanical Diagnosis and Therapy & posture education) is more effective in decreasing pain (6 months after, $p<0.001$; no change in cervical range of motion) than a standard program. Pho and Godges[31] performed a case study using a patient suffering from a whiplash-associated disorder. Their treatment included soft tissue mobilization, active and passive range of motion, exercise, mobilization and manipulation to the upper thoracic spine, and contact-relax techniques to the lower cervical spine (opening then closing procedures). The good results they achieved led them to suggest assessing upper thoracic spine as well as cervical spine in patients with functional limitations associated with neck pain.

Revel, et al[32] found the proprioceptive system of the neck, which is involved in cervicocephalic kinesthesia, has learning abilities which could be improved by rehabilitation techniques. The functional organization of the neck, mainly of the proprioceptive apparatus, supports the inclusion of exercises based on eye neck coordination for cervical patients. The role of neck proprioception alteration in chronic neck pain and suggests a component of the rehabilitation program based on eye-hand coupling should be included in most medical management of cervical patients.

Ylinen, et al[33] performed a blind, randomized clinical trial and found isometric strength training and dynamic endurance training resulted in a significantly decreased pain level and disability level in women with chronic neck pain even after 1-year follow up. Aerobic exercise & stretching were less effective. Sarig-Bahat[34] performed a literature review of randomized clinical trials and randomized comparative trials. He found there was strong evidence supporting effectiveness of proprioceptive exercises and dynamic resisted strength exercise of the neck-shoulder musculature for chronic and frequent neck disorders (whiplash-associated and chronic neck pain).

Gross, Hoving, et al[35] performed a cochrane review of randomized clinical trials or quasi randomized clinical trials of patients with neck pain, with WAD grade I-III, and headache. They concluded a multimodal treatment plan using mobilization and/or manipulation combined with exercise was beneficial for pain relief, functional

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impairment, and global perceived effect for sub-acute and chronic mechanical neck disorders with or without headache.

Gross, Kay, et al[36] developed a cycle/model and cochrane reviewing process of the literature to critique past reviews, randomized clinical trials, and surveys to develop clinical practice guidelines based on current evidence-based literature. The authors provided some "Evidence-Based Recommendations" to apply to those with symptomatic mechanical neck disorders with or without headache; which includes DDD or whiplash associated disorders. They recommend the following: 1) Use of a multi-modal treatment strategy using mobilization or manipulation plus exercise to relieve mechanical neck pain; 2) Use your best judgment concerning other common multi-modal treatment strategies. They do not recommend a single session of manipulation to decrease pain.

Conclusion Whiplash

The evidence from the present literature suggests that those with WAD (grade I to III) are best treated by mobilization and/or manipulation in combination with exercise. Manual therapy should be directed primarily to the cervical spine and secondarily to the upper and middle thoracic spine with exercise procedures that address the deep neck flexors, scapular musculature, and include mobilizing exercises to the cervical and thoracic spine. There continues to be a need for quality, randomized clinical trials to support evidence-based treatment.

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