2006 Vol. 15 No 1

SCIENTIFIC

PHYSICAL THERAPY

Increased bone formation may protect against cartilage loss

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

Researchers in Australia have investigated the possibility of bone markers being useful to predict cartilage loss.[1]

The subjects were 40 healthy men (mean age 52.3 years) with no symptoms of osteoarthritis. The evaluation consisted of a MRI of the dominant knee at baseline and two years later. Serum level of osteocalcin, urinary levels of pyridinoline and deoxypyridinoline which are all markers of bone metabolism was measured as well as total body bone mineral content. These measurements were all done at baseline. Tibial plateau bone size was also measured at baseline and tibial cartilage volume was measured both at baseline and at follow up. Twenty eight men (70%) completed the study.

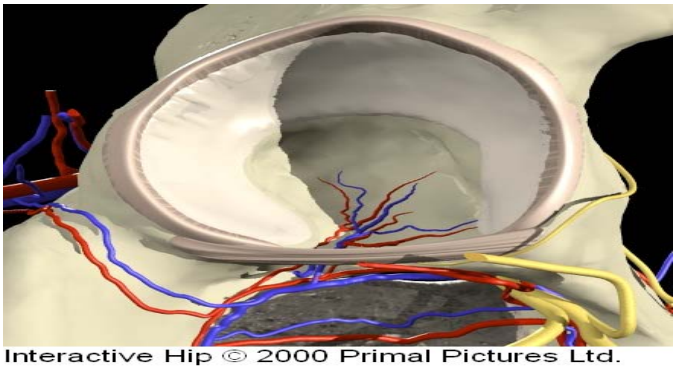
The investigators found that higher baseline serum osteocalcin was associated with a decreased rate of cartilage loss. This suggests that increased bone formation may protect against tibial cartilage loss over two years.

To support bone formation and the synthesis of cartilage important minerals are calcium, magnesium, zinc, copper and manganese. Important vitamins are vitamin C, vitamin B6 and vitamin D3.

In this issue:

This is useful clinical information. By recommending patients to supplement their diet with these important nutrients they may reduce their risk for both osteoporosis and degenerative joint disease.

Picture Ref:
www.primalpictures.com



Reference

1.Wang Y, Ebeling PR, Hanna F, et al. Relationship between bone markers and knee cartilage volume in healthy men. *J Rheumatol. 2005 Nov;32(11):2200-4.*

Free radical damage plays a role in the pathophysiology of osteoarthritis

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

Superoxide dismutase (SOD) the body's own antioxidant enzymes, is a constituent of cartilage.

The objectives of the following study was to determine if there is a relationship between extracellular superoxide dismutase deficiency and osteoarthritis, samples of human cartilage as well as mouse cartilage were used.[1] The samples were obtained from femoral heads of patients at the time of joint replacement surgery for osteoarthritis or from patients with femoral neck fracture.

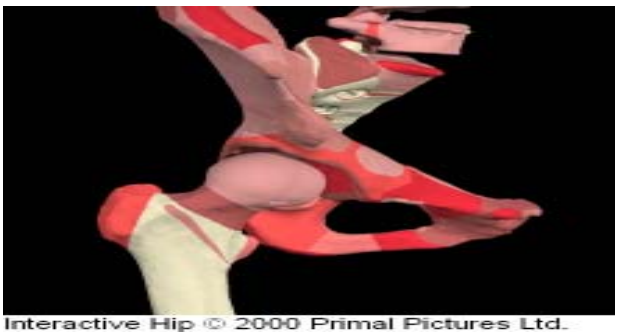
Extracellular SOD was measured several ways from the patient's samples and also from the mouse cartilage. The cartilage samples were also measured for several other factors.

The results showed that human articular cartilage contained large amounts of extracellular SOD. When comparing the patients with osteoarthritis and the patients with hip fractures, the patients with osteoarthritis had approximately a 4-fold lower level of extracellular SOD.

The mice started to show a decreased level of extracellular SOD before the histological evidence of disease occurred.

The researchers concluded that extracellular SOD, the major scavenger of reactive oxygen species in extracellular spaces is decreased in osteoarthritis. The researchers concluded that extracellular SOD, the major scavenger of reactive oxygen species in extracellular spaces is decreased in osteoarthritis. This suggest that inadequate control of reactive oxygen species plays a role in the pathophysiology of osteoarthritis.

The clinical importance of this is that the minerals zinc, copper and manganese are necessary for the production of SOD.



Picture Ref: www.primalpictures.com

By recommending patients to supplement their diet with these minerals they can help prevent damage to cartilage caused by free radicals.

Reference

1. Regan E, Flannelly J, Bowler R, et al. Extracellular superoxide dismutase and oxidant damage in osteoarthritis. *Arthritis Rheum. 2005 Nov;52(11):3479-91.*

Abstract

Evidenced-Based Medicine for Manipulation and Vertebral Artery Concerns

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

When discussing manipulation to the upper cervical spine, the vertebral artery is of primary concern. The upper cervical spine is an area under the most debate due to the potential for vertebral artery injury, and side effects from a manipulative procedure. It is the purpose of this article to provide evidenced-based medicine of the present literature as it relates to the upper cervical spine manipulation and its risk to the vertebral artery.

Vertebral Artery Anatomy

The vertebral artery contributes approximately 11% of the total cerebral blood flow, the remaining 89% is supplied by the carotid system. Approximately 60% of axial rotation of the cervical spine and occiput occurs in the upper region (C0-C1-C2), while 40% is found in the lower region (below C0-C1-C2). It most commonly enters the C6 foramen transversarium, however, variations may occur. Historically, it was believed 30 degrees of rotation caused the contralateral vertebral artery to become kinked and stretched, and at 45 degrees of rotation, the ipsilateral vertebral artery begins to kink. However, as the recent literature on rotation and the vertebral artery demonstrates, this may not be the case[1,2].

The vertebral arteries can be disrupted in many ways and in many areas, both by intrinsic and extrinsic factors. Intrinsic disorders are related to pathology of the artery itself and often involve narrowing of the arterial lumen. These include conditions like atherosclerosis, aneurysms, thrombosis, and emboli. Extrinsic disorders are caused by encroachment of the artery by external structures. These include conditions like osteophytes, bony anomalies, muscular entrapment, fibrous bands, nerve entrapment, and excessive mechanical forces[1,2].

The vertebral artery has four primary zones or regions where it can be compromised and is more susceptible to injury due extrinsic causes. Zone One extends between the subclavian artery and the C6 foramen transversarium. It runs in the angle between scalenus anterior and longus colli muscles and is invested by the deep cervical fascia. The extrinsic factors most likely implicated in Zone One include anomalous origins of the longus colli or the scaleni, and fascial bands[1,2].

Zone Two runs vertically through the foramina transversaria of the upper six cervical vertebrae. It primarily relates to two bony structures, the uncinate process of the vertebral bodies and the superior articular processes of the zygopophyseal joints. Potential extrinsic factors in this region are the uncovertebral osteophytes (primarily at these segments C5-6, C4-5, C6-7), subluxation of superior articular process, tumors, and cancers[1,2].

Zone Three passes though the foramen transversarium of C1 and turns horizontally across it. The 2nd and 3rd zones of the VA are fixed within the foramina transversaria, therefore, the VA must move whenever the transverse processes move. This motion is greatest at the atlanto-axial level during rotation. Therefore, zone three tends to be of primary concern when discussing upper cervical manipulation; specifically rotational techniques. Extrinsic factors include subluxation of C1, the bony arch on the superior surface of C1 (arcus ponticulus or retroarticular foramen), and mechanical forces to this region, including techniques that involve rotation, extension, or traction[1,2].

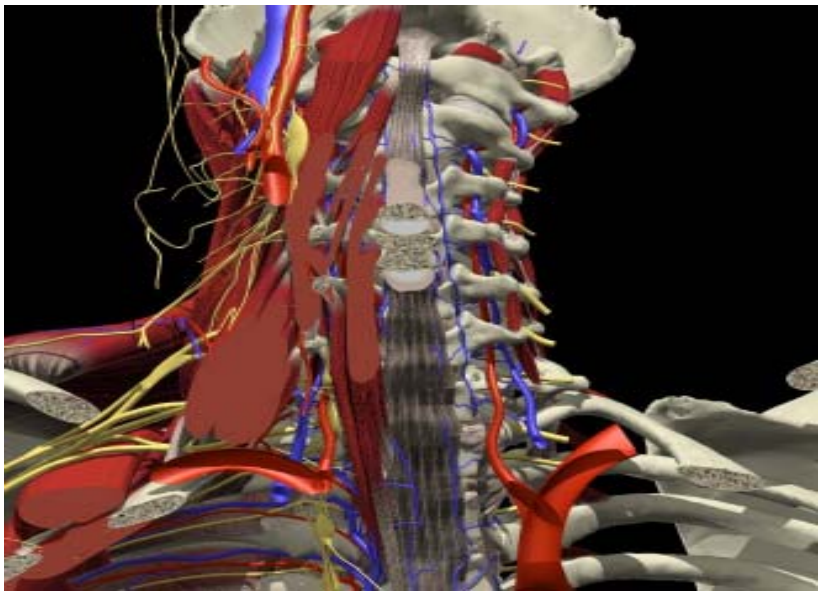
Zone Four enters the foramen magnum to join the opposite vertebral artery and form the basilar artery. Extrinsic disorders include mechanial forces to the artery may get distorted with extension and

rotation movements, as well as compression between the occiput and posterior arch of C1[1,2].

Manipulation and the Vertebral Artery

Vertebral artery syndrome is defined as a transient, partial, or complete occlusion of a branch of the vertebrobasilar arterial system resulting in ischemia or infarct of the spinal cord, brainstem, or cerebellum. It is typically associated with occlusion of the vertebral artery through cervical hyperextension or rotation. Primary signs and symptoms from vertebral artery compromise may be numerous. However, they primarily involve remembering the 5 D's, which are dizzines (most common), diplopia (double vision), drop attacks (syncope, black out), dysarthria (difficulty speaking), and dysphagia (difficulty swallowing)[2].

Cerebral ischemia, specifically vertebral-basilar artery insufficiency (VBI), can cause non-overt signs. Symptoms indicating potential involvement of the vertebral arteries in the clinic are more difficult to identify. The variability in the symptomatic presentation makes it difficult to specifically identify with physical examination testing, especially since evidence-based guidelines regarding vascular causes are limited. Potential symptoms due to blood flow disturbance include difficulties with speech, swallowing, balance, and vision; including syncope, nausea, and vertigo. A recent article by Asavasopon, Jankoski, and Godges[3] found that that, "Episodic vertigo, especially when lasting more than 1 minute, occurring in isolation or with other associated VBI symptoms, should be considered a potential medical-screening red flag, and should increase the index of suspicion of vascular insufficiency" (p649). From the present literature, the authors identified possible risk factors, or co-morbidities, associated with VBI, including hypertension, hyperlipidemia, diabetes, carotid disease, heart disease, alcoholism, and smoking.



Picture Ref:
www.primalpictures.com

Evidence-based medicine is based on statistical findings to clinical situations. The usefulness from these studies is described by various statistical terms. Sensitivity is the proportion of people who actually have the disease and are correctly identified as "positive" by the screening test. Specificity is the proportion of people who do not have the disease and are correctly identified as "negative" by the screening test. Likelihood Ratios (LR) combines sensitivity and specificity and indicate the change in odds favoring the disease given the screening test results. The greater the LR+, the more likely the condition is present given a positive test result. The smaller the LR-, the more likely the condition is absent given a negative test. An LR of 1.0 does not change the odds for or against the disease[4].

Study of the vertebral artery was undertaken by Richter & Reinking[4], who performed a literature search to obtain evidence to guide clinical decision-making. Their interpretation of the cervical spine test of extension-rotation presented by Sakaguchi et al[5], demonstrated a sensitivity of 9.3% (95% CI=4 to 19.9%), a specificity of 97.8% (95% CI=96.7 to 98.5%), a LR+ of 4.243 (95% CI=1.678 to 10.729) and a LR- of 0.928 (95% CI=0.851 to 1.011). The authors had two primary conclusions: 1) A negative VA extension-rotation test does not rule out VBI. A negative test does not add anything to the clinical-decision process. A positive test may suggest the presence of VBI and require further diagnostic testing, 2) The VA test does not expose the patient to a high-velocity, low-amplitude thrust, therefore, a negative test cannot be used to determine the safety of cervical manipulation.

Childs, et al[6] completed a commentary on the ability to identify patients at risk for VBI and found a paucity of peer-reviewed evidenced. They found presently there is no clinical predication rule that can accurately identify patients at risk for VBI and there is little evidence substantiating the accuracy of historical information, physical examination screening procedures, or diagnostic imaging to accurately identify patients at risk for VBI prior to manual therapy. However, the authors believe that information can be gained from the history and physical exam to help guide clinical decision-making. From the history, it would be unwise to ignore the signs & symptoms thought to be associated with VBI or a positive screening test. The mechanism of injury is helpful, trauma, particularly from high-velocity flexion-distraction and rotational forces that may occur during a whiplash incident. This information can help differentiate a diagnosis of VBI from fracture, sensorimotor function or vestibular involvement. Patients with VA injury may present with just neck pain, which may be pre-existing and misdiagnosed as mechanical neck pain. Testing positions that implement the application of incrementally greater movements and loads were supported by the authors as appropriate. Prior to manual therapy procedure, maintain patients head position in the position (i.e. premanipulative hold technique) where the procedure is to be done for 10 to 15 seconds prior to imparting the force and assess for signs and symptoms of VBI.

Many studies looked at cervical manipulation and vertebral arteries to help clarify the risks and benefits of upper cervical manipulation. Zaina, et al[7] performed ultrasound duplex Doppler, at C1-2 and C5-6, at 45 degrees rotation and at end range rotation. They found that repetition of the rotational position did not have a cumulative effect on the patency of the vertebral arteries. They found that premanipulative hold tests do not have a morbid effect on the vertebral arteries and a 10 second rest period is a sufficient identifier for latent effects form the test positioning.

Arnold, et al[8] performed a pilot study using duplex colour doppler sonography with testing performed in 6 different clinical test positions. They found premanipulative hold for minimum of 10 seconds at C1-2 (positioned in cranio-vertebral side bending with contralateral rotation down to and including atlano-axial joint with digital pressure on, just short of manipulative thrust) and rotation are useful screening positions for the identification of high-risk patients for VBI (decrease in contralateral vertebral artery).

Symons, Leonard, Herzog[9] performed a cadaveric study to determine strains and lengthening movements that occur to the vertebral arteries during manipulation. They found that the strains produces from manipulation on the vertebral arteries are within the range of strains produced during normal physiological cervical spine movement. Under normal circumstances, a single high-velocity and low-amplitude manipulative thrust is highly unlikely to tear or otherwise mechanically disrupt the vertebral arteries.

Rosner[10] wrote a commentary on vertebral artery and related causes of cerebrovascual accidents. He identified that the spontaneous vertebral artery dissections in hospital settings occur annually in 1 to 1.5 per 100,000 patients, and twice as high in community setting. While cerebrovascular accidents (CVAs) attributed to spinal manipulation was equal to that of the spontaneous rates for cervical arterial dissections. The author suggested if these rates of occurrence are correct, we need to look at what can cause spontaneous events, rather than just focusing solely on manipulation. He identified a genetic defect that leads to

increased levels of the amino acid homocysteine. This amino acid may play a role in disrupting collagen and elastin in the arterial wall. He believed elevated levels of the amino acid homocysteine are the most reliable method of identify those at risk for CVAs.

Symons and Westaway[11] wrote a review paper on blood flow and spinal manipulation using Virchow's Triad as a conceptual model to evaluate research on thrombosis with an emphasis placed on high-velocity low-amplitude manipulation thrust of the cervical spine. The authors proposed this revision of Virchow's Triad: 1) Abnormal Blood Flow, including atherosclerosis, HTN, and homocysteine levels. Clinically, this can be tested, to a limited extent, by taking blood pressure and by auscultation for bruits. 2) Predisposing Factors can be identified as genetic or lifestyle (female, advancing age, obesity, sedentary, smoker, or oral contraceptives), by various pathological or medical conditions (diabetes mellitus, lupus, sickle cell disease, previous strokes, history of TIA's, HTN, or atherosclerosis). 3) Physical damage, which is from the manipulative procedure itself. The authors reported if performed daily for two weeks, manipulation may have a greater potential to cause vertebral artery injury than if performed over a longer period of time, for example two times a week for seven weeks. Therefore, the authors believe that a disruption of vertebral artery blood flow is not likely due to manipulative procedures based on two arguments. First, most people have four major arteries that supply the Circle of Willis, the remaining collateral arteries would reflexively compensate for any decrease in brain perfusion. As support, the Symons and Westaway cited two studies in which compensatory blood flow occurred even when 100% VA was occlusion and did not result in VBI. Second, the manipulative procedure took 5-10 seconds to set up and then perform the manipulation, which only took 200 ms, whereas most TIAs last from 2 to 15 minutes and did not produce any substantial side effects. Therefore, the authors concluded that if manipulation induces VBI, it does so only in the presence of other factors.

Haynes[12] performed a literature review to evaluate doppler velocimetry as a vertebral artery-screening tool for use prior to manipulation. He found that there may be an increased risk for VBI in the vertebral arteries due to marked reduction in patency while in neutral position and/or in a positional stenosis of cervical rotation causing contralateral blood flow obstruction. There was high inter-examiner reliability using the doppler velocimetry technique. The author concluded there is no ultimate screening test at this time to prevent all strokes from occurring. Clinicians should implement the most recent evidence-based approaches available. There was strong evidence supporting the use of doppler velocimetry as a valid VA screening too, thus the conclusion supported its use as the standard for premanipulative cervical procedures.

Harper[13] performed a modified extensive literature review concluding that there is no penultimate screening test or protocol to prevent all stokes from occurring. However, clinicians should perform manipulative therapy according to the best evidence-based approaches available. This includes a thorough history (identifying co-morbidities), general medical screening examinations (by minimally taking blood pressure, heart rate, and auscultation for bruits), by the performance of physical testing procedures (i.e. deKleyn's, premanipulative hold, and full rotation), and, where available, using blood panel results (amino acid homocysteine) and doppler velocimetray (hand held unit).

Manipulation and Side Effects

Many concerns have expressed regarding the use of cervical manipulation due to the potential side effects that may occur from the implementation of this procedure. The primary concern usually involves the vertebral artery, previously discussed. However, the question still remains, what are the risks of cervical manipulation? Atchison[14] performed a literature review, prospective study, of randomized clinical trials. He found following cervical manipulation there were mild complications in 0.00025% (1 in every 40,000), serious complications (including fracture, SPI, or vertebrobasilar accident) in 0.00001% (5-10 per every 10,000,000), major functional impairment (including paralysis and other neurological deficits) was 3-6 per every 10,000,000), and a risk of death in less than 3 per every 10,000,000. As a comparison, the author identified the potential risks of non-steroidal anti-inflammatory drugs (NSAID) which were estimated for risk of hospitalization due to gastric ulcers 0.4% as well as the risk of death at 0.04%. These percentages are much higher than what has been found as the result of manipulation.

Di Fabio[15] performed a literature review of case reports (116) and randomized clinical trials (12) on efficacy of manipulation to the cervical spine and potential risk factors. He found risk for severe neurovascular compromise ranged from 1 in 50,000 to 1 in 5,000,000. He reported the population at risk for VBI is not always easily identifiable, that rotational thrusts represented the most cerebrovascular cases, and that manipulation has not been shown to be better than mobilization. However, Harper[13] performed a modified extensive literature review and found that the efficacy of manipulation, as compared to mobilization, resulted in positive results supporting manipulation, although

the numbers of qualified studies were limited. In conclusion, Harper found that the research has implicated that cervical manipulation, which includes mobilization and manipulation, in combination with exercise would provide the most significant outcomes.

Senstad, Leboeuf-Yde, and Borchgrevink[16] performed a prospective survey questionnaire (4712) pilot study, among chiropractors in Norway looking at unpleasant side effect following spinal manipulation. The authors found no serious complaints of injury. They did find following manipulation there was various resultant symptoms that occurred. These types of reactions included local discomfort (53%), headache (12%), tiredness (11%), radiating discomfort (10%), dizziness (5%), nausea (4%), hot skin (2%), and other (2%). These symptoms tended to occur at various intervals. The onset of symptoms occurred within 10 minutes (17%), between 10 minute to 4 hours (47%), after 4 hours (32%), or were not stated (4%). The authors concluded at least half of new patients who receive manipulation would report at least one unpleasant reaction during the course of treatment. This may mean the occurrence of side effects to cervical manipulation may be higher than has been estimated in the past, however, no serious complications were found.

Cagnie, et al[17] performed a prospective observational survey (465) to determine side effects and risk factors associated with manipulative therapy among manual physiotherapists, chiropractors, and osteopaths in Belgium. They found multiple side effects from manipulation, including headache (19.84%), stiffness (19.46%), aggravation of original complaints (15.18%), fatigue (12.06%), and radiating discomfort (12.06%). Most side effects started within 4 hours of manipulation (60.54%) and ended within 24 hours of treatment (63.96%). Despite the presence of side effects, 66.9% of patients reported improvement in original diagnosis within 48 hours of manipulation.

Upper cervical spine manipulation is 3.17 time more likely to cause side effect of headache than lower cervical spine. There is a 2.4% decreased risk of headache for each 1-year increase in age. Women had 1.66 times greater risk of headache than males. Women ($P<0.001$), smokers ($P=0.045$), individuals with history of migraines ($P<0.001$), and those using medication regularly ($P=0.011$) complained more of headache. Women complained more than men about stiffness ($P=0.38$), local discomfort ($P=0.030$), and fatigue ($P=0.036$). The authors recommend asking about headache, dizziness, and nausea on the visit following the treatment. They considered these three side effects as red flags, indicating a contra-indication for further cervical manipulations.

Conclusions

The potential for serious side effects continues to be associated with cervical manipulation, especially when applied to the upper cervical spine. Despite this assumption, there appear to be more significant causes of vertebral artery disruption other than mechanical disruption alone. It is evident that serious side effects still occur, although at extremely limited numbers. It is more common for those who receive cervical manipulation to experience non-serious side effects at varying time intervals after the procedure. Therefore, it is important for physical therapists to inform the patient of the expected potential common physical side effects from the manipulative procedure and when these effects might occur. This will also help the practitioner remember what can be expected and what should be avoided regarding the implementation of the manipulative procedure. It will also help guide physical therapy practice concerning further implementation of manipulative procedures.

Reference

1. White AA, Panjabi MM. *Clinical Biomechanics of the Spine.* 2nd ed. Philadelphia, PA: Lippincott: 1990.
2. Ola Grimsby Institute (OGI, Part II Fellowship, San Diego, CA 2004.
3. Asavasopon S, Jankosk J, and Godges J. Clinical diagnosis of vertebrobasilar insufficiency: Resident's case problem. *JOSPT.* 2005;35:645-650.
4. Richter RR, Reinking MF. Evidence in practice. *Physical Therapy.* 2005;85:589-599.
5. Sakaguchi M, Kitagawa K, Hougaku H, et al. Mechanical compression of the extraranial vertebral artery during neck rotation. *Neurology.* 2003;61:845-847. As cited in: Richter RR, Reinking MF. Evidence in practice. *Physical Therapy.* 2005;85:589-599.
6. Childs JD, Flynn TW, Fritz JM, et al. Screening for vertebrobasilar insufficiency in patients with neck pain: manual therapy decision-making in the presence of uncertainty. *J Orthop Sports Phys Ther.* 2005;35:300-306.
7. Zaina C, Grant R, Johnson C, Dansie B, Taylor J, Spyropolous P. The effect of cervical rotation of blood flow in the contralateral vertebral artery. *Manual Therapy*. 2003;8:103-109.
8. Arnold C, Bourassa R, Langer T, Stoneham G. Doppler studies evaluating the effect of a physical therapy screening protocol on vertebral artery blood flow. *Manual Ther.* 2004;9:13-21.
9. Symons BP, Leonard T, Herzog W. Internal forces sustained by the vertebral artery during spinal manipulative therapy. *J of Manipulaive and Physiol Ther.* 2002;25:504-510.
10. Rosner R. Spontaneous cervical artery dissections and implications for homocysteine. *J of Manipulaive and Physiol Ther.* 2004;27:124-132.
11. Symons BP, Westaway M. Virchow's triad and spinal manipulative therapy of the cervical spine. *J Can Chiropr Assoc.* 2001;45:225-231.
12. Haynes MJ. Vertebral arteries and cervical movement: Doppler ultrasound velocimetry for screening before manipulation. *J of Manipulaive and Physiol Ther.* 2002;25:556-567.
13. Harper, BA. *Cervical Spine Manipulation for the Treatment of Cervicogenic Headache: A Modified Extensive Literature Review* [doctoral dissertation]. San Diego, CA: Ola Grimsby Institute; 2005.
14. Atchison JW. Manipulation efficacy: upper body. *J of Back and Musculoskelatal Rehab.* 2000;15:3-15.
15. Di Fabio RP. Manipulation of the cervical spine: risk and benefits. *Physical Therapy*. 1999;79:50-65.
16. Senstad O, Leboeuf-Yde C, Borchgrevink C. Frequency and characteristics of side effects of spinal manipulative therapy. *Spine.* 1997;22:435-441.
17. Cagnie B, Vinck E, Beernaert A, Cambier D. How common are side effects of spinal manipulation and can these side effects be predicted? *Man Ther.* 2004;9:151-156.

Advertise here with SPT

- Do you own new or gently-used equipment you would like to sell?
- Do you provide a service physical therapists and orthopedic professionals need?
- Would you like to advertise to professionals like yourself?

If you answered yes to any of these questions, call us! We have reasonable prices and advertising for 1/4 page, 1/2 page and full page.

Scientific Physical Therapy
4420 Hotel Circle Court Suite 210
San Diego, CA 92108-3423
Phone: [800] 883-1252
E-mail: scientificpt@sbcglobal.net

To sign up for classes, please download our Registration Form (requires Adobe Acrobat Reader). To apply for our degree or certificate programs, please download our Application Form. Please fax your completed registration form to (619) 298-4225 or mail it to The Ola Grimsby Institute, 4420 Hotel Circle Court, Ste. 210, San Diego, CA 92108.

Please visit our Continuing Education section for course descriptions; visit our Degrees section for more information about our degree programs. Thank you for your interest in Ola Grimsby Institute. We look forward to helping you further your career in manual physical therapy!

The Academy of Doctoral Sciences, Inc is a Utah-based corporation offering a doctor of manual therapy degree for physical therapists who have completed their manual therapy residency and fellowship programs and who have received their DPT from the Ola Grimsby Institute.

The third year of postsecondary education following the OGI programs is a year of advanced clinical specialization for which the academy is granted the right to issue a doctor of manual therapy degree.

For further information contact:
The Ola Grimsby Institute
4420 Hotel Circle Court, Suite 210
San Diego, CA 92108
Phone: 1-800-646-6128.

If you, by making a simple recommendation, could improve treatment outcome, would you be interested?

The website www.tissuerecovery.com was set up to make it easy for your patients to get access to nutritional information and supplements supporting the treatment you do.

E-books with just the important facts, quick and easy to read, can be downloaded immediately. We can also print and mail these books to people who prefer that.

The e-books based on the latest research and sound physiology, are:

Facts You Need to Know About Carbohydrates, but No One Told You

Facts You Need to Know About Fat, but No One Told You

Facts You Need to Know About Protein, but No One Told You

We also have an **anti-inflammatory formula,** giving quick and effective pain relief, without the side effects of anti-inflammatory drugs.

As a physical therapist we have a special offer for you. Give us a call at 1-800-883-1252 or 1-619-299-8346 and we will explain it to you. You will not find this offer on the website.

Your patients are of course also welcome to call us if they are more comfortable with the phone than the computer.

The easiest way to incorporate nutrition is for patients to start taking the BMJ Formula. The BMJ supplies specific nutrients in an easy absorbable form targeted to support bone and joint cartilage as well as other connective tissue.

BioPro

Log on to www.tissuerecovery.com and read what some of the latest research reveals about inflammation. Check out our website and call us at 1-800-883-1252 or 619-299-8346

Improve your treatment outcome

- ✓ Do any of your patients complain of stiffness in the morning?
- ✓ Do you have patients with degenerative joint disease?
- ✓ Would your patients like to prevent joint degeneration?
- ✓ Do you have patients who complain of muscle cramps?
- ✓ Do you have patients with decreased bone density?
- ✓ Do you treat patients who are recovering from a fracture?
- ✓ Would your patients like to prevent osteoporosis?
- ✓ Would you like to support collagen formation in your patients?

If you answered yes to any of these questions, introduce your patients to the BMJ formula. Both you and your patients will be glad you did.

The BMJ is a unique formula based on scientific studies providing important support for the tissue you treat:
bone, cartilage, disk, ligaments and tendons, as well as, neuromuscular function.

The BMJ contains calcium, magnesium, zinc, copper and manganese, vitamin D, vitamin B_6 and glucoseamine sulfate.

The minerals are supplied as patented amino acid chelates for greater absorption.

We will provide you brochures with a list of scientific references. **BMJ, the ultimate tissue support for orthopedic patients.** Small effort, big benefits, supporting your treatments.

You can order for your patients [or for yourself] or have your patients order directly by calling 800-883-1252.
Visit our web site at www.tissuerecovery.com.

Scientific Physical Therapy

a peer-reviewed publication on the internet

- Scientific Physical Therapy is a peer reviewed journal published on the internet four times yearly

- Please visit our web site: www.scientificphysicaltherapy.com

For a free subscription, contact us at scientificpt@sbcglobal.net
Scientific Physical Therapy
4420 Hotel Circle Court Suite 210
San Diego, CA 92108-3423 USA

Material to be considered for publication can be submitted as articles, case studies, research reviews or clinical pearls related to the practice of manual therapy. The material can be e-mailed to scientificpt@sbcglobal.net or mailed on a PC formatted disk or cd to Scientific Physical Therapy 4420 Hotel Circle Court Suite 210 San Diego, CA 92108-3423 USA