Discs *are not* Shock Absorbers *of the spine*

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MANY clinicians have the wrong mental picture of vertebral body and intervertebral disc structure and function left by the study of conventional wisdom gained by cadaberic dissection. A common misnomer when describing the spinal elements to a patient is to describe the vertebral bodies as blocks of bone with "shock absorbers" (discs) separating these bones. Clinicians must gain a better understanding of this functional anatomy and thus create a better mental image of healthy function in order to understand the injured state.

Rather than describing the vertebral bodies as "blocks of bone," describe the anterior element as a barrel with a mini trampoline on the top and bottom. The barrel equates the bony cortex and the mini trampolines are analogous to the flexible cartilaginous end plates. Nourishment for the disc including nutrients, oxygen, and glucose comes from the blood rich, cancellous bone inside the "barrel" (vertebral body). the three-dimensional lattice work inside the "barrel" is comprised of vertical columns of bony trebeculiac and oblique connections, kind of like "angle iron" corner supports hold up a metal structure.

Remember—a healthy disc contains high amounts of water. Water is a hydraulic, non-compressible fluid; therefore a disc does not absorb shock, but transfers the stresses as the nucleus pulposus deforms the flexible cartilaginous end plates of the vertebral body.

In fact, internationally known spinal biomechanist Stuart McGill, PhD, has found nearly impossible to herniate a disc in the manner conventionally thought (axial compression with flexion). McGill has reproduced under laboratory controls that the vertebral body cancellous bone repeatedly fails first. Additionally, McGill and colleagues have visualized this physiology using fluoroscopy to observe power lifters lumbar spine biomechanics while lifting as much as six hundred pounds. These findings are contrary to the conventional wisdom which considers the vertebral body a rigid block.

The cortical wall of the vertebral body, or "barrel," works somewhat like a closed vessel and the pressures exerted on the highly vascular cancellous bone can cause what we classically call a burst fracture. Short of causing a burst fracture, I have hypothesized that the blood and fluids contained within the vertebral bodies under forced pressure may "escape" through the basivertebral veins into the internal venous plexus or longitudinal venous sinus of the spinal canal. If the clinician reviews this venous anatomy, one could quickly imagine the over swelling or dilation of these veins causing compression of the spinal cord and associated nerve roots in the exact same locations thought to be compressed by an extruded disc.

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So the "pop" in the back often ascribed to rupture of a disc is much more likely to be rupture of the vertebral end plate which tends to occur after the end plate succumbs to the radial stresses which result in a stellate pattern fracture. The nucleus pulposus is squished through the end plate into the vertebral body cancellous bone. Otherwise recognized after the fact, with a significant bony healing, as a Schmori's node. Prior to the calcium deposition of healing causing the radiographic appearance, a clinician is more likely to consider an acute herniated disc diagnosis rather than a more accurate vertebral compression fracture description. In fact, these are very difficult to visualize on radiograph in the early stage.

The vertical columns of the cancellous bone within the vertebral body are connected by transverse ties which fracture after excessive loading. The cancellous bone is remarkably dynamic and can rebound to at least 98% of its original unloaded shape, according to Eyhrie and Schaffler. Cancellous bone fractures appear to heal quickly, given the available blood supply and relatively small amount of esterophyte activity needed, when compared to the length of time required to repair collagenous tissues.

A clinical point includes the need to support bone healing with bone building nutritional supplements, whereas the current focus on back injuries in regards to nutrition includes more support for the cartilaginous disc and joint tissues.

Now that the vertebral bone is understood to be a much more flexible and dynamic tissue than previously thought, etiology of posterior element damage must also be reconsidered. Previous biomechanical hypothesis of pars fractures in the posterior elements of vertebrae were mostly taught as hyperextension sources of trauma. More recent evidence demonstrates that injury in the posterior bony elements is a fatigue injury caused by cyclic full flexion and extension with repeated bending. A patient may better understand the analogy of bending a metal spoon back and forth repeatedly, which causes weakening and eventually breaks the spoon handle in half.

With significant posterior sheer forces, failure of the vertebral end plates causes an avulsion from the vertebral body. Severe anterior sheer of a superior vertebra has been documented to cause pars and facet fracture, leading to what has been classically described as spondylolisthesis. One could easily identify with the repeated flexion and extension bending motions performed by gymnasts which would cause this effect.

Previously, high incidence of pars fractures found in football players would have been attributed to blocking, hyperextension, and an anteroposterior sheer force. More realistically, the repeated flexion to extension and high velocity loading, such as a lineman leaving the "down" position and springing upward to block an oncoming tackler, is the fatigue mechanism leading to failure of the pars.

Markolf and Morris demonstrated that the nucleus pulposus preserves disc height

which has implications on facet loading after the nucleus has pushed through the vertebral and plate. This causes a functional loss of disc height. Once the hydrostatic pressure balance of an intact disc has been disturbed, then the disc's outer annulus will bulge outward and the inner annulus will bulge inward with compression. This tears apart the concentric layers of the annulus. This delamination may allow a path for the nuclear material to be extruded through the laminated layers now representing a "true" herniated disc.

Recall that a healthy nucleus pulposus is a gel-like substance with viscous and elastic properties. During fetal development of the nodal cord andintervertebral discs, these tissues are not in contact with material blood supply and are therefore not recognized by the immune system later as "part of self." Once the nucleus has been exposed to the blood supply, it is attacked like a foreign invader or "splinter under the skin" and becomes a consistency McGill describes as "crabmeat." Adams and Hutton concluded herniations tend to occur in younger spines with a higher water content whereas Goel and others found that older spines exhibit delamination of the annulus and develop radial cracks which progress with repeated loading.

These important biomechanical and basic science discoveries should be applied directly to improve clinical treatments and thus patient outcomes. I've heard many times humble clinicians explain, "Doctor is the Latin name for teacher," hence his or her goal is to educate patients. Aside from the classic definition of doctor, "one trained in the healing arts," doctor is also "to alter or falsify." Not without consequences we often make wrong assumptions based on clinical observations, and we must learn to alter our treatment rationales in the face of good science proving previous conventional wisdom false. In this vein I say, "Doctors should humbly remain students for life in an effort to become better teachers."

Much of the information reviewed in this article is a brief synopsis of Stuart McGill's lecture, "Prevention and Treatment of Industrial Injuries," session 1 of Southern California University of Health Sciences Chiropractic Rehabilitation Diplomate Program and reading from Clinical Biomechanics, *Churchill-Livingston, 2001, editor Zeevi Dvir; chapter 5, Biomechanics of the Thoracolumbar Spine, pages 103-139, by Stuart McGill.*

Acupuncture Council

New Rule for Acupuncture Effective July 1

LARRY KWAN, DC

THE Acupuncture Council had an agenda meeting on Saturday, February 16, at the Greensboro Airport Marriott. Due to the sudden illness of Vice Chairman Don Austin, Sr., it was decided that we would postpone our education seminar that was scheduled for January 26 until further notice. The Council will contact Dr. Austin to determine if he is interested in continuing to serve the Council or seek other options.

We will begin mailing our membership dues for the Council in March. A certificate of membership will be sent to all renewed members at that time.

We have spoken with Dennis Hall concerning the requirements that are necessary for chiropractors to practice acupuncture in North Carolina. He was informed that the 100 hours are now formally established in the Board of Chiropractic Examiners N.C. Rule 0208. This rule will become effective on July 1, 2002. The Council has to renew our efforts to change to 200 hours as soon as this rule is in effect.

The Council also intends to formally request the NCCA Board to request that our NCCA attorneys and lobbyists work to change our chiropractic scope of practice law to include acupuncture as an adjunct therapy as taught in chiropractic colleges. Currently, chiropractors can practice acupuncture only under the exemption of the Board of Acupuncture Examiners. The inclusion of acupuncture, as taught by chiropractic colleges, will insure the continual practice of this non-surgical, non-drug adjunct therapy to our profession.

The Council discussed the possibility of acquiring some acupuncture continuing education books and/or tapes that would be checked out through the NCCA office in Raleigh. The Council also examined the acupuncture requirements and the different scope of practice laws for chiropractors in other states.

Our next open Council meeting will be during the Fall Convention at the Embassy Suites in September 2002.

Can We Learn to Get Along?

In a major article in the October 2001 issue of *Business & Health*, it is pointed out that complementary and alternative medicine (CAM) is "now big business." Four in 10 U.S. adults use it. Yet most CAM services, "except chiropractic," are still paid for out-of-pocket. John Weeks, editor of *The Integrator*, a newsletter tracking "the business of alternative medicine," points out that $50 billion a year is spent on such services. The jargon has changed relative to CAM. What was once called "alternative care" was later called "complementary" to indicate its use as an adjunct to, rather than a replacement for, conventional medicine. Now "integrative medicine" is the term used by the small but growing cadre of allopathic doctors and CAM advocates who believe communication and collaboration between integrative and conventional medicine can lead to the best patient outcomes.

Weeks, who organized the summit sponsored by Integrative Medicine Communications, says that in recent years "there has been a rapid expansion of initiatives to integrate CAM with mainstream payment and delivery systems." This year's summit assembled MDs, NDs (naturopathic doctors), employers and leaders of health plans, hospitals, and delivery systems to advance these efforts.

Surveys showed that 80% of firms with 500 or more employees provided chiropractic in their health plans. Of Fortune 200 firms, 76% provided chiropractic. Of those providing chiropractic coverage, 63% said it was because employees request the coverage.