Dynamic Chiropractic

Dublin's ESB Conference - The Old Meets the New

Over 500 delegates from 25 countries convened in Dublin, Ireland, at the historic University of Dublin's Trinity College for the 12th Conference of the European Society of Biomechanics (ESB), August 27-30, 2000. Founded in 1592, Trinity College was the first university in Ireland. Its great heritage and history are still preserved in its cobblestone walks and magnificent buildings, where over 12,000 students study the arts and sciences today.

The opening address, by Patrick Prendergast,PhD, from the college's department of mechanical engineering, provided an historical account of biomechanics in Ireland and Europe. He reflected on the pioneers who fundamentally contributed to the application of mechanics in biology, such as Samuel Haughton (1821-1897) of Dublin, who challenged Darwin's theory of natural selection. Haughton asked: "If the musculoskeletal structure of animals is optimized to perform minimum mechanical work, then how can any peculiarity (mutation) possibly give the animal a more advantageous musculoskeletal structure?" After years of work in the dissection laboratory, and studying the geometry of skeletal muscle, Haughton's critique of *On the Origin of Species*, which he published as *Principles of Animal Mechanics*, is perhaps the only truly scientific rebuttal to the theory of natural selection ever written.

Today, Ireland boasts some 75 medical device/diagnostics companies, including 10 of the world's top 15 medical device manufacturers, a testimony to the country's contribution to biomedical engineering and biomechanics.

Dr. Prendergast's welcome was followed by a reception featuring traditional Irish music and dancing, great food and camaraderie. As it was sponsored by the Guinness Brewing Company, one can be assured that a good time was had.

The next morning, Tony Keaveny, PhD, from the Orthopaedics Biomechanics Laboratory at the University of California, Berkeley, delivered the 6th Samuel Haughton Lecture on Micromechanics of Trabecular Bone Strength. It provided a review of the contemporary micromechanical models of the strength properties of trabecular bone, which can be used to gain insight into the effects of aging, disease, and treatments for patients.

Throughout the week, advances in the field of biomechanics were witnessed in many sessions throughout the conference. The topics included: fracture and fracture healing; implant testing; trabecular patterns; remodeling; microdamage in bone: musculoskeletal loading; biomechanics in sport; clinical biomechanics; modeling human motion; and extremity biomechanic. Each topic sparked interest and are of great relevance to any health care provider.

NICR-Sponsored Research

Of over 470 abstracts submitted to the conference, just over 200 were accepted for podium presentation. Our group, from the National Institute of Chiropractic Research (NICR), was pleased to

have an abstract accepted for podium presentation, and another for poster presentation. Taking the podium during the spinal biomechanics session, I was proud to represent the chiropractic profession in this esteemed scientific forum, presenting our paper, *Mechanical Impedance of the Human Lower Thoracic and Lumbar Spine Exposed to* in vivo *Posterior-Anterior Manipulative Thrusts*.

This paper comprises the results of original research on dynamic spinal stiffness in patients with low back pain. The research was conducted by Tony Keller,PhD and myself in my private practice. Dr. Keller, a professor from the department of mechanical engineering at the University of Vermont, took sabbatical in Phoenix, Arizona for six weeks in 1998 and 1999 with funding from the NICR and the Foundation for the Advancement of Chiropractic Education (FACE) to collaborate with me on numerous research projects. Taking full advantage of his expertise in the field of biomechanics, we actively recruited subjects to participate in our research project, performing examinations each evening from 6:30-10:30, following my regular day of seeing chiropractic patients.

Our paper investigated dynamic spinal stiffness testing in patients with low back pain. Traditionally, clinicians have relied on their kinesthetic sense to perceive the motion response and tissue stiffness of the spine during the examination of patients. Such assessments are highly qualitative, and many studies have demonstrated that clinical judgments based upon perceived motion responses are unreliable or inaccurate (Keating, Bergmann, et al. 1990; Mootz, Keating, et al. 1989; Ross, Bereznick, et al. 1999; and Troyanovich, Harrison, et al. 1998).

While numerous studies exist investigating the stiffness or mobility of the spine, we found that most of these examined asymptomatic subjects at low frequencies. Because the spine is a viscoelastic structure, meaning that it exhibits both time-dependent and frequency-dependent mechanical properties, Dr. Keller developed and validated a dynamic stiffness assessment technique involving the application of an impulsive thrust (150 N, < 5 msec.) to the spine, and measuring the spine's response to the perturbation (Keller, Colloca, et al. 1999). Using this technique, we were able to perform over 1,600 samples on 22 patients, obtaining an enormous amount of data to be analyzed. With the assistance of Daryn Seltzer,DC, the data was processed, and we found that the patients with more frequent and constant symptoms tended to have increased spinal stiffness. We feel that this research is important, as it may serve to uncover an objective means of assessing the spine and researching the chiropractic vertebral subluxation.

Our second paper accepted at the ESB conference, *Dynamic Response of the Human Lumbar Spine: a five-Degree-of-freedom lumped parameter time and Frequency Domain Model*, represents a mathematical model of the spine to posteroanterior forces. The utility of such a model allows for calculations of how much motion takes place at the segmental contact point and adjacent vertebrae during a chiropractic adjustment. Allowing for the input of different forces and lines of drive, the model and its animation predict the spinal motion and response to forces applied by the clinician.

We believe that ultimately this will help protect chiropractors accused of injuring patients during chiropractic treatment. Currently, the manuscript of this abstract is in review at a prestigious biomechanical journal, and soon, you will be able to access this model at my website: http://www.neuromechanical.com.

Research from AECC

Other chiropractic research presented at ESB included two papers by our colleagues from the Anglo-European College of Chiropractic in Bournemouth, England. Gabreille Ghirila,DC, presented her work

with Dr. Guy Gosselin, associate professor at AECC, titled *Sacrum Load Displacement Behaviour and its Relationship to Bilateral Hip Flexion*. Their study examined motion of the SI joint in relationship to different loads applied to the sacral apex and sacral base. The authors found that tightening of the *thoracolumbar fascia* through bilateral hip flexion contribute to SI joint locking. This may mean that a lumbar extensor stretching protocol for your patients with SI joint pain may be of benefit.

A second AECC study by Gosselin and Blouin was the poster presentation, *Cervicocephalic Kinesthesia Sensibility and Postural Sway in a Formula 3000 Racing Car Driver: Preliminary Report*. This study represented Dr. Gosselin's investigation of the proprioceptive system by use of a head repositioning system and analysis of postural sway. He determined that subjects involved in competitive driving suffered from functional disturbances, including the inability accurately reposition the head and postural drift. They concluded that it appears that cervical proprioception contributes significantly to static balance, and it is suggested that other equilibrium mechanisms are primed by the massive afferent stimulation sustained during driving. Having had the opportunity to visit with Dr. Gosselin previously when I guest-lectured at AECC in June, I am now collaborating on new research projects with him in a multi-center international data draw.

Other Relevant Research

From the Research Unit on Manual Therapies, Laboratory for Functional Anatomy at the University of Brussels (Belgium) came other research of interest to chiropractors. *Three-Dimensional Kinematics of the Cervical Spine Before, During and After a Cervical Manipulation Performed by Different Manipulators* (Van Geyt et al.) investigated the ranges of motion, velocity, and acceleration employed by four clinicians trained in the same lateral cervical break technique. The results of the study indicated that the same practitioner used the same kinematic parameters to manipulate either the lower neck (C5) or upper neck (C3), but each practitioner produced his or her own motion with a specific range, velocity and acceleration. The authors found that experience tended to play an important role in acceleration of the cervical spine during the thrusts, and believe that this study has implications for the training of those participating in spinal manipulation, to attempt to improve the repeatability of manual spinal manipulation by clinicians.

Ballroom Reception

As interesting as the scientific presentations were, applying the concept of "all work and no play" was not healthy. We enjoyed a state reception, held at St. Patrick's Hall at Dublin Castle, where the minister for science, technology and commerce, Mr. Noel Treacy, addressed the group. The magnificent ballroom was adorned with murals and paintings from the 17th and 18th centuries, and a banquet was held Ireland's Royal College of Surgeons.

The 12th Conference of the European Society of Biomechanics not only served as a forum for the dissemination of quality research, but was also a means for colleagues and friends to share their ideas and cultures. Abstracts from the conference can be found online at http://www.mme.tcd.ie/esb2000.

References

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