Focus on Research

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The End of the Disease Era

The authors of this paper, from the Yale School of Medicine, state, "The time has come to abandon disease as the focus of medical care. "

The changed spectrum of health, the complex interplay of biological and non-biological factors, the aging population, and the inter-individual variability in health priorities render medical care that is centred on the diagnosis and treatment of individual diseases at best out of date and at worst harmful.

A primary focus on disease may inadvertently lead to under treatment, over treatment, or mistreatment.

The numerous strategies that have evolved to address the limitations of the disease model, although laudable, are offered only to a select subset of persons and often further fragment care.

Clinical decision making for all patients should be predicated on the attainment of individual goals and the identification and treatment of all modifiable biological and no biological factors, rather than solely on the diagnosis, treatment, or prevention of individual diseases.

Anticipated arguments against a more integrated and individualized approach range from concerns about medicalization of life problems to "this is nothing new" and "resources would be better spent determining the underlying biological mechanisms."

The perception that the disease model is "truth" rather than a previously useful model will be a barrier as well. Notwithstanding these barriers, medical care must evolve to meet the health care needs of patients in the 21st century.

Reference: - Tinetti M, Fried T. The end of the disease era. Am J Med 2004;116:179-85.

Mechanobiology and Diseases of Mechanotransduction

The current focus of medicine on molecular genetics ignores the physical basis of disease even though many of the problems that lead to pain and morbidity, and bring patients to the doctor's office, result from changes in tissue structure or mechanics. The main goal of this article is therefore to help integrate mechanics into our understanding of the molecular basis of disease.

This article first reviews the key roles that physical forces, extra cellular matrix and cell structure play in the control of normal development, as well as in the maintenance of tissue form and function.

Recent insights into cellular mechanotransduction—the molecular mechanism by which cells sense and respond to mechanical stress—are also described.

Re-evaluation of human path physiology in this context reveals that a wide range of diseases included within virtually all fields of medicine and surgery share a common feature: their etiology or clinical presentation results from abnormal mechanotransduction. This process may be altered by changes in cell mechanics, variations in extra cellular matrix structure, or by deregulation of the molecular mechanisms by which cells sense mechanical signals and convert them into a chemical or electrical response.

Molecules that mediate mechanotransduction, including extra cellular matrix molecules, transmembrane integrin receptors, cytoskeletal structures and associated signal transduction components, may therefore represent targets for therapeutic intervention in a variety of diseases.

Insights into the mechanical basis of tissue regulation also may lead to development of improved medical devices, engineered tissues, and biologically-inspired materials for tissue repair and reconstruction.

Reference: - Ingber DE. Mechanobiology and diseases of mechanotransduction. Ann Med. 2003;35:564-77.

Intercellular mechanotransduction: cellular circuits that coordinate tissue responses to mechanical loading

Physical forces play an important role in modulating cell function and shaping tissue structure.

Mechanotransduction, the process by which cells transduce physical force-induced signals into biochemical responses, is critical for mediating adaptations to mechanical loading in connective tissues.

While much is known about mechanotransduction in cells involving forces delivered through extra cellular matrix proteins and integrins, there is limited understanding of how mechanical signals are propagated through the interconnected cellular networks found in tissues and organs.

We propose that intercellular mechanotransduction is a critical component for achieving coordinated remodelling responses to force application in connective tissues.

We examine here recent evidence on different pathways of intercellular mechanotransduction and suggest a general model for how multicellular structures respond to mechanical loading as an integrated unit.

Reference - Ko KS, McCulloch CA. Intercellular mechanotransduction: cellular circuits that coordinate tissue responses to mechanical loading. Biochem Biophys Res Commun. 2001;285:1077-83.

Is the Responsiveness of an Infant's Autonomic Nervous System Compromised during Prone Sleeping?

The association between the prone sleeping position and SIDS is now well documented (1-3). Furthermore, dysfunction of the autonomic nervous system ANS has been documented in some infants that have subsequently died from SIDS.(4,5) Since the ANS is the controlling system which regulates the rescue response in life-threatening events some authors have hypothesised that prone sleeping may lead to further stress for a baby with an already compromised ANS responsiveness.

What is not so clear, however, is whether there is a relationship between sleep position and ANS responsiveness.

The aim of the following study(6) was to compare the effects of sleep position (prone as opposed to supine) on the responsiveness of the autonomic nervous system as measured by the degree of peripheral vasoconstriction with a Laser Doppler flow meter (LDF).

The cutaneous vasoconstrictor responses following a 60 degrees head-up tilt (a means by which to stress the ANS) was measured in 36 infants at 1 and 3 months age to investigate the effects of sleep position on this response. The mean reduction in blood flow (vasoconstriction) was 52% following the tilt. Prone positioning 1-month-old infants as compared to supine, reduced the degree of vasoconstriction following the tilt (P=0.027). Therefore, the prone position was associated with a decrease in ANS responsiveness when the infants ANS was stressed via a tilt test.

This study(6) provides data on a simple measure of sympathetic activity during sleep that has not previously been described in any detail in infant studies, and adds more evidence that autonomic activity is reduced in the prone position compared to supine during sleep.

ASRF Chiropractic Update Editor's comment - A recent review of the literature pertaining to prone sleeping and SIDS by Galland et al. (7) came to the following conclusions -

Generally, compared with the supine, the prone position raises arousal and wakening thresholds, promotes sleep and reduces autonomic activity through decreased parasympathetic activity, decreased sympathetic activity or an imbalance between the two systems. In addition, resting ventilation and ventilatory drive is poorer. The majority of findings suggest a reduction in physiological control related to respiratory, cardiovascular and autonomic control mechanisms, including arousal during sleep in the prone position.

References:

1. Mitchell E, Scragg R, Stewart A, et al. Results from the first year of the NZ cot death study. NZ Med J 1991; 104 :71-6.

2. Dwyer T. Ponsonby A, Newman NM. Prospective cohort study of prone sleeping position and SIDS. Lancet 1991;337:1244-7.

3. Flemming PJ, Gilbert RE, Azaz Y, et al. Interaction between bedding and sleeping position in SIDS: a population based case-control study. BMJ 1990; 301: 85-9.

4. Swartz PJ, Stramba-Badiale M, Segantini A, et al. Prolongation of the QT interval and SIDS. NEJM 1998 ; 338 : 1709- 14.

5. Taylor BJ, Williams SM, Mitchell EA, et al. Symptoms, sweating, and reactivity of infants who died of SIDS compared to community controls. J Paediatr Child Health 1996 ; 32 : 316-22.

6. Galland BC, Taylor BJ, Bolton DPG, et al. Vasoconstriction following spontaneous sighs and head-up tilts in infants sleeping prone and supine. Early Human Dev 2000; 58: 119-32.

7. Galland BC, Taylor BJ, Bolton DPG. Prone versus supine sleep position: a review of the physiological studies in SIDS research. J Paediatr Child Health 2002; 38: 332-8.

Does the adjustment cavitate the targeted joint? An investigation into the location of cavitation sounds

Background: The cavitation sounds heard during chiropractic adjustments of the spine are common phenomena; yet, their location relative to the technique used is relatively untested. It is believed that the cavitation sounds are produced when the particular surfaces of the joint are sufficiently separated during an adjustment. To some chiropractors cavitation is a sign that their procedure has been performed correctly and thus will have the desired therapeutic effect. However, other authors contest the clinical significance of the cavitation sound.

The aim of this investigation was therefore to evaluate the effects of 2 different chiropractic adjustive techniques performed on the fifth lumbar vertebra and the sacroiliac joint in terms of the location of the cavitation sounds produced to determine whether these techniques resulted in significantly different areas of joint cavitation. rst objective was to determine the effect of the L5 pull adjustment in terms of the location of the cavitation sound produced. The second objective was to determine the effect of the lower sacroiliac adjustment in terms of the location of the cavitation sound produced. The third objective was to compare the results of objectives 1 and 2 to

Thirty asymptomatic volunteers were randomly divided into 2 equal groups. Each group represented either the spinous hook adjustment or lower sacroiliac adjustment. Subjects had 8 microphones taped to their skin, over the relevant facet and sacroiliac joints. Radiographic confirmation was used to ensure optimal placement of the microphones. Sound signals produced during the adjustments were digitized, recorded, and analyzed statistically.

The results indicated that no statistically significant correlation existed between the anatomical location of cavitation sounds and the adjustment technique selected.

It is concluded by the authors that the location of cavitation sounds does not appear to have a relationship with type of manipulative technique selected. They suggest that further studies using other techniques need to be performed.

Reference: Beffa R, Mathews R. Does the adjustment cavitate the targeted joint? An investigation into the location of cavitation sounds. JMPT 2004; 27: e2.

An exploratory study of provocation testing with padded wedges: Can prone blocking demonstrate a directional preference?

2004; 27:103-108. Anthony J. Lisi, Robert Cooperstein, Elaine Morschhauser,

Abstract TOP

Background: Currently, no traditional chiropractic examination method to determine a spinal listing offers demonstrated guidance in treatment decisions for low back pain (LBP) patients. Development of an

examination that bypasses the difficulty of accurately and reliably identifying a listing, yet provides guidance on manipulative vectors, could be very valuable to clinicians and patients.

Objective to explore 2 potential protocols for provocation testing and assessment of directional preference using padded wedges.

Methods: Two groups of 20 subjects were examined while lying prone on various positions of padded wedges. In the first group, pain pressure threshold (PPT) was measured at 4 anatomic points; in the second group, tenderness was measured at 1 anatomic point. We investigated whether either method could demonstrate a directional preference response.

Results: When tenderness was measured at 1 anatomic point, 70% of subjects demonstrated a directional response, and only 1 subject exhibited an increase in baseline tenderness at the end of the procedure. When PPT was measured at 4 anatomic points, 40% of subjects demonstrated a directional response, but 12 subjects exhibited decreased PPT at the end of the procedure.

Conclusion: Measuring changes in tenderness at 1 anatomic point in response to various padded wedge patterns appears promising as an examination procedure to determine directional preference.

Introduction TOP

Currently, there is no significant evidence that any traditional chiropractic examination method to determine a spinal listing—and subsequent direction of manipulation—has a bearing on clinical outcome in the management of low back pain (LBP).1-6 That is, no current method of finding a segmental lesion/subluxation offers demonstrated guidance in treatment decisions for LBP patients.

In the physical therapy field, a component of the McKenzie mechanical examination method has been shown to provide information that can influence LBP treatment. Donelson et al7,8 have demonstrated that patients may exhibit a directional preference on mechanical examination of the spine. This is described as a direction of motion that produces a beneficial change in symptoms, such as increased range of motion and/or decreased pain. Furthermore, the opposite motion usually produces a worsening of symptoms. For example, if lumbar flexion decreased low back pain and lumbar extension increased low back pain, then flexion would be that subject's directional preference. Several authors have shown that using directional preference to guide treatment of certain low back pain patients results in positive clinical outcomes.7-12

Elements of mechanical examination and directional preference are incorporated into provocation testing, a relatively novel chiropractic examination method. Described by Triano,13,14 provocation testing is an assessment of patient symptoms in response to a manually applied load, such as would be applied by a given high-velocity low-amplitude (HVLA) manipulative procedure, but without the thrust. It is the application of premanipulative tension, either singularly or repetitively. Thus, it is essentially grade IV mobilization used as a diagnostic procedure. Several authors have suggested that using provocation testing to guide the direction of chiropractic manipulation has resulted in positive clinical outcomes. 13-19 Our proposals for provocation testing findings are summarized in Table 1.

Provocation testing, as described thus far, involves manual loading in premanipulative positions, particularly for side- posture HVLA procedures. As such, it is presently extremely difficult to study the reliability or validity of provocation testing in a controlled fashion. However, it may be possible that other chiropractic examination methods which are more easily regulated can be refined to include elements of provocation testing and directional preference. Ultimately, this may lead to reliable and valid examination methods that can guide the application of chiropractic manipulation.

One such examination method, padded wedge analysis, has been suggested by Cooperstein.19 This involves using various positions of padded wedges (commonly called pelvic blocks) to assess changes in patient pain or tenderness and to derive adjustive strategies from such assessments. It is suggested that the direction of the adjustment (HVLA, blocking, or other) should be in a direction consistent with the blocking pattern that decreases pain or tenderness. At present, it appears that this examination method may be more amenable to study than manual provocation testing.

The purpose of this project was to explore 2 potential protocols for provocation testing by varying positions of padded wedges under a prone subject. Provocation testing and assessment of directional preference typically appraise symptoms in symptomatic subjects. Prior to studying the padded wedge protocol on subjects with significant LBP, we chose to measure 2 signs in asymptomatic or minimally symptomatic subjects. Therefore, the first protocol involved measuring pain pressure threshold (PPT) at 4 anatomic points, and the second protocol involved measuring tenderness at 1 of 4 anatomic points. We investigated whether either method could demonstrate a directional preference response.

Method TOP

Two groups of 20 subjects were recruited from the student body of Palmer College of Chiropractic West. Inclusion criteria were as follows:
Aged 20 to 40 years;
LBP of 2 or less on a 0 to 10 pain numeric rating scale (NRS);
No contraindications to blocking procedures, as determined by the investigators (this included participants who had suffered a negative effect from previous blocking procedures); and
No history of significant low back pathology and/or trauma.

Baseline characteristics of the subjects are outlined in Table 2. The study was approved for human subjects by the Institutional Review Board of the Palmer Center for Chiropractic Research.

All subjects gave written informed consent. All measurements took place in the Palmer College of Chiropractic West research laboratory.

Experimental procedure 1

Subjects from group 1 were positioned prone on a pelvic bench, and 4 points (each posterior superior iliac spine [PSIS] and L5-S1 facet joint) were marked with a skin marker. Baseline PPT measurements were taken using an algometer (Force Dial, Wagner Instruments, Greenwich, Conn) at each of the 4 points. All algometric readings were taken with the instrument contacting the participant's skin at a 90° angle. Pressure was applied until the subject reported pain or the maximum of the algometer's scale (11 kg) was reached, whichever came first. Measurements were recorded in kilograms.

A pair of padded wedges was then placed under the subject, in each of 4 positions (Fig 1) in the following order:

Fig 1. Padded wedge positions. A, Left anterior superior iliac spine (ASIS), right intertrochanteric line region. B, Right ASIS, left intertrochanteric line region. C, Left and right ASISs. D, Left and right intertrochanteric line regions.

Left anterior superior iliac spine (ASIS), right intertrochanteric line region; Right ASIS, left intertrochanteric line region;
Left and right ASIS; and
Left and right intertrochanteric line regions.

PPT measurements were taken at each of the 4 monitoring points immediately after each position. The wedges remained in place during the PPT measurements, which took approximately 25 seconds for each position. At the conclusion, PPT measurements were taken with no wedges in place.

Experimental procedure 2

Data collection for procedure 2 took place 1 week later. Subjects from group 2 were positioned prone on a pelvic bench, and 4 points (each PSIS and L5-S1 facet joint) were palpated with approximately 8 kg of pressure. Subjects were asked to identify the most tender point, which was then marked with a skin marker. An algometer was then used to apply 8 kg of pressure to the most tender point. This was done by applying the tip of the algometer at a 90° angle to the nail plate of the examiner's palpating thumb, which was located on the particular tender point (Fig 2). Thus, the pressure was applied through the examiner's thumb in a measured manner.

Subjects were asked to rate the tenderness on a numeric pain scale from 0 to 10.

A pair of padded wedges was then placed under the subjects in the same manner and order as in experiment 1.

Tenderness was measured immediately after each position. The wedges remained in place during the tenderness measurements, which took approximately 5 seconds for each position. At the conclusion, tenderness was measured with no wedges in place.

Operational definitions

For the purposes of this study, the following operational definitions were used to describe subjects' responses:

No response
No change in PPT or tenderness with any wedge pattern. Directional response, anticipated

The response expected consistent with traditional chiropractic models of pelvic torsion (anterior-superior/posteriorinferior [AS/PI] ilium) and/or postural models emphasizing sagittal spinal configurations (hyperlordosis/hypolordosis). These are described as follows:

PPT or tenderness changed in response to opposing purported pelvic torsional wedge patterns (wedges at left ASIS and right intertrochanteric line region or right ASIS and left intertrochanteric line region), or PPT or tenderness changed in response to opposing purported lumbosacral flexion/ extension wedge patterns (wedges at left and right ASISs or left and right intertrochanteric line regions).

This response was further classified as strong if PPT increased (or tenderness decreased) with 1 wedge pattern and PPT decreased (or tenderness increased) with the opposite wedge pattern. The response was considered weak if PPT increased (or tenderness decreased) with 1 wedge pattern and no change occurred with the opposite wedge pattern.

Directional response, not anticipated
A response inconsistent with the above traditional chiropractic models.

Both purported pelvic torsional wedge patterns increased PPT (or decreased tenderness), or Both purported lumbosacral flexion/ extension patterns increased PPT (or decreased tenderness).

Nondirectional response
Changes occurred, fitting no directional pattern.

All patterns increased PPT (or decreased tenderness), or No pattern increased PPT (or decreased tenderness).

Results TOP

All subjects in each group completed the study. Data from experimental procedure 1 were analysed in 2 ways. First, we considered the changes in the average PPT measurement from all 4 anatomic points at each wedge pattern. Second,
we examined the changes in PPT at the 1 anatomic point with the lowest PPT measurement at baseline. Results from experimental procedure 1 are presented in Table 3.

Using the 4-point average method, 10 subjects (50%) demonstrated a nondirectional response, 5 (25%) demonstrated an anticipated directional response, 3 (15%) demonstrated an unanticipated directional response, and 2 (10%) demonstrated no response. Using the lowest PPT method, 9 subjects (45%) demonstrated a nondirectional response, 6 (30%) demonstrated an anticipated directional response, 3 (15%) demonstrated no response, and 2 (10%) demonstrated an unanticipated directional response. In comparing aggregate baseline with post procedure measurements, 6 subjects showed an increase in PPT (mean 1.5 kg), 12 subjects showed a decrease in PPT (mean 5.1 kg), and 2 subjects were unchanged.

Data from experimental procedure 2 were analysed by considering a change in reported tenderness without considering magnitude of the change. Results from experimental procedure 2 are presented in Table 4.

Eleven subjects (55%) demonstrated an anticipated directional response, 4 (20%) demonstrated a nondirectional response, 3 (15%) demonstrated an unanticipated directional response, and 2 (10%) demonstrated no response. In comparing baseline with post procedure measurements, 5 subjects showed a decrease in tenderness, 1 subject showed an increase in tenderness, and 14 subjects were unchanged.

Adverse effects

Twelve subjects in experimental procedure 1 demonstrated a decrease in aggregate PPT measurement (mean 5.1 kg) from baseline to post procedure. One subject in experimental procedure 2 demonstrated an increase in tenderness from baseline to post procedure. No subject in either group required further examination or treatment.

Discussion TOP

Traditional chiropractic examination methods attempt to discover a segmental listing—generally joint misalignment and/or motion restriction. The validity, reliability, and clinical relevance of these methods remain undemonstrated. Development of an examination that bypasses the difficulty of identifying a listing, yet provides guidance on manipulative vectors, could be valuable to clinicians and patients. Provocation testing may be able to provide a more direct pathway to a rational clinical intervention.

We explored 2 novel protocols for provocation testing and assessment of directional preference. Experimental procedure 1 (PPT measurements at 4 points) appears to show little promise for clinical application. Although 40% of subjects demonstrated a directional response, most of the subjects experienced a decrease from baseline aggregate PPT at the end of the procedure. Since no greater information was obtained than in procedure 2, it seems inappropriate to subject patients to an examination procedure that decreases PPT. Furthermore, the procedure was time consuming and cumbersome for typical clinical practice.

Experimental procedure 2 (tenderness measurement at 1 point) seems promising as an examination method to determine directional preference. Seventy percent of subjects demonstrated a directional response, and only 1 subject exhibited an increase from baseline tenderness at the end of the procedure. Once prone, each subject could be measured in approximately 60 seconds or less.

It is important to note that there is no prior evidence suggesting that a directional preference should be readily identifiable in the majority of asymptomatic subjects or, indeed, even in the majority of LBP patients. The reported prevalence of directional preference in LBP patient populations has ranged from 30.8% to 80%.15 From the McKenzie perspective, these patients are classified as centralizers—patients whose referred pain can be made to recede proximally with the preferred motion. There is evidence suggesting that such patients are likely suffering from various stages of intervertebral disk disease.8,15

The operational definition of directional preference for this study did not include centralization. We were simply looking for a change in local tenderness in essentially asymptomatic subjects. Therefore, there is no reason to suppose that the padded wedge analysis should detect directional preference with any preconceived frequency in this population. We presume that a directional response would occur with a lower frequency in asymptomatic subjects than in subjects with LBP.

The studies reporting positive outcomes when provocation testing was used to guide chiropractic manipulation have been on subjects with various intervertebral disk diseases. 14-18 There is no published evidence demonstrating that using provocation testing to find a directional preference in adjusting—that is, employing a procedure whose set-up position decreased pain—would lead to positive clinical outcomes in all types of LBP patients. For instance, an appropriate manipulative procedure for a patient with a symptomatic disk protrusion may be one that decreases pain on provocation testing, perhaps by decreasing posterior annular pressure or relocating nuclear material. On the other hand, an appropriate manipulative procedure for a patient with symptomatic facet joint adhesions may be one that increases pain on provocation testing, perhaps by straining or breaking said adhesions. Much more work is needed to understand the physiological mechanism of spinal manipulation and to maximize its benefit to particular patient populations.

The anatomic points used for PPT/tenderness monitoring were chosen because they appear to be commonly tender in LBP patients in clinical practice. However, we have no evidence suggesting that they are the most responsive points to padded wedge positioning; other points may yield better clinical information. In procedure 2, we used an algometer to apply a measured pressure through the examiner's thumb. This was done to minimize irritation of the subject's skin caused by the firm algometer tip and to make the procedure more closely resemble clinical practice, that is, the clinician palpating the patient rather than using an algometer. Had we used this same process in procedure 1, the results may have been different.

To our knowledge, there are no data on the loads transmitted to the spine by pelvic blocking procedures, and this study did not attempt to measure any biomechanical effects. The traditional concept that various patterns could induce either pelvic torsional moments or lumbosacral flexion/ extension moments appears plausible but is untested.

The authors point out the following limitations to their study -

There are several limitations to this study. First, this was an exploratory study on essentially asymptomatic subjects; therefore, the results cannot be generalized to symptomatic populations. Also, the interexaminer and intraexaminer reliability of this procedure have not been tested. Lastly, there are no previous data on the frequency with which directional preference, as defined herein, occurs in asymptomatic subjects; therefore, the validity of this procedure is still unknown.

The authors conclude -

Measuring changes in tenderness at 1 anatomic point in response to various padded wedge patterns appears promising as an examination procedure to determine directional preference. In the absence of traditional chiropractic examination methods significantly related to outcome, provocation testing and assessment of directional preference
may provide clinical guidance on appropriate adjustive strategies. 1-3 4, 5 6.