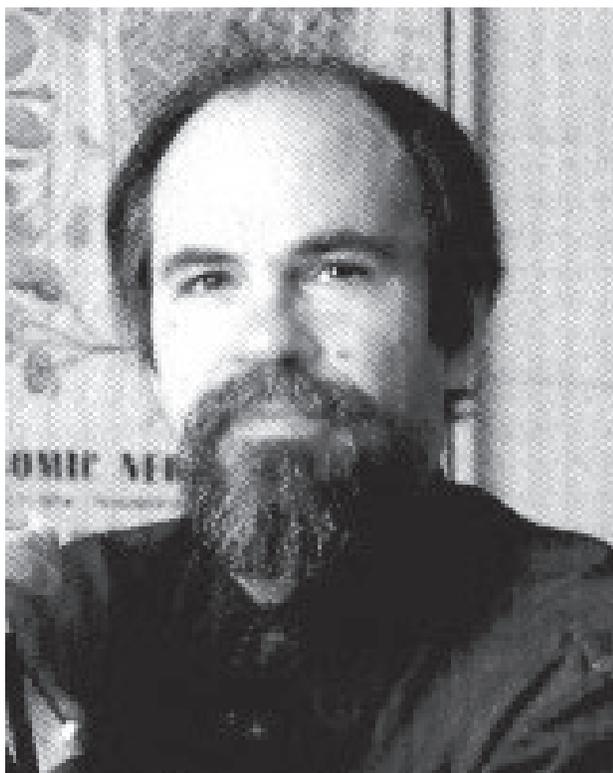


## Chiropractic subluxation assessment: what the research tells us

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The chiropractic profession has long had a philosophic attachment to the subluxation concept. Recently, however, the research sector has paid increasing attention to the evidence-base for subluxation. Subluxation Theory has become a topic of discussion at the annual Research Agenda Conferences, since 1999. This article will review several of the recent contributions to the scientific literature that develop subluxation models and evaluate the methods chiropractors use to assess patients for the presence of vertebral subluxation.

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When you speak of subluxation, the first description that often jumps to mind is the traditional misalignment, occlusion of a foramen, pressure on a nerve and interference (MOPI) model proposed by B.J. Palmer.<sup>1</sup> In fact there are several modern models currently in use as well. Some are conceptual models, such as the Vertebral Subluxation Complex model of Faye and Lantz,<sup>2</sup> which proposes as many as nine components interacting in a complex. The profession has also developed consensus models, such as that in use by the Association of Chiropractic Colleges:

“Subluxation is a complex of functional and/ or structural and/ or pathological articular changes that compromise neural integrity and may influence organ system function and general health.”<sup>3</sup>

While consensus models are very broad in order to encompass all their constituents, they are actually fairly useless for research purposes. The definition above posits that subluxation should have an element of articular pathology, but leaves the exact nature of that pathology unspecified. According to this definition, it could be a functional or structural lesion. Is it a fixation, a slight disarticulation or perhaps a change in joint surface area of contact? This definition does specify that the articular change should be associated with a neurological effect in order to be considered a subluxation. Still, the exact nature of the compromise to neural integrity is unclear. Is it compressive or reflexive in nature?

Our greatest need in this area is for an “operational definition” that describes subluxation according to the measurements or procedures you use to locate and analyze it. The operational definition is the model you can test for reliability and validity using the tools of science. Once validated at some level, the operational definition could then be used more widely in outcomes studies.

Nearly any named chiropractic technique has some

kind of specific set of procedures you use to assess the patient, either from a structural or functional point of view. Very few of these models have been subjected to scientific scrutiny, however. There are some recent models that do describe operational definitions and the evidence base that exists in support of that definition. (See Table 1.) Each of these models represents a different view of what the authors consider a subluxation to be; however, there are some overlaps, particularly in the clinical methods described.

Osterbauer proposes an integrated model where regional measures such as palpation and intersegmental range of motion are combined with assessments of pain, physical capacity and physical performance to arrive at a comprehensive diagnosis.<sup>4</sup> He performed a literature review to identify the usefulness of several assessment procedures, some were survey instruments and others were manual assessments. In general the manual assessments such as Leg Length Reactivity and palpation had high quality studies available, but did not rate as highly as clinical measures of patient symptoms or function, such as the Visual Analog Scale (VAS) for pain or the Neck Disability Index. Osterbauer advocates using physiologic measures as indicators of normal function and relating those measures to subluxation measures in future studies of validity.

Bergman and Finer describe a system of diagnosis called the P.A.R.T.S. system. The acronym stands for

those modalities evaluated clinically: pain, asymmetry, range of motion, tone and texture and special tests.<sup>5</sup> Like Osterbauer's model, several methods, including palpation, x-ray analysis and ROM are used in conjunction to render an assessment. Bergman and Finer also describe how the P.A.R.T.S. system fits in with a comprehensive patient evaluation scheme, including medical history and physical examination components.

Cooperstein and Lisi focus on the pelvis and develop a model of pelvic torsion based on a review of the literature.<sup>6</sup> They describe the types of pelvic motions observed and ways of measuring them, from instrumented methods on cadaver specimens to manual methods used in patients. Pelvic inclinometry, radiographic methods, palpation and leg checks are considered useful in detecting the presence of abnormality, but methods vary in their accuracy and validity. These methods are often poor indicators of what adjustment is needed to correct the problem. The authors recommend taking a close look at the biomechanical features of typical orthopaedic maneuvers, such as Gaenslen's test, for indications of what care to provide.

Owens and Pennacchio present the operational definition in use at Sherman College for locating subluxations. Like the above, it is a multi-test system, including paraspinal thermography, leg checks, palpation and x-ray analysis.<sup>7</sup> Owens and Pennacchio review the literature regarding the reliability of the methods used at their college. As seen below, some methods have been found reliable to some extent, but very few have been tested for validity. There is also the beginning here of a scheme for defining how individual procedures fit together into a complete package.

Finally, Triano presents a somewhat new model of subluxation, which he calls the Functional Spinal Lesion (FSL), and describes the evidence base for it.<sup>8</sup> This model is more structural in its approach, considering the material properties of the structures that are required to bear loads in the spine. When the tissues are overstressed due to injury or lack of muscle coordination, then instability and buckling can occur, leading to further injury and symptoms. Unlike in the models above, which are based more on procedures and practical methods, Triano does not go into details on the operational definition of the FSL.

Notice that none of the models above goes into the details of how the nervous system might be impacted in the subluxation. They are devoted to the clinical aspects of

**Table 1**

**Several articles published in the past 6 years describing operational definitions of subluxation**

<ul style="list-style-type: none"> <li>• Paul Osterbauer "Technology Assessment of the Chiropractic Subluxation"<sup>4</sup></li> <li>• Tom Bergmann, Bradley Finer "Joint Assessment – PARTS"<sup>5</sup></li> <li>• Bob Cooperstein, Anthony Lisi "Pelvic Torsion: Anatomic Considerations, Construct Validity and Chiropractic Examination Procedures"<sup>6</sup></li> <li>• Ed Owens, Val Pennacchio "Operational Definitions of Vertebral Subluxation: A Case Report"<sup>7</sup></li> <li>• John Triano "The Functional Spinal Lesion: An Evidence- Based Model of Subluxation"<sup>8</sup></li> </ul>
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the subluxation that we can observe from the outside. Some consider the possible regional effects of subluxation on physiological processes such as muscle tone or thermoregulation. None of them posits a particular nerve interference event, as does the classic MOPI definition of subluxation, with its occlusion of a foramen and compression effects. Perhaps it is the more pragmatic nature of operational definitions, what cannot be observed can only be guessed at, so why bother? The exact nature of the neural impact of subluxation might be better evaluated by basic science research, including animal models.

Researching any of these operational definitions typically involves evaluating the evidence for the reliability and validity of the methods used. Reliability is often considered just the repeatability of the measurement, but it involves several principles: Is the thing being measured stable or prone to shift at random? Can the measurement be done in an objective manner so that different assessors can agree on findings? How accurately and precisely can the measurement be made? Intra-examiner reliability tests how well the same examiner can reproduce the same results, while inter-examiner reliability compares results between different examiners. All these components help us understand whether changes that might be seen in measures before and after care are really due to the care provided, and not due to measurement error, examiner bias or spontaneous fluctuations.

Validity is an even trickier condition to demonstrate and determines our understanding of the usefulness or sensitivity of an analysis method. Check any research methods book and you may be surprised to discover that some include 15 or 20 different aspects of validity. In the simplest version, validity is akin to accuracy. Does the method under consideration measure what it says it does? This kind of validity is assessed by comparing a new system of measurement to an existing best method or "gold standard" that allows you to calibrate the new method. At the very least, any system must be reliable to be considered valid, and if there are component measures, they should be internally consistent.

A deeper validity question involves the meaning of a measure. What ranges are considered normal and when is pathology indicated? In chiropractic, we have as yet no established standard subluxation measure to use to validate models, so we are actively looking for alternative methods.<sup>9</sup>

Two interesting examples of how validity tests can come up with different results were presented at the International Conference on Spinal Manipulation this past October in Toronto. B. Kim Humphreys of CMCC and Mitch Haas of Western States Chiropractic College both presented the results of validity studies of cervical end-play assessments.

Their methods were quite different and the results opposite of each other. (No blows were thrown, however.) Humphreys used a simple but elegant method to test whether clinicians could detect the incidence of block vertebrae in three patients.<sup>14</sup> The levels of block vertebrae and presumed absolute fixation were known from radiographic evaluation (a gold standard for end-play). Clinicians did a fairly good job of detecting those abnormalities, indicating that manual end-play assessment does in fact detect what it says it does in those extreme cases.

Haas' test of validity was quite different. In their study, they checked to see whether patients adjusted using the results of an end-play assessment fared any better in terms of pain and stiffness than patients who were adjusted based on a random assignment of adjustment levels.<sup>15</sup> The results showed no benefit to the end-play assessment, suggesting that the test provides no useful information for patient care and questioning the validity of the method. Stay on the lookout for full-length articles of both of these studies in the next year or so.

Reliability testing has been going on in chiropractic since at least the mid 1970s. Much of the work appears in conference proceedings and some in peer-reviewed journals. A good way to find citations is to do a literature search in an electronic database. The easiest database to access is MEDLINE, a service of the National Library of Medicine. Since MEDLINE indexes only a few journals of interest to chiropractors, it is more productive to search one of the commercial specialty sites like MANTIS or CINAHL. A search of MEDLINE in April, 2002 using the keywords palpation, leg length inequality, X-ray analysis and thermography produced 11 citations, all to articles in JMPT. A second search of CINAHL using those same keywords, along with a special term in CINAHL's word list "chiropractic assessment", produced an additional 22 citations. The CINAHL search was restricted to "Expert Peer Reviewed" journals, to eliminate several references found in trade journals, rather than research journals.

If you want to follow along this trail yourself, a good

place to start is with the critical review article published by Lise Hestbaek and Charlotte Leboeuf-Yde.<sup>10</sup> They evaluated studies that were published between 1976 and 1995 on measures used to assess the lumbar spine. Their review also looked at the methods used in each study and judged the results based on the quality of those methods. None of the tests they studied reached a very high degree of both reliability and validity, although palpation for tenderness had the best results.

In my literature review, I also found a number of studies that were published in peer-reviewed journals that either had more recent data or looked beyond the lumbar spine. In compiling a list of methods used to assess subluxation, they can be divided into “local” or “remote” methods. Local methods look at joint alignment or muscle tone just in the area of a suspected vertebral subluxation (Table 2). Remote methods look at more global responses to the spinal problem, such as postural distortion or range of motion (Table 3). The citations listed in the tables refer to articles in the reference list that report on reliability or validity of the methods. I’ve rated the reliability and

validity of each measure according to what I found in the literature review. If the most recent studies were showing results in favor of reliability or validity, I rated that measure as a “+” in the table, indicating moderately positive findings. If the preponderance of data was negative, the rating was simply “-.” In those cases where the references were equivocal, some positive and some negative, the rating “+/-” was given. In some cases, articles with very differing opinions, or long sequences of letters-to-the-editor suggested to me that the measure is more than just equivocal, but actually contentious; those are denoted with a “!” in the table.

**Conclusion**

Progress is being made on several fronts toward operationally defining subluxation. Most new models combine commonly used manual assessment methods into a system for rendering a subluxation diagnosis. Researchers performing reliability studies have learned from the mistakes of the past and are using more valid methods of investigation. Perhaps as a result, more subluxation assessments

**Table 2**  
**Local methods of subluxation assessment. Citations are indicated by reference number.**

Reliability and validity are rated: “+” = fair to moderate, “+/-” = equivocal, “-” = poor to nonexistent, “!” = contentious, “ ” = no data found.

Local Methods	Citations	Reliability Intra-examiner	Reliability Inter-examiner	Validity
Palpation – pain/tenderness	10	+	+	
Palpation – alignment	10	-	-	-
Tissue Compliance	11	+	+	
Motion Palpation – active	10	+	+/-	!
Motion Palpation – end play	10, 12–15	+	-	+/-
Static X-ray – Cervical	10,16–22	+	+	!
Static X-ray - Lumbar	23, 24	-	-	!
Surface EMG	25–27	!	!	+/-
Para-Sp Thermography	28–30	+	+	

**Table 3**  
**Local methods of subluxation assessment. Citations are indicated by reference number.**

Reliability and validity are rated: “+” = fair to moderate, “+/-” = equivocal,  
 “-” = poor to nonexistent, “!” = contentious, “ ” = no data found.

Remote Methods	Citations	Reliability Intra-examiner	Reliability Inter-examiner	Validity
Visual inspection	10, 23	-	+/-	
LLI – Prone	10, 31, 32	+	+	+
LLI – Supine	10, 33–35	+	+	+
LLI – Reactive	10, 36–38	+/-	+/-	+/-
SOT tests	10	+/-	-	+

are being found reliable in current studies, including palpation for pain/tenderness, paraspinal thermography, prone and supine functional leg length inequality and cervical x-ray line drawing analysis. New methods, such as computerized tissue compliance measurement and computer-aided thermographic pattern assessment are being developed, and initial results have been positive for reliability. Still, we are hampered in our ability to test validity of the measures and systems. As local phenomena, several tests appear to measure what they claim to measure, but the meaning of the findings, in terms of an external measure of health or function is mostly unknown.

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