

Subluxation and semantics: a corpus linguistics study

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Introduction: The purpose of this study was to analyze the curriculum of one chiropractic college in order to discover if there were any implicit consensus definitions of the term subluxation.

Methods: Using the software WordSmith Tools, the corpus of an undergraduate chiropractic curriculum was analyzed by reviewing collocated terms and through discourse analysis of text blocks containing words based on the root 'sublux.'

Results: It was possible to identify 3 distinct concepts which were each referred to as 'subluxation:' i) an acute or instantaneous injurious event; ii) a clinical syndrome which manifested post-injury; iii) a physical lesion, i.e. an anatomical or physiological derangement which in most instances acted as a pain generator.

Conclusions: In fact, coherent implicit definitions of subluxation exist and may enjoy broad but subconscious acceptance. However, confusion likely arises from failure to distinguish which concept an author or speaker is referring to when they employ the term subluxation.

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KEY WORDS: chiropractic, subluxation, semantics, discourse analysis, corpus linguistics

Introduction : Le but de cette étude était d'analyser le programme d'études d'un collège de chiropratique afin de découvrir s'il y avait des définitions consensuelles implicites du terme subluxation.

Méthodologie : Un corpus d'un programme de premier cycle en chiropratique a été analysé à l'aide du logiciel WordSmith Tools, en examinant les termes cooccurrents et par une analyse du discours de blocs de texte contenant des mots dont la racine est « sublux ».

Résultats : Il a été possible d'identifier 3 concepts distincts chacun décrit comme « subluxation » : i) un événement dommageable aigu ou instantané; ii) un syndrome clinique qui se manifeste après une blessure; iii) une lésion physique, c.-à-d. un trouble anatomique ou physiologique qui, dans la plupart des cas, a agi comme un générateur de douleur.

Conclusions : Des définitions implicites et cohérentes du terme subluxation existent et sont largement, quoique subconsciemment, acceptées. La confusion se pose probablement de l'absence de distinction entre les concepts faite par les auteurs ou conférenciers lorsqu'ils emploient le terme subluxation.

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MOTS CLÉS : chiropratique, subluxation, sémantique, analyse de discours, corpus linguistique

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Introduction

Subluxation is, in the terminology of linguistics, a *key-word* in the chiropractic literature, and two studies have indicated that it is over-represented in comparison to its prevalence in general English.^{1,2} *Subluxation* is a core concept in the discipline of chiropractic, and so in chiropractic education, and *vertebral subluxation* remains, by far, the most common term used in the curriculum of Canadian Memorial Chiropractic College (CMCC) to refer to what has been called the 'definitive chiropractic lesion'.³

Notwithstanding the currency of the term, there is much debate within the chiropractic profession concerning the meaning(s) of *vertebral subluxation* and its synonyms, fixation and restriction.⁴ Any number of attempts has been made to consolidate a broadly accepted definition (see for example^{5,6}). Nonetheless, consensus seems elusive⁴, and one must wonder how this could be so when most chiropractic clinicians identify and treat the entity referred to as *subluxation* on a regular basis.

Outside of chiropractic, the term *subluxation* refers to a displacement of a joint, less than a frank dislocation. The *chiropractic subluxation*, if we may use that term, is a different entity – something affecting the spine and often thought of as encompassing something beyond a biomechanical lesion.⁷ Of course, profession-specific language may at times be a challenge to interprofessional communications.⁸ Interestingly, other professions seem to have little specific concern about the use of the term *subluxation* by chiropractors (see^{9,10}). However, little consideration is given to the possibility that the difficulty in settling on a single broadly accepted definition within chiropractic may be that there is not a single entity (but see⁴).

Thus, the purpose of this current study was to analyze a corpus of the written curriculum of CMCC to determine whether, in fact, the single term *subluxation* was being used to refer to multiple concepts.

Methods

As described previously, a corpus of the CMCC curriculum was created from instructional materials archived on the school's learning management system.³ The archived texts comprised 3,076,237 tokens (words) from thirty-nine 1st to 3rd year courses taught during the 2010-2011 academic year; i.e. every textual learning object posted on the school's learning management system. The 4th year of the program is primarily an internship with little di-

dactic instruction. The archived documents included all course syllabi, lecture notes, texts of Powerpoint™ presentations and published articles which were required or recommended readings.

Using methods conventional to corpus linguistics¹¹, the corpus was analyzed in two steps: first looking at immediately adjacent words to discern immediate contexts, and secondly by examining entire sentences for a finely granulated semantic analysis. Thus, the corpus was first analyzed using the software, Wordsmith Tools V6.0. The collocation function was used first to identify terms most commonly collocated (i.e. located within 5 words to the left or right within running text) with *subluxation*. This provides some indication of immediate context. Subsequently, the concordance function was used to identify 1,000-character blocks of text centred on the root *sublux**. That is to say that each word identified as based on the root *sublux** was centred within 1,000 alphanumeric characters which would normally be equivalent to approximately 200 words. This provided a broader context within which to deduce the meaning(s) of the target term. Initially, 1,777 such blocks of text were captured (supplementary file attached). However, by eliminating duplicates, 573 unique text blocks were identified. Duplicates occur commonly in electronic archives when sections of text are copied and pasted, for example from original articles into class notes or Powerpoint™ presentations.

Text blocks were laid out in a spreadsheet and read once in succession. Notations concerning meaning were added after each block of text. The investigator then reviewed these notations and grouped meanings into what appeared to be three naturally occurring taxa. The investigator then re-read each of the text blocks and assigned it to one of the three taxa.

In this exploratory study, the single author read each block of text and attempted to discern whether any natural taxonomy appeared for the terms *subluxation* and *subluxations*. As this was an exercise in imputation, the investigator brings their own biases to the analysis. Another investigator might look at the same data and see a greater or lesser number of natural taxa, or might assign different meanings to extracted texts, based on their own understanding of the language. Nonetheless, the apparent classes of meaning, whether natural or fanciful, will likely provide a useful departure point for further discussions on the semantics of *chiropractic/ vertebral/ spinal subluxation*.

Results

The most common collocations with *subluxation(s)* (and the number of such instances) were *vertebral* (207), *chiropractic* (195), *theory* (135), *complex* (123), *joint* (118), *dysfunction* (110), *model* (96), *syndrome* (67) and *spinal* (64).

Fifty-four text blocks referred to subluxation of an extra-vertebral joint; most often (21 instances) the glenohumeral joint. As reported previously, there were 189 instances of the phrase *vertebral subluxation*, 23 instances of the phrase *spinal subluxation*, and 44 instances of the phrase *chiropractic subluxation*, all of which referred to *vertebral subluxation*.³ All expressions of concern about the definition of subluxation referred to the vertebral subluxation, not extravertebral subluxation. Thus, unless otherwise stated, the results reported herein refer to vertebral subluxation.

The nature of the source material, meant that the term *subluxation* often occurred outside of coherent sentences, for example in word lists, titles and legends, so that it was most often not possible to assign any particular nuance to the word. Nonetheless, in a sizeable minority of instances (178 in total) a natural taxonomy did seem to occur, suggesting 3 different meanings for ‘subluxation,’ as follow. In 15 cases, the term *subluxation* appeared to refer to the essentially instantaneous event of spinal injury, referred to hereinafter as the ‘subluxation event.’ In a further 82 instances, the term referred to the clinical presentation which developed following the subluxation event, and hereinafter referred to as the ‘clinical subluxation.’ In an additional 81 instances, the term referred to an anatomical lesion or pathophysiological process which was independent of the precipitating event or clinical presentation, hence, referred to hereinafter as the ‘subluxation lesion.’ The relationship of these concepts is, of course, that i) a patient is exposed to some kind of injurious event, ii) which creates clinical signs and symptoms, iii) which are due to some underlying tissue damage.

The criteria for assignment to the taxon of ‘event’ included reference to an essentially instantaneous biomechanical phenomenon resulting in perceived injury to the spine. Expressions assigned to the taxon of ‘event’ included, for example:

- a) ‘... when subluxation occurs, it may be likened to a wheel, the hub of which is not the center...’

- b) ‘... the model of subluxation based on Triano’s biomedical model of buckling...’
- c) ‘... develop the buckling model of subluxation from the scientific evidence...’
- d) ‘... spinal buckling: a mechanical model of subluxation...’
- e) ‘... spinal buckling failure = subluxation injury: mechanical form of deformation incompatible with intended function...’

The criteria for assignment to the taxon of ‘clinical presentation’ included reference to signs or symptoms, diagnostic tests, treatment or consideration of the foregoing. Expressions assigned to the taxon of ‘clinical presentation’ included:

- a) ‘... The word subluxation was the term first conscripted by D.D. Palmer to characterize the clinical entity on which he focused his manual interventions...’
- b) ‘Subluxation syndrome; an aggregate of signs and symptoms that relate to pathophysiology or dysfunction of spinal...’
- c) ‘... the younger Palmer began to profess that subluxation detection and adjustive intervention should be...’
- d) ‘A subluxation is evaluated, diagnosed and managed through the use of chiropractic procedures based on the best available...’
- e) ‘Subluxation in which altered alignment, movement or function can be improved by manual thrust procedures...’

The criteria for assignment to the taxon of ‘lesion’ included reference to anatomical derangement or pathophysiological processes at any level of organization (whole organism to biochemical). Expressions assigned to the taxon of ‘lesion’ included:

- a) ‘The pathophysiologic complex model of subluxation describes component elements without clarifying mechanisms...’
- b) ‘...left-right heat asymmetry purported to identify the inflammation associated with the chiropractic lesion, subluxation...’
- c) ‘...the term vertebral subluxation complex re-

fers to the theory that there are pathophysiological and/or visceral events associated with spinal lesions...’

- d) ‘Many hypothesized that a fundamental component of the vertebral subluxation complex is the development of adhesions in the z joints after hypomobility of these structures...’
- e) ‘A subluxation is a complex of functional and/or structural and/or pathological articular changes...’

Discussion

In discussing the definition or the challenge of defining subluxation, authors in general do not distinguish between the event of subluxation, the clinical constellation and the physical lesion; see, for example.¹² Consequently, when different authors arrive at different but perfectly sensible definitions, this may mistakenly be taken as a difference of opinion or even a controversy. It is not. Different definitions of different entities, even if they use the same referent term, may be completely compatible and even help to present a consistent understanding of a phenomenon.

Within the current undergraduate curriculum at CMCC there appear to be three different but synergistic implicit definitions of subluxation. These are the subluxation event, the clinical subluxation, and the subluxation lesion.

The Subluxation Event

The subluxation event is characterized as an essentially instantaneous failure of spinal stability, sometimes expressed as ‘spinal buckling’. The terminology and the concept have been championed by authors including Cholewicki and McGill¹³, and Triano¹⁴. In brief, the proposed mechanism is failure of a local stabilizing element such as an intersegmental ligament or muscle. This results in an injurious concentration of forces which would otherwise be more broadly distributed. An actual subluxation event in the lumbar spine was serendipitously captured with videofluoroscopy by Cholewicki and McGill.¹³ Furthermore, Kaneoka et al demonstrated essentially the same phenomenon in an experimental study involving a whiplash-like injury delivered to human volunteers.¹⁵ In other words, the subluxation event is not simply a hypothesis. It is something which has been captured in real life and duplicated experimentally.

The Clinical Subluxation

The clinical subluxation, as presented in the modern CMCC curriculum is quite congruent with its presentation in the historical curriculum², a modern corpus of the Journal of the Canadian Chiropractic Association¹, and, likely, in the broader literature. In other words, with a few outlying descriptions, the implicit operational definition is not controversial at all. Implicit characteristics of the clinical subluxation are that it is an acquired, spinal, intersegmental, biomechanical phenomenon. It is acquired in the sense that it is not inherited. For chiropractors, it is spinal rather than extravertebral. It is very much a local phenomenon – if the phenomenon spreads across more than one joint level then it is likely to be referred to as a series of subluxations or some other phenomenon altogether. It is biomechanical in the sense that posture or movement is invariably affected. Furthermore, explicitly expressed characteristics include sustained involuntary muscle contraction, pain or tenderness on palpation, asymmetry of position or motion, restricted motion and tissue texture changes. In some instances, neurally mediated phenomena, such as skin temperature asymmetries, are also mentioned.

The Subluxation Lesion

Within the CMCC curriculum, no single definition of the subluxation lesion is presented, nor could it be, based on the foregoing. From the definition of the subluxation event above, it is logical that different tissues would be injured and different pathological processes initiated in different people. By way of example, in a whiplash-like injury as modeled by Kaneoka et al.¹⁵, one would predict injury to the facet joints, and, indeed, studies have demonstrated the efficacy of facet joint anaesthesia/neurotomy in some cohorts of whiplash patients¹⁶. In other regions of the spine, or with other vectors, it might well be ligament, discs or muscles which are injured. Hence, a single pathophysiological definition for a subluxation lesion makes about as much sense as a single pathophysiological definition for a ‘sports injury’ or a ‘traffic accident injury.’

Conclusions

In summary, this analysis of discourse in the CMCC curriculum suggests that three distinct but related concepts are all referred to as subluxation. Only one model is presented for the subluxation event, and this is a coherent

model based on conventional anatomical and biomechanical concepts, and validated through observation and experimentation. The clinical subluxation also has a very coherent operational definition grounded in the history and symptomatology reported by patients, and the findings of conventional diagnostic techniques.¹⁷ The subluxation lesion has no single definition, as seems most appropriate, since it is likely that different tissues and processes are involved in different patients.

Both in education and in professional discourse, it would likely be beneficial, when using the term subluxation, to clarify which of these three concepts is/are actually under consideration.

Limitations

The findings of a corpus analysis are, naturally, constrained by the corpus. In this instance, the texts analyzed were all taken from the curriculum of Canadian Memorial Chiropractic College. The corpus was comprised of virtually every text document presented to the students through the learning management system and so was a very good representation of the written language that students are exposed to. However, no attempt was made to represent aural exposure, as for example through lectures, labs or audiovisual resources. Furthermore, a corpus based on materials from another institution would produce quantitatively different results, and might well reveal a different taxonomy. Consequently, the results of this study should not yet be extrapolated to other schools nor to the profession at large. Additionally, semantic analysis, while it may be machine-assisted, is a human endeavor, with meanings seen through the eyes the researcher. The raw data from this study are provided as a supplementary file to permit alternative analyses by others.

Competing interests

The author declares that he has no competing interests.

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