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The Vertebral Subluxation premise:

Part 1: The medical literature regarding nomenclature

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Narrative abstract: The sheer volume of medical, physiological and clinical citations presented in this paper demonstrate the degree of recognition within the medical and related literature of the chiropractic model of the Vertebral Subluxation Complex. This literature is additional to that from the chiropractic perspective which is available in the electronic *Index to Chiropractic Literature*.

This paper demonstrates the tacit acknowledgement and weight of recognition of the vertebrogenic effect of physical, biomechanical, and physiological vertebral disturbances.

We demonstrate that the clinical practices of chiropractic, manipulative medicine and osteopathy collectively recognise the biomechanical and physiological phenomena and associated neural ramifications of spinal lesions.

We present the preponderance of papers from the field of manipulative medicine which support the chiropractic nomenclature, neurophysiological and clinical implications of the Vertebral Subluxation Complex.

Indexing terms: Subluxation; Vertebral Subluxation Complex; vertebrogenic nomenclature; manipulation

Editor's note:

Rome and Waterhouse have, together, perhaps the most thorough understanding of the medical literature from the mid 20th Century to this moment in respect to its voluminous descriptions of spinal lesions known to chiropractors as indicative of the Vertebral Subluxation Complex (VSC).

This first paper canvasses the evidential literature of spinal lesions and their clinical effects as documented throughout the literature of medicine.

The reporting of Rome and Waterhouse is so extensive that the *Journal* is publishing the reports over 5 or so papers. These papers will also be held on the *Journal* website as 'MasterClasses' to form an invaluable reference base for students and doctors.

To this end, each key element of this paper is immediately supported by its source references, a departure from the usual practice of collecting them at the end of the work.

> *... To manipulate a spine and not identify what it is that is being addressed or to specify exactly what is being manipulated would be blind, unsafe general manipulation in the hope of achieving a result avoiding the judicious examination procedures that are necessary to assess and diagnose ...'*

Phillip Ebrall

Editor

Preamble to this series of papers

A review of five principles of the vertebral subluxation complex (VSC) is presented. Evidential recognition for these components is offered. The purpose has been to numerically illustrate the availability of papers on the clinical, physiological and pathophysiological data which underpins the VSC hypothesis. Due to the similarities, we find these terms and concepts consistent between the chiropractic VSC or subluxation, and the osteopathic somatic dysfunction. Although not a conventional review as such, the sheer volume of medical, osteopathic, physiological and clinical citations presented demonstrate the degree of recognition of the principles proffered under a chiropractic model where further supporting data is available on the electronic Index to Chiropractic Literature.

This presentation is designed to demonstrate the tacit acknowledgement and weight of recognition of the vertebrogenic effect of physical, biomechanical, and physiological vertebral disturbances. This VSC term refers to the potential for broader neurophysiological ramifications of localised symptoms and signs as well as certain vertebrogenic clinical conditions, these are offered as being more comprehensive in recognising many more aspects than just a plain osseous displacement. The data provides a rational hypothesis for a multitude of signs and symptoms that present to manipulative practitioners many of which are ameliorated upon manual correction.

The format presented is intended to demonstrate that the clinical practice of chiropractic, manipulative medicine and osteopathy have recognised the biomechanical and physiological phenomena and associated neural ramifications. However, elements within traditional conservative medicine continue to resist the wider clinical adoption despite the accumulated evidence from others within that profession.

The preponderance of manipulative medicine and osteopathic papers also support the chiropractic model of the Vertebral Subluxation Complex. Conventional medical sciences evidence in neurophysiology underpins the clinical application of this evidence but is geographically selective, predominantly in continental Europe.

From the outset, we acknowledge the Subluxation Complex (SC), especially the Vertebral Subluxation Complex (VSC) under our preferred definition of 'an articular dysfunction with or without displacement, typically but not limited to the spine and pelvis and characterised by anatomical and physiological modifications with associated neurophysiological signs and symptoms which may be addressed by a specific manual or instrument assisted adjustment.'

The World Health Organisation (WHO) define the chiropractic vertebral adjustment as 'Any chiropractic therapeutic procedure that ultimately uses controlled force, leverage, direction, amplitude and velocity, which is applied to specific joints and adjacent tissues. Chiropractors commonly use such procedures to influence joint and neurophysiological function.'

We regard the narrow traditional definition of a subluxation as being biologically inappropriate due to it being limited to physical osseous displacement and that it ignores all the other factors involved with such a lesion. That limited definition could be seen as appropriate for a dry skeleton only, given that it has no sensory network or soft tissue elements.

Peter Rome and John Waterhouse

Introduction to Paper 1

'*The assessment and correction of vertebral subluxation is a core clinical objective in the practice of chiropractic*' (Russell 2019)

This overview is presented as a means of depicting certain components of a vertebral subluxation complex (VSC) and the literature support for each. As a complex and not a merely a displacement, the supporting evidence at each stage tends to corroborate the multifaceted nature of this pathoneurophysiological phenomenon. (Gatterman, 2005) (Leach 1994) (Haldeman, 1992) However, it is recognised that there are other hypotheses regarding the VSC, such as the compatible dysafferentation model proposed by Seaman and Winterstein. (1998) (Kent 1996)

This paper presents a pooling of supporting references available to interested researchers. These are extracted from publicly available sources, namely PubMed, internet searches and textbooks. The vast majority (estimated at 90%) of the reference list are not chiropractic papers as this would expand the list prohibitively. The intent is to depict the large amount of evidence that has been ignored in relation to the influence upon, and attributed to, the neural effects of this biomechanically and functionally disturbed segmental lesion. Notably, most of the citations are from medical journals, mostly from Europe and Asia.

Kent (1996) noted that other have also produced models along this theme. They include Dishman (1985,1988), Herfert (1986), Lantz (9 components) (1989,1990) and the Rubicon 8 component model. (Boone Dobson 1996) Kent offers both chiropractic, osteopathic and medical citations in his discussion.

Apart from numerous published papers, three of the more authoritative textbook sources on the subluxation topic are the chiropractic volumes published by Gatterman (2005), Leach (1994), and Haldeman (1992). These provide broad coverage of the VSC model. In addition, extensive neurophysiological research supporting the more complex ramifications of the vertebral subluxation have been conducted through Drs A and Y Sato in Japan, and Dr R Schmidt from Germany. (1997)

Papers by chiropractic authors in medical and chiropractic journals listed in PubMed are regarded as readily accessible evidential material. Chiropractic papers from over 60 journals are listed on The Index to Chiropractic Literature and are similarly accessible. (Bolton 2000), (Budgell 2000), (Welch & Boone, 2008)

Slosberg (2010) reported a dynamic but limited explanation of a subluxation when he noted that '*Panjabi offered a unique model of joint dysfunction with disturbed kinematics, loss of spatial and temporal integrity of received receptor signals, and corrupted motor programs*.'

As with much terminology unique to virtually all professions, there are alternative definitions, synonyms and euphemisms. In using the term 'subluxation', it is necessary to define one's intended interpretation as suggested by Budgell in 2016. The term 'somatic dysfunction' has also been subject to a variety of definitions over the years. Although in literal terms, it invokes a concept of only a change in motion, it is more a complex condition or lesion as alluded to by Panjabi. (Panjabi 2006)

Essentially all four of the manual health professions; chiropractic, osteopathy, manipulative (or physical) medicine, and physiotherapy, recognise a biomechanical lesion. The chiropractic term 'Vertebral Subluxation Complex' (VSC) is intended to encompass the range of elements comprising the components presented here, and not just a plain displacement. In a 2001 paper on the subluxation, Triano (2001) stated that '… *there appears to be a cross-discipline consensus that*

these altered biomechanical behaviours may manifest as local and/or remote clinical signs and symptoms.'

The notable difference between the chiropractic, osteopathic and medical recognition of this biomechanical articular phenomena is the consideration of associated elements including neural and vascular components. The allopathic nomenclature assumes a simple osseous displacement. This would be akin to regarding an ankle sprain as an osseous displacement without acknowledgement the soft tissue damage, noxious sensory activation, inflammatory response and motion changes.

The pathoneurophysiological somatosensory/somato-autonomic model of the VSC as explored here and acknowledged in the highly researched and referenced text by Sato et al (1997a). They state that, '*The elucidation of the neural mechanisms of somatically induced autonomic reflex responses, usually called somato-autonomic reflexes, is, however, essential to developing a truly scientific understanding of the mechanisms underlying most forms of physical therapy, including spinal manipulation and traditional as well as more modern forms of acupuncture and moxibustion.*'

The VSC term currently remains as an optimal designation and explanation of the now well-recognised clinical entity. Further, its correction best explicates many positive clinical outcomes. Other terms appear to be confined to only the musculoskeletal elements. Although once only relating to displacement, most in the manipulative professions now associate an articular dysfunction component with certain segmental disruptions.

In essence, this study seeks to gauge terms used in relation to pathoneurophysiology and the somato-autonomic role of articular subluxations. We found the numerical frequency significant as it implies a reasonable degree of valid acknowledgement and rationale of a relatively common clinical entity. The study is not intended as a formal review, but an informative presentation of the availability of so many papers when some continue to claim there is no evidence.

There appears to be quite a contradiction when the medical and physiological evidence used to support medical manipulation (particularly from Continental Europe and Asia) is not recognised as evidence for other manipulative sciences.

This presentation follows a VSC model proposed by Pickar (2001) of altered sensory input leading to central facilitation and altered somato-somato and/or somatovisceral reflexes. (Sato et al 1997) (Slosberg 2010) (Kang et al, 2002)

In essence this paper provides a source of references that are primarily independent of chiropractic and osteopathy. It constitutes predominantly medical-sourced citations. Reference material on these same topics originating in chiropractic and osteopathic sources are available in the digital indexes of Pubmed, the Index to Chiropractic Literature (ICL), and the osteopathic–OSTMED.DR.

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Methods

In presenting in this format, it is emphasised that the subluxation is not merely a mechanically displaced vertebra, but one which is multifactorial in its expression and deserving of recognition as a complex.

The purpose of this paper is to pool readily available evidence about the vertebral subluxation by drawing the majority of evidence from medical publications, and the medical electronic index *Pubmed*. While the evidence from other professions is included, it is on a more diminished representative scale.

In accessing material for this discussion, terms were extracted from the titles, abstracts, and text of the material cited. Internet sources were used as well as the electronic online medical and

chiropractic indexes. The key elements were osseous displacement, dysfunction, neural activation with related physiological and pathophysiological factors, as well as associated clinical signs and symptoms.

Interpretation of a subluxation as purely a displaced bone or joint is simplistic. Such an occurrence could only occur on a dry skeleton. Even a subluxated carpal bone or an ankle sprain would have soft tissue damage, inflammation and noxious sensory activation, pain being one of them. As such, all subluxation terms should be qualified by a specific definition to eliminate the possibility of misinterpretation to reflect their characteristics and the author's intent.

The categorisation of the vertebral subluxation complex into components indicates a defined appreciation of the complexities and understanding of it to include multiple factors including possible clinical ramifications.

This paper is designed to demonstrate the acknowledgment and recognition of the disruption of all elements of vertebral segment's physiology and their effects. The potential for broader neurophysiological ramifications and symptoms associated with the complex is in consideration of the integration of their complex structures and functions.

The vast majority of papers cited in this review are medical papers. These are listed on the PubMed index. (https://pubmed.ncbi.nlm.nih.gov/) Seven chiropractic journals are also listed on the PubMed medical index. The limited number of chiropractic papers cited here are listed on the on the online Index to Chiropractic Literature (ICL) which comprises some 60 journals. (https://www.chiroindex.org/#results)

The available supporting citations under these criteria are extensive. Most of the supportive evidence lists medical papers that recognise the pathophysiological rationale. The intent is to assess the numerical volume of evidence recognising the principles underpinning VSC or the VSC itself regardless of the synonym used at the time. Evidence from osteopathic sources is also included, with limited physiotherapy papers beginning to emerge. Chiropractic papers were not included at this time for pragmatic time and space reasons, but are available through the Index to Chiropractic Literature and on https://atlas.chiro.org/ or https://chiro.org/LINKS/RC_SCHAFER.shtml.

As the intent of this paper is to demonstrate the immense volume of published material relevant to the vertebral subluxation complex, its format is atypical in that it merely presents the title, topic and publication details of papers. Further, the paper principally reports the medical literature.

The emphasis here is on the frequency of use of terms involving the elements of the VSC. We suggest this is more than a tacit form of recognition of a clinical entity. It is based on identifying the use of the particular term in the source's title or text be it journal paper or textbook. The textbooks will be noted as medical where appropriate, and journal papers will all be available on the PubMed Medical Index.

While a presentation of chiropractic papers in the format presented here would be a separate undertaking, two of this profession's journals do not have chiropractic in their title. These two exceptions are the *Journal of Manipulative and Physiological Therapeutics* and the *Journal of Electromyography and Kinesiology* both of which are listed on the PubMed medical literature index.

Initially an attempt was made to categorise the papers into professions however, this proved to be too complex as there is an intricate collaboration of inter-professional authors inter woven with journals. In the categories of cardiovascular and gastroenterology a degree of professional separation was conducted. In addition, to include all relevant chiropractic and osteopathic research papers would likely triple the reference list, when one of the goals of this paper is to

assess numerically the amount of medical papers which support the chiropractic VSC and associated concepts.

While some citations were only associated with elements of the subluxation complex, they provide supportive evidence on critical neurophysiological elements as the basis of the Vertebral Subluxation Complex (VSC) hypothesis – the pathophysiological blending of somatic disturbance and neural elements.

This study of the vertebral subluxation model serves to provide primarily medical evidence in support of elements comprising this pathophysiological construct.

Primary elements comprising the Vertebral Subluxation Complex (VSC)

The five theoretical principles of the vertebral subluxation were proposed by Janse et al (1947). These may be adapted as a foundation to study the basic elements of the vertebral subluxation complex (VSC). They also offer flexibility to evolve the concepts as new evidence and research develop. (Ebrall (2022)

Various definitions of a vertebral subluxation have been proposed over the years. These have naturally developed in recent years in light of neurophysiological research towards deeper appreciation of the clinical findings. Two definitions are offered here, one also by the WHO, with further discussion later in this paper.

Haavik et al (2021) note that '*The literature suggests physical injury, pain, inflammation, and acute or chronic physiological or psychological stress can alter the vertebral column's central neural motor control, leading to a central segmental motor control (CSMC) problem.*' In 2022, she further substantiated in detail, the current hypotheses regarding the subluxation.

Giles (1997) defined a subluxation as '*the alteration of the normal dynamics, anatomical or physiological relationships of contiguous articular structures.*' (Attributed to Schafer 1980) Further he stated that, '*the term is used when apposing facet surfaces of the zygapophysial joint are no longer contiguous, as demonstrated by imbrication (telescoping) of the zygapophysial joint facet surfaces'.* (Attributed to Hadley 1964)

Gatterman (2005) discusses a variant of the five-component model of a vertebral subluxation proposed by Schafer and Faye in the 1970s. (p197,198) and published again by Faye in 1983. Seaman and Faye later discussed the concepts in detail and elaborated on the five elements of the original version. (p198).(Seaman 2005) The components included:- kinesiopathology,, neuropathophysiology, myopathology, histopathology, and biochemical changes. (Leach 1994)

The five principles discussed here are focussed on the vertebral subluxation although much of the discussion may also apply to other anatomical articulations. (Leach p 382, 1984) (Lantz 1989)

Mootz discussed a number of elements under theoretical models of a vertebral subluxation. We suggest that there are five fundamental elements to a vertebral subluxation which appears to have the most influence upon physiology, although these components may also occur to other disturbed articulations. The five principles of the VSC are:

1. Articular dysfunction, namely vertebral and sacroiliac joint dysfunction
2. Articular displacement, particularly segmental facets and the sacroiliac joint.
3. Neural pathophysiology. This includes -somato-autonomic reflexes, somatosensory activation - especially pain, or degrees of it.
4. Effects of pathophysiology. This includes signs, symptoms, muscular, vascular influence, visceral dysfunction. (Mootz 2005)
5. Mootz also discusses the possibility of an hypothesis for axoplasmic transport aberration in subluxations. (Mootz, 2005)

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Primary elements

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Principle 1: The Vertebral Subluxation Complex

That vertebral joint physiology may be subject to articular physiological dysfunction with or without anatomical displacement

While any articulation may undergo subluxation due to the apparent potential for a greater influence upon the body's neurophysiology, emphasis will be placed on the vertebral subluxation complex. The physical medicine specialist Maigne (1972) suggests that upon examination, a combination of clinical and radiological information may '*... make a diagnosis of a minor intervertebral derangement*', (p95) later he states that following all necessary clinical procedures, *'a diagnosis becomes probable.*' Lewit (1999) goes further when he opines that '*Without a good understanding of functional anatomy as presented by x-rays, it is almost impossible to understand impaired function ….*'. (p35)

A vertebra may subluxate and exhibit localised symptoms such as tenderness or pain, and these may act as clinical signs to the clinician and may be elicited further when exaggerated by light pressure. These may be considered as symptoms in need of attention as noted by the patient. (Finneson, 1980), (Lewit, 1999)

A static-displacement concept of a subluxation is insufficient. Recognition of it must also consider integration of the influence of altered functional factors such as sensory and other neurophysiology as well as connective tissue. Such an integration must qualify this accrual of signs and symptoms as a complex.

The biomechanical segmental dysfunction may be in the form of fixation, hypermobility, hypomobility or aberrant motion. We suggest that such dysfunction of a vertebra which may not adapt physiologically to be more independent in postural motion and initiate segmental activation of noxious sensory input.

We would contend here that contemporary MRI and PET scanning imaging technology has been studied and contributes to confirmation and demonstration of the VSC. Since the 1980s, Magnetic Resonance Imaging (MRI) technology has become a useful analytical and diagnostic facility in contemporary chiropractic. The Index to Chiropractic Literature lists 213 published papers relating to this form of imaging. (Kovacs 1955; Penning 1964; Cailliet 1967; Maigne 1972;

Mooney 1976; Allen & Cramer 1987; MacDonald 1988; Cramer et al 2000, 2002, 2006, 2011, 2013; Kulig 2004; Abbott 2006, 2011, 2013; (Giles et al 2013; Francio et al 2015; Inami 2017; Kent 2020; (Kent & Costello 2021; Kent 2021)

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Subluxation overview

The articular subluxation has been recognised for 3,000 years. (Palmer 1910) (Ebrall 2020) There is inter-professional recognition that vertebral joint pathophysiology may contribute to a range of a complex of signs, symptoms and pathophysiological dysfunction as a result of the articular biomechanical disturbance. These clinical findings have been identified and attracted a range of nomenclature from the manipulative professions including physicians in manipulative medicine. (Vernon 2010)

DD Palmer, the originator of chiropractic, adopted the ancient term subluxation in 1903. It has been used by chiropractors since then. A number of medical authors have also adopted the term in this sense, although the general medical definition of a subluxation is somewhat limited. (Peters 2009) (Henderson 2012)

The World Health Organisation

The following definitions from the WHO are presented in order to differentiate the chiropractic subluxation and adjustment from terms used by other professions. (World Health Organization 2005)

> Subluxation complex (vertebral): *A theoretical model and description of the motion segment dysfunction, which incorporates the interaction of pathological changes in nerve, muscle, ligamentous, vascular and connective tissue.*
>
> Subluxation: *A lesion or dysfunction in a joint or motion segment in which alignment, movement integrity and/or physiological function are altered, although contact between joint surfaces remains intact. It is essentially a functional entity, which may influence biomechanical and neural integrity*.

The equivalent WHO document *Benchmark for Training in Osteopathy* does not define somatic dysfunction, although it does reference two osteopathic glossaries. (World Health Organization 2010)

The term 'subluxation complex (vertebral)' as well as 'subluxation (vertebral)' have also been incorporated by the *World Health Organisation* and are afforded a coding in the *International Classification of Disease (ICD-10) - the International Classification of Diseases M19*. Subluxation complex (vertebral) codes are listed as M99.10 to M99,19, while Segmental and somatic dysfunction are listed as codes M99.00 to M99.99 for the same 10 anatomical regions in each category of Biomechanical lesions, not elsewhere classified. (WHO Subluxation. 2021/2022) (WHO Somatic dysfunction 2021/2022)

In an apparent recognition of the similarity, it would appear that the *WHO's International Classification of Disease* suggests that there is little difference between a vertebral subluxation and the somatic dysfunction, The ICD 10 lists virtually identical codes for each region of subluxations or somatic dysfunction differentiated only by terminology. These are regarded as '*Diseases* (sic) *of the musculoskeletal system and connective tissue*.' (ICD codes 2022)

- M99 Biomechanical lesions, not elsewhere classified
- M99.0 Segmental and somatic dysfunction
- M99.00 … of head region
- M99.01…… of cervical region
- M99.02…… of thoracic region

- M99.03..... of lumbar region
- M99.04..... of sacral region
- M99.05..... of pelvic region
- M99.06..... of lower extremity
- M99.07..... of upper extremity
- M99.08..... of rib cage
- M99.09..... of abdomen and other regions
- M99.1 Subluxation complex (vertebral)
- M99.10..... of head region
- M99.11..... of cervical region
- M99.12..... of thoracic region
- M99.13..... of lumbar region
- M99.14..... of sacral region
- M99.15..... of pelvic region
- M99.16..... of lower extremity
- M99.17..... of upper extremity
- M99.18..... of rib cage
- M99.19..... of abdomen and other regions

If a vertebral subluxation is classed as a theoretical model as many aspects of allopathy are, cynics might disagree with the theories, but they could not disagree with the positive patient reported and documented clinical outcomes when those 'theories' are addressed through vertebral adjustments, or other forms of manipulation. Such phenomena have been observed for centuries, and it is more recently that the neurological and vascular complexes have been demonstrated. (Lantz 1989, 1990) (Senzon 2018)

The physiologist Korr, suggested neurobiologic grounds to justify conducting manual procedures on a spine in 1978. This cannot be based purely on symptoms or signs. To manipulate a spine and not identify what is being addressed or to specify exactly what is being manipulated would be blind general manipulation in the hope of achieving a result. Such vague hope avoids the judicious examination procedures that are necessary to assess and diagnose each possible patient.

There also seems to be a role for spinal manipulation in certain post-surgical conditions where medical discussion is noted and where spinal pain persists. (Peña et al, 2018) (Sposato & Bjerså, 2018) (Michaelsen 2000) (Trager et al, 2021)

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Preview discussion

Definitions

In recognising there exists a range of definitions for a subluxation, for the purpose of this study our preferred definition of a subluxation is defined as:

> 'an articular dysfunction with or without displacement, typically but not limited to the spine and pelvis and characterised by anatomical and physiological modifications with associated neurophysiological signs and symptoms which may be addressed by a specific manual or instrument assisted adjustment.'

This definition covers the six elements of a VSC,

- Biomechanical
- Anatomical
- All articulations, but particularly vertebral facets
- Neurological
- Clinical symptoms and signs
- Amelioration by adjustment.

The subluxation is only one aspect of chiropractic practice focus. It remains a primary focus of up to 70% of practitioners. (Glucina 2020) Other considerations of chiropractic practice involve the effects on health status of prior accidents, injuries, and illnesses, genetic predisposition, and of exercise, muscular tone, diet and nutrition, lifestyle, work practices, sport, and hobbies. (ACA Undated)

Once again, as the authors' preference, we offer the definition for a corrective adjustment of a vertebral subluxation complex which may be defined as:

> 'The physical application of a highly developed finely tuned advanced form of manual or instrument assisted intervention directed to restore specific anatomical, functional and neurophysiological elements of an articular subluxation in order to ameliorate associated signs, symptoms and altered physiology'.

While manipulation is a generic term covering a wide range of manual procedures, an adjustment is appreciably different in view of its intent, specificity and efficacy. Mobilisation and manipulative therapy refer to more general manipulations in application. It is critical to differentiate these models in order to evaluate the comparative efficacies. (Slaven et al, 2013)

While it is recognised that the abundance of nomenclature listings do not necessarily 'prove' the existence of a subluxation complex or its component parts, such wide recognition indicates a lesion deserving of attention. This is supported by neuropathological research by various neurophysiology researchers (Sato 1997) and a plethora of case reports. Reported positive clinical outcomes justify the mode of intervention in correcting the VSC as the most likely current explanation. (Dishman 1985, 1988) (Rome 2016) (Rome & Waterhouse 2019) (Lantz 1989,1990)

As a means of analysing the rationale of vertebral subluxations, Faye first introduced the five-component model of the subluxation complex in 1967 through *The Motion Palpation Institute*. (Gatterman 2005) Apart from Faye, through the 1970s and 80s, others have suggested component models of the subluxation. (Senzon Part 9). Leach (1994) details 6 components, Flesia (1982) lists 4 components, Lantz (1989,1990) 9 components, and Herfert (1986) 5 components. A more comprehensive 8 component version which explains in more detail has been proffered with referencing by *The Rubicon Group* under key elements of compromised (spinal) movement patterns, compromised neurophysiology and, compromised adaptability. It carries an appropriate rider which states that it is currently defined subject to evolution of evidence.

Over 35 years ago, Dishman declared that '*No longer can "informed" critics support the accusation that chiropractic practice is based upon irrational, untenable premises*'. (Dishman 1985) (Seaman & Faye 2005)

Three years later Dishman (1988) nominated the biomechanical aspect of the subluxation of comprising intervertebral dyskinesia, dysarthrosis or dysfunction. He also named other biochemical and histological changes that complemented these components. Earlier, neurological and muscular involvement was described by Homewood (1962). Previously, Műller (1954) published a textbook on the autonomic nervous system in chiropractic.

A synopsis of the neuropathophysiology of vertebral subluxations has been proposed by Painter: (Undated)

- Facilitative lesion, the facilitative segment, neurological irritation, neurological hyperactivity: The literature indicates that, of the neurological damage induced by spinal kinesiopathologic changes, about 85–90% results in a facilitated profile
- Articular neuropathy, the hyaline cartilage pads in the diarthrodial spinal joints as well as the local articular ligamentous support tissue are seriously stressed during an acute episode of the vertebral subluxation complex and more so in long term uncorrected vertebral subluxation complex episodes. This causes, in addition to the histopathologically induced pathoanatomical changes due to long term uncorrected vertebral subluxation complex, significant damage to the balance and proprioceptive nerve endings (the Type I Mechano receptors, Type II & III Articular Receptors and Type IV Nociceptive 'Pain' Receptors) in the articular surfaces and the capsular ligaments so that 'Noxious' nerve impulses are fired off afferently back to the spinal balance center in the cerebellum, the proprioceptor center in

the cerebral cortex and in the Limbic 'joint pain' regions of the cerebral cortex. Surprisingly, the spinal cord stores facilitated data also, causing reflexogenic activity from the involved joint

- Compressive lesion, the pinched nerve, neurological hypoactivity: The literature indicates that of the neurological damage induced by spinal kinesiopathologic changes, about 10-15% results in a compressive profile.

In 1960 Dalgleish in discussing manipulation, coined the unusual term *ortho-spondylo-dysathrics* for a vertebral subluxation which he referred to as the forgotten spinal joints. However it serves more as a limited descriptive and it does not appear to have been taken up in other papers. (Dalgleish 1960)

The indexed literature lists a range of synonyms, metaphors and euphemisms for the subluxation. (Gatterman, 2005, pp 6-7) These are also derived from chiropractic, medical, osteopathic and physiotherapy sources. This plethora of terms now number over five hundred. (Rome 1996, 2017 x2), (McCoy 2010) To dismiss such a large number is to ignore widely recognised clinical observations and accepted phenomenon. A short selection is given here:

- Subluxation (Palmer 1910)
- Articular lesion (1933 AOA House of Delegates; Shepler1972)
- Intervertebral derangement. (Maigne & Vautrevers. 2003)
- Intervertebral lesion. (Gibbons and Tehan 2000)
- Joint dysfunction Bourdillon and Day 1988, p21,40)
- Lesion. 1874 (Still) (Liem 2016)
- Manipulatable spinal lesion (Osteopathic) (Fryer 2003)
- Osteopathic lesion (Denslow, 1940)
- Somatic dysfunction (Bourdillon and Day 1988, p40)
- Spinal joint lesion (Bourdillon and Day 1988, p37)
- Subluxation (Bourdillon and Day 1988, p38; Elite Physio (2021)
- Vertebral dysfunction, Cervical dysfunction, Spinal dysfunction (Murtagh 2011,2022; Fryer 2003)
- Vertebral fixation. (Gillet, 1963, 1969;(Faye 1970s, 1983; Alley 1983; Innes 1995; King 2006; Senzon 2018; Faulkner et al, 2021; Schafer undated)
- Vertebral subluxation complex (VSC) (Faye 1983; Seaman Faye 2005)
- Vertebral subluxation syndrome (Gatterman 1992)

The disturbance of vertebral segments has been referred to in the medical literature by Abbott and colleagues as '*displacement kinematics*.' (Abbot et al, 2006)

There have been a number of definitions proposed over the years both for the vertebral subluxation and the osteopathic lesion. Most of these initially seemed to focus on just the biomechanical aspect, although these have now become more inclusive.

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Medical acknowledgment of the Vertebral Subluxation concept

The earliest medical doctors to recognise the chiropractic model of vertebral subluxation would have to be those that became chiropractors themselves within three years of Palmer's 1895 innovative breakthrough. Indeed, a number of medical doctors have undertaken chiropractic qualifications since that time. Medical doctors comprised a third of the initial class of chiropractic students in 1898. (Wardwell 1992) (McDowall 2021)

As will be demonstrated here, other medical recognition of the key elements of the subluxation (displacement, dysfunction), as well as certain signs and symptoms is well established but seemingly only adopted by a limited number of physicians who have accepted models of manipulation. In 1964 Penning noted '*Nonpathologic and pathologic relationships between the lower cervical vertebrae.*' (Hadley1936,1976; Penning 1964; Cailliet 1967; Schmörl & Junghanns 1971; Eriksen 2004; Paterson 1985; Rome, 2016)

This vertebral subluxation complex model appears to be recognised clinically but not politically. This is probably due to efforts by political medicine to contain chiropractic before this was litigiously removed, and would appear to be consistent with the *Iowa Plan* formulated by the *American Medical Association*. Chiropractic terminology seems to have been deliberately and politically misrepresented and suppressed. (Rome 2017; Wilk 1996; Wolinsky 2020)

Clinically, the hypothesis of the subluxation has been noted by a wide range of medical authors. Also, as a complex comprising symptoms, signs and clinical recognition, it has also attracted

attention by the various medical authors. Table 1 summarises a number of medical textbooks that recognise elements of the subluxation complex.

The traditional medical definition of a subluxation appears inadequate as it does not imply any other factors other than an osseous displacement, particularly somato-autonomic or noxious sensory activated reflexes. In addition, it does not distinguish between a minor or greater displacement, not does it attempt to recognise the stage at which a displacement may become symptomatic. *Dorland's Medical Dictionary* peremptorily describes a subluxation as '*An incomplete or partial dislocation*' Nor does an articular functional alteration appear to be a consideration although perhaps a partial dislocation may be considered fixated, or subject to minimal motion. If a fixation occurs within a facet's normal range of motion and is symptomatic, such a definition would not include this displacement, while the term dislocation may be interpreted as an exaggeration of the degree of displacement, if it is not defined. This definition does not specify the degree of displacement before a subluxation becomes clinically significant or symptomatic. (Agnew et al 1965)

Apart from the authoritative *World Health Organisation* (2021) recognition of the chiropractic model of a vertebral subluxation, *Gray's Anatomy* (1980) recognised subluxation of the sacroiliac joint noting that '*locking may occur …*' and that '*This so-called subluxation of the sacro-iliac joint causes pain'* and that '*reduction by forcible manipulation may be attempted*.' (Williams & Warwick 1980) Gartenberg et al also recognised the functional fixation element of this joint's subluxation by publishing sacroiliac joint dysfunction: pathophysiology, diagnosis, and treatment. (Gartenberg 2021)

To varying degrees, chiropractors and osteopaths have also provided in-hospital manipulative care for patients in many countries for over 100 years. (Bishop et al, 2010; Meade et al, 1995; Rome 2016; Till & Till 1999)

In presenting in this format, it can be noted that the VSC is not merely a mechanically displaced vertebra, but one which is multifactorial and attracting recognition as a complex.

In his chapter on '*Subluxations of the cervical spine including the "Whiplash" syndrome*', Cailliet (1967) uses terms like confusion, ignorance, poorly understood and complete denial in reference to conventional medical recognition of possible effects of (and presumably the existence of) subluxation injuries.

Lewit (p5) declared that modern medicine '*has shown that an uncompromisingly negative attitude to manipulation*.' And further that '*while osteopaths and chiropractors, who were regarded by the medical profession as quacks, were elaborating sophisticated manipulation techniques, qualified doctors began to use very crude methods of manipulation, even employing anaesthesia*.' (Lewit 1999)

James Cyriax felt that the concepts of manipulation may 'revolutionise' physiotherapy which would be '*… altered beyond recognition*' although mooted in his text of 1965 (p3), such a change did not happen quickly as there seemed to be resistance to anything chiropractic. The initial text by Cyriax was published in 1944 some 50-60 years after the advent of chiropractic and osteopathy. Pettman (2007) and Ottossom (2011) seem to attempt to claim the science for physiotherapy. Cyriax lists the inaugural lecture at the first meeting of the Association of Manipulative Medicine in 1963 (p.61). Cyriax also appears to have tried to interest physiotherapy in the science of spinal manipulation, He also notes that medicine has '*withheld*' manipulation '*during all of this century*' (p4) (1900s). He has been quite dismissive of chiropractic and osteopathy who collectively pioneered the very model of care he is attempting to promote. (Cyriax 1965, pp 53-57,61-69)

Contrary to Cyriax, Kaptchuk and Eisenberg offered inter-professional deference to chiropractic when they stated, '*Chiropractic is an important component of the US health care system and the largest alternative medical profession. (and) chiropractic has found an internal coherence that has allowed it to become an enduring presence in the United States. This integrity has to do with the profession's belief in the importance of biomechanics; the centrality of manual therapy, especially for the spine; and a clinical dynamic that provides patients with explanations, meaning, and concrete experiences that promote a strong patient-physician bond, a sense of caring, and a restored sense of well-being*.' (Kaptchuk & Eisenberg 1998)

However, the following definition of a subluxation by Parker in 2020 is somewhat limited. As described, it did not identify that the superior of two vertebrae may be displaced in that manner. That forward displacement essentially described the vertebral body when the whole segment is displaced. No mention is made of a separation of the respective vertebra's spinous processes or facet wedging. There is no mention of sensory, ligamentous, discal or neural compromise. This is akin to describing an ankle sprain as a bone being displaced while overlooking the ligamentous, vascular, inflammatory and cartilage structures, as well as the effect on noxious sensory activation and altered function. '*The facets of a vertebra are mildly displaced in a forward position, over the facet surface of the vertebra below. This condition results in a mild anterior (forward) displacement of one vertebral body over the other*.'

Earlier, in 2001, Roche et al noted vertebral fixation but, based on the limited traditional medical definition of a subluxation noted that the vertebral joints were neither subluxated nor dislocated. They stated '*as in most cases the fixation occurs within the normal range of rotation of the joint. By definition, therefore, the joint is neither subluxed nor dislocated*.' That comment portrays the limitation and deficiency of the medical definition. Both the chiropractic definition of a subluxation and the osteopathic definition of a vertebral dysfunction incorporate those factors. (Roche et al 2002)

The *International Society for the Study of the Lumbar Spine* recognised such terms as sacroiliac joint dysfunction (Vol 1, pp 561, 566) locked in a faulty position, correct the alignment, and increase the range of motion. (Paris 1996, Vol 2, p1014) This study by the orthopaedic surgeon Wiesel et al (1996) incorporated a number of interpretations for manipulation.

- Dysfunction syndrome in low back pain (p1004)
- Derangement syndrome (p1004)
- Treatment of mechanical dysfunction syndrome (p1009)
- Manipulation for disc herniation (p 485)
- Manipulation for sacroiliac joint dysfunction (p566)
- Manipulation of joint definition (p1012-3)
- Manipulation for spondylolisthesis (p 659)
- Purpose of (p1014)
- Techniques of (p1013)

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Subluxation

Medical adoption of the term

Under traditional interpretation of a subluxation, a degree of displacement may be evident, or may even be regarded as being within normal limits. However, it is associated signs or symptoms that indicate that a subluxation complex exists and is worthy of addressing, a convention that has successfully persisted for over 125 years in chiropractic and osteopathy.

A noted difference in the evaluation of medical and chiropractic radiographs is the emphasis in the clinical aspects as well as the radiographic findings recognised by chiropractors. This difference may be noted in a study by Curtin and McElwain where they consider that displacement of less than 3mm was normal, but rare in adults. Bickle states that less that 2mm displacement is a pseudosubluxation. We suggest this term is misleading and demeans the patients' symptoms. At times, a fixation with no displacement may cause symptoms so that identified articular dysfunction may be responsible for activating noxious sensory sensations particularly from the involved facet(s). This may lead to further signs and symptoms such as cervicogenic headaches or sciatica. It is suggested here that the dysfunction factor, particularly in association with displacement however slight, that should be taken into account. Abel appears to allude to this condition as occult by opining '*The dynamic interrelationship between segments of the cervical spine and the cervical spine as a whole*.' (Abel, 1975; Harrison et al, 1980; Fechtel, 1983; Curtin & McElwain, 2004; Bickle, 2022)

In addition, and unless the so-called pseudosubluxation is an incidental finding, for a radiological study to be conducted in the first place, there would have to be a reason to justify the procedure be it at least the presence of symptoms and/or signs. This suggests neurological sensory activation and more than merely osseous displacement, especially if that is the only finding. Segmental instability is also a consideration in such a radiological finding. (Ghanem et al. 2008)

While the term vertebral subluxation is used in the medical literature, it seems to be viewed primarily as a mechanical displacement. Other key elements of the subluxation complex appear to be largely overlooked. The dysfunction, and noxious sensory disturbance factors should be considered, along with the degree and type of displacement, degree of dysfunction, as well as the nature and direction of subluxation. The term subluxation in relation to vertebrae has been adopted in medical literature since at least 1918 as indicated by Warbasse, extracted as Figure One.

Figure 1: Warbasse extract

Subluxations of vertebræ occur in all parts of the spine and in all degrees. When the dislocation is so slight as not to effect the spinal cord, it will still produce disturbances in the spinal nerves, passing off through the spinal foramina. The dominant teaching has been that dislocations were gross lesions, causing pressure upon the cord, easily palpable, and with a high mortality. Blasius, (1869) showed that slight dislocations occurred, which presented but slight symptoms. Then nearly half a century elapsed, during which time a pseudoscience sprang up as a result of the scientific neglect of these common subluxations. We are indebted to H. P. deForest, of New York, for placing this whole subject upon a scientific basis, and showing that a large category of peripheral nerve disturbances are due to such subluxations and are relieved by treatment upon this basis. He demonstrated the finer displacements which had escaped the notice of Blasius, and applied successful treatment. As a result of the work of deForest many cases of "neuralgia," "rheumatism," "lame back," "crick in the back," "stiff neck," vague abdominal symptoms, and girdle pains may be cured by looking for these slight dislocations and correcting them.

The technic of treatment is simple. Little or no force is required. Spontaneous reduction often takes place. Slight traction upon the spine is made either by the hands or with the suspension apparatus, the patient sitting upright in a chair. While traction is made, corrective manipulation is applied to the displaced vertebra. When the bone slips into place, which it often does with a snap, the patient feels a sense of relief from the pressure upon the spinal nerve trunk. In some cases no displacement is palpable, but empiric pressure and manipulation cause relief of the symptoms. In such cases deForest employed vibratory massage in connection with traction.

Warbasse, a surgeon, recognised the term common subluxations, and claimed that deForest demonstrated finer displacements of vertebrae. He states further that '*Subluxations of vertebrae occur in all parts of the spine and in all degrees … When the dislocation is so slight as not to affect the spinal cord, it will still produce disturbances in the spinal nerves*… '. (p623)

Some 724 synonyms, euphemisms and metaphors have been identified in relation to chiropractic lexicon, and 671 relating to the vertebral subluxation itself. (Rome 2016, 2017 Parts1 & 2) Other published medical works refer to vertebral subluxations in the title of their publication. (Hadley 1936; Feld 1954; Cailliet 1967; Tonomura et al 2007; Ishii et al 2011; Moley 2020; Chu et al 2020)

Cailliet (1967) devoted an entire chapter to the vertebral subluxations of the cervical spine as a result of whiplash and other traumas. He also noted changes to articular positions, and effects on the spinal canal and vertebral artery foraminal alignments. (p44) In recognising the subluxation associated with cervical sprains, Cailliet also used the phrase derangement of opposing joint surfaces, (p 61) and attributes a range of symptomatic involvements with the sympathetic nervous system due to activation of sensory elements. (p69)

Hadley discussed extensively the radiological finding of mechanical subluxations. He also identifies a spontaneous subluxation as a result of an inflammatory process, particularly in children. Grisel's syndrome would be such condition. (Hadley 1976)

A state of subluxation with tension, pressure, stretching, or irritation of the vertebral joint capsule as a result of postural strain or trauma but without narrowing of the related foramina was noted by Panzer in 2016.

It can also be noted that there are different interpretations of a facet subluxation and a vertebral subluxation. Such confusion emphasises the need for clarifying definitions which incorporate dysfunction and neural disturbance when associated with minor displacement. In addition, a functional fixation (dysfunction) is distinctly different to a surgical vertebral fixation (fusion). As such, a dysfunction is an element of a chiropractic subluxation along with soft tissue affectations and altered biomechanical function together with neural dysfunction having wide potential ramifications.

We have also noted that the literature seems to carry differing interpretations as to:

- Criteria to differentiate between a dislocation compared to a subluxation.
- At what stage does a displaced facet become a dislocation?
- When does a displacement deemed responsible for certain symptoms?
- How to differentiate the symptoms associated with segmental hypermobility and segmental hypomobility or fixation.

A summary of synonyms, metaphors and euphemisms terms directly associated with the biomechanics of the VSC comprising Tables, 1 (Euphemisms for subluxation), 2 (Euphemisms for articular dysfunction) ,3 (Euphemisms for segmental fixation) ,4 (Euphemisms for hypomobility), 5 (Euphemisms for hypermobility), 6 (Euphemisms for osseous displacement), and 11 (Euphemisms for sacroiliac subluxation) totals 595. Of these 212 (35.6%) are drawn from medical sources. (Rome 2017 Pt2) We would suggest that these figures constitute a reasonable recognition of the VSC in medical publications.

Rome's earlier study (2017) on vertebral subluxation complex-related terms revealed that a significant number are derived from the medical literature. The balance of the percentages in the following overview are from the other three manual professions.

In overview:

- Of 109 general terms related to the vertebral subluxation complex 44 (40.4%) related to medical papers or chiropractic authors in PubMed listed medical journals or medical textbooks. (Appendix 1)
- Of 199 terms related to biomechanical segmental dysfunction, articular pathophysiology, 65 (32.7%) were sourced from medical papers or chiropractic authors in PubMed listed medical journals or medical textbooks. (Appendix 2)
- Of 67 terms related to articular fixation, 21 (31.3%) were sourced from medical papers or chiropractic authors in PubMed listed medical journals or medical textbooks. (Appendix 3)
- Of 39 terms related to articular hypomobility, 4 (10.3%) were sourced from medical papers or chiropractic authors in PubMed listed medical journals or medical textbooks. (Appendix 4)
- Of 16 terms related to articular hypermobility, 5 (31.25%) were sourced from medical papers or chiropractic authors in PubMed listed medical journals or medical textbooks. (Appendix 5)
- Of 116 terms related to osseous displacement at an articulation, 56 (48.3%) were sourced from medical papers or chiropractic authors in PubMed listed medical journals or medical textbooks. (Appendix 6)
- Of 35 terms related to articulation-related muscular and ligamentous pathophysiology, 4 (11.4%) were sourced from medical papers or chiropractic authors in PubMed listed medical journals or medical textbooks. (Appendix 7)
- Of 83 terms related to pathoneurophysiology, 13 (15.6%) were sourced from medical papers or chiropractic authors in PubMed listed medical journals or medical textbooks. (Appendix 8)
- Of 25 terms related to articulation-related symptoms and clinical signs, 10 (40%) were sourced from medical papers or chiropractic authors in PubMed listed medical journals or medical textbooks. (Appendix 9)
- Of 10 terms related to articulation-related vascular and biochemical changes, 2 (20%) were sourced from medical papers or chiropractic authors in PubMed listed medical journals or medical textbooks. (Appendix 10)
- Of 49 terms related to sacroiliac subluxation pathophysiology, 17 (34.7%) were sourced from medical papers or chiropractic authors in PubMed listed medical journals or medical textbooks. (Appendix 11)
- Of 94 terms related to manual modification of the VSC, 38 (40.4%) were sourced from medical papers or chiropractic authors in PubMed listed medical journals or medical textbooks. (Appendix 12)
- Of 50 terms offered as synonyms or metaphors for the professions of manual manipulation of the VSC, 32 (65%) were sourced from medical papers or chiropractic authors in PubMed listed medical journals or medical textbooks. (Appendix 13)

> [The purpose of this list is to show the usage of these terms available in medical sources. The balance of the percentages are terms used in chiropractic, osteopathic or physiotherapy sources. Appendix numbers relate to the tables in the cited paper (Rome 2017, Pt2).]

Murtagh (2011) only mentions subluxation once in relation to vertebrae when he states, '*Although most people live with and cope with the problem, progressive deterioration can occur,*

leading to subluxation of the facet joints.' (p384) It is also stated that '*The main cause of back pain presenting to the doctor is dysfunction of the intervertebral joints of the spine due to injury, also referred to as mechanical back pain (at least 70%).*' (Murtagh et al. 2011, p 373)

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Osteopathy's Somatic Dysfunction

Analogous to the chiropractic VSC

The osteopathic equivalent (more of less) of the chiropractic terms *subluxation* and *subluxation complex* are *somatic dysfunction*, *vertebral lesion* or *vertebral dysfunction*. As an identity, this distinguishes the osteopathic profession and differentiates it from other manual professions. However, unless clarified by a definition, the nomenclature itself implies just the structural/functional aspects excluding the neural, vascular and soft tissue elements in the term itself.

Despite the similarity, the osteopathic model of 'somatic dysfunction' does not seem to attract the cynicism that befalls chiropractic's 'subluxation complex' terminology.

Reported in 1968, a definition for the articular osteopathic articular lesion was adopted by the AOA House of Delegates in 1933 as '*... any alteration in the anatomical or physiological relationships of the articular structures resulting in local or remote functional disturbance*.' A number of definitions were discussed at that time. (Shepler 1972) In 1935, there were moves to change the controversial osteopathic term, lesion to somatic dysfunction. (Noy 2016). One previously offered definition concisely stated that the osteopathic lesion was '*A disturbed physiology in an anatomical component*.' (Rumney 1971)

In a further similarity with chiropractic, the *American Association of Colleges of Osteopathic Medicine* nominated basic and clinical science principles of the osteopathic model of principles and philosophy of manipulative care. (Hruby et al, 2017; AACOM 2017)

These integrated and coordinated biological functions and coping strategies are considered in a context of healthful adaptation to life and its circumstances: (Ratay, 2022; Tramontano et al, 2017; Bergna et al, 2020; Licciardone et al, 2005)

- Biomechanical: Posture and motion, including fundamental structural and biomechanical reliability
- Neurological: Neurologic integration, including central, peripheral, autonomic, neuroendocrine, neurocirculatory, and somatic elements
- Respiratory-circulatory: Macro- and microrespiratory and circulatory factors
- Metabolic: Metabolic processes of all types
- Behavioural: Psychosocial, cultural, behavioural, and spiritual elements

A detailed definition for a somatic dysfunction is offered from an osteopathic glossary: (Giusti 2017)

> Impaired or altered function of related components of the body framework system: skeletal arthrodial and myofascial structures, and their related vascular, lymphatic and neural elements. It is characterized by positional asymmetry, restricted range of motion, tissue texture abnormalities, and/or tenderness. The positional and motion aspects of somatic dysfunction are generally described by:
>
> (1) The position of the body part as determined by palpation and referenced to its defined adjacent structure
>
> (2) The directions in which motion is freer, and

(3) The directions on which motion is restricted. Somatic dysfunction is treatable using osteopathic manipulative treatment. (Giusti, 2017)

In the plethora of terminology in the manipulative professions, osteopathy also adopted the term facilitated segment. This infers a degree of specificity consistent with an adjustment. The course also recognised associated segmental reflexes. (Principles of manual medicine, 2017)

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To be continued

This series will continue by reporting evidence associated with the *Vertebral Subluxation Complex*.

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Refer to Table 1 held on the Journal website