XIV. Summary

These Radiographic Protocols/Guidelines were written by practicing chiropractors, who have noticed that other more restrictive radiographic protocols are/were written either by Managed Care Organizations (MCOs) to cut costs and maximize profits, by IME doctors working for MCOs, or by College Academics working for MCOs. Neither MCOs nor their paid IMEs have a place in the writing of clinical guidelines whether these are “Best Practices” or “Radiographic Practices” since these organizations/individuals have a huge potential financial conflict of interest that most often conflicts with the needs of the patient seeking healthcare.

Previous Radiographic Guidelines have often cited medical research that does not fit Chiropractic practice. Radiographic usage in the pharmacological treatments of patients has no bearing on the radiographic needs of chiropractors, who is applying physical forces to patients’ spines via manipulation, adjustment, and rehabilitation forces in exercises and traction procedures.

This document, written by Practicing Clinicians, presents evidence supporting routine radiographic examinations of children and adults seeking chiropractic care for the biomechanical evaluation of spinal subluxation. Critics of routine radiographic utilization in Chiropractic practice often claim (personal opinion) that there is no supporting evidence for biomechanical assessment of the spine. However, contrary to their opinions, there are approximately 900 references of Class I-V (Levels I-IX of clinical research), reliability studies, validity studies, and/or biomechanical studies cited as the evidence in these Guidelines. The evidence is overwhelmingly in favor of routine radiographic utilization in clinical Chiropractic practice.

Since this Guideline document is over 260 pages, we present a very short summary of each section (I-XIII) for the interested reader who does not have the time to study each page.

Preamble & General Radiography Summary

Any Guidelines that are “evidenced-based”, especially Radiographic Guidelines for Practicing Chiropractors, must not replace the clinical decisions of the healthcare provider, nor apply general rules to individual patients, who may not benefit from these average rules. In fact, the “father of Evidence-based Medicine” (EBM), Sackett, stated that EBM is clinical decision-making based on (a) sound external research evidence, (b) the individual healthcare provider’s clinical experience, and (c) the needs of the individual patient. MCOs often remove the individual healthcare provider’s clinical experience and the needs of the individual patient from their guidelines in order to minimize costs and increase profits.

It is assumed in these Radiographic Guidelines that the Chiropractor has studied x-ray physics, x-ray positioning, radiographic safety, x-ray diagnosis, and x-ray geometric line drawing methods, but a few expectations of basic radiographic usage are listed. The healthcare provider is expected to be performing these items without statements referring to these items in the rest of this document.

Chiropractic Guideline for Spine Radiography for the Assessment of Spinal Subluxation in Children and Adults

A list of 27 “Indications” for spine radiographic examinations is presented, which include any axial pain, any restricted range of motion, any head aches, any trauma, any radiating pain, any abnormal posture, any spinal deformity, etc.

The minimum radiographic evaluation of the spine is defined and some general and specific evaluations on these radiographic views are suggested. Additional radiographic views for trauma cases are recommended, as are post-radiographic examinations to monitor patient progress. Computer assisted radiographic analysis is deemed reliable and valid for spine analysis.
Description of Levels of Evidence

When considering “Evidence-Based Practice” (EBP), one of the immediate questions should be “what does and does not provide evidence?” MCOs and/or their paid IMEs often restrict “their” evidence to randomized clinical control trials (RCTs). This often severely limits the evidence to be considered because there are many more published cohort, cases series, and case studies than there are published RCTs. Sackett, the father of EBM and EBP, suggested using all available evidence, but by rating evidence levels (i.e., RCTs are rated higher than Case Studies). Along these lines, the US Department of Health and Human Services (http://www.ahrq.gov/) listed four levels of evidence:

- **Level 1.** Randomized controlled trials—includes quasi-randomized processes such as alternate allocation.
- **Level 2.** Non-randomized controlled trial—a prospective (pre-planned) study, with predetermined eligibility criteria and outcome measures.
- **Level 3.** Observational studies with controls—includes retrospective, interrupted time series (a change in trend attributable to the intervention), case-control studies, cohort studies with controls, and health services research that includes adjustment for likely confounding variables.
- **Level 4.** Observational studies without controls (e.g., cohort studies without controls, case series without controls, and case studies without controls)

Some documents rating evidence will include “Level V” as “Expert Opinion”. In this document we have included this “Expert Opinion” level of evidence. In this document we use Class I-V for Levels I-V because we added some Basic Science, reliability, and validity studies to Class I.

However, the reader should be wary of any Protocols/Guidelines that eliminate any of the above levels of evidence (i.e., http://ccgpp.org), as there is usually a preconceived reason (agenda) for eliminating any levels of evidence. This is especially the situation in the Chiropractic literature evidence, where few RCTs have ever been published, but where a vast number of Case Studies have been published.

Background

Chiropractors, in English speaking countries, enjoy radiographic privileges due to their education in all aspects of radiography but also in part to the history of utilization of spine radiography by early Chiropractic pioneers.

A publishing subgroup of the Diplomats of the American Board of Chiropractic Roentgenology (DACBRs) and a few chiropractic academics have attempted to reduce x-ray privileges for practicing Chiropractic Clinicians. These suggested reductions in x-ray privileges by the subgroup of DACBRs and academics have come in the form of “expert opinion” chapters in various chiropractic texts, articles published in Index Medicus journals (JMPT, Chiropractic & Osteopathy), CINAHL and Mantis Indexes.

Relying on selective literature citations and Clinical Class V (expert opinion) evidence instead of all the available data, these DACBR and academic “expert opinions” have claimed a series of positions that have been shown to be false. These include:

- Normal spinal position does not exist,
- Acute muscle spasms cause cervical and lumbar kyphosis or hypo-lordosis,
- Normal spinal anatomic variants cause the spine to appear to be subluxated,
- X-rays should not be taken for biomechanical, screening, and follow-up treatment x-rays are not warranted,
- Radiographic line analysis of spinal displacements is unreliable,
- X-ray positioning of patients is unreliable,
- X-ray analysis lacks predictive validity and biologic plausibility, and
• X-ray use to dictate treatment does not yield improved patient outcomes.

Additionally, this subgroup of DACBRs has been suggesting that Chiropractic X-ray privileges be confined to “Red Flag” cases only (i.e., fracture, infection, ruptured discs, tumors, etc.). Problematically, managed care organizations (MCO’s) use the DACBR “Red Flag” documents to enforce their mandatory reduction in radiographic utilization rates of practicing chiropractic clinicians. In fact, there is no evidence that these policies actually benefit the patient; but there is evidence that this increases the profits of MCO’s and insurance providers. Thus, it becomes clear that current attempts to limit radiography utilization rates of chiropractic clinicians is motivated more by profits and less by what is best for the patient.

Most of the “evidence”, that is not personal opinion, cited by this subgroup of DACBRs and MCOs are medical studies, which applied drug therapy as the treatment. Since studies using pharmacological treatments (“chemical” treatment) do not apply to the needs in Chiropractic care, where “physical” forces are being applied to patients’ spines, chiropractic radiographic utilization cannot be inferred from medical studies.

**Historical & Current Perspective**

Historically, radiographic spinal analysis has been an integral part of a Chiropractic evaluation. The use of x-ray for clinical decision making dates back to BJ Palmer in 1910. Many Chiropractic Techniques were originated that used x-ray to determine subluxation listings. These include, but are not limited to, HIO, Wernsing’s Atlas Specific, Grostic, Gonstead, Diversified, Zimmerman’s Specific Adjusting, Logan Basic, Mears, Atlas Orthogonal, Life Cervical, Pettibon, CBP, Blair, Pierce-Stillwagon, Toftnes, Barge’s Tortipelvis and Torticollis, Orthospinology, and NUCCA.

Initial radiographs are a mandatory necessity in some of the chiropractic techniques practiced by the majority of chiropractors. This is evident by the National Board of Chiropractic Examiners’ surveys on utilization of techniques in the past few years. It is known from these surveys that Gonstead, HIO, Logan Basic, and Pierce-Stillwagon are four of the most prevalent chiropractic techniques and radiographic analysis is a necessity in these techniques. Thus, taking initial x-rays for biomechanical assessment of subluxation is the Standard of Care in Practicing Chiropractic offices.

**Definition of Subluxation and Average Normal Spinal Alignment**

Historically, there have been many different definitions of vertebral subluxation used by chiropractors and other health care providers. However, a commonality of many chiropractic definitions has been: 1) vertebral misalignment and 2) disturbance of normal nerve function. In general, chiropractors have long been displeased with the medical profession’s definition of subluxation, which usually has had something to do with translations of single vertebra beyond the limits of the spinal ligaments; i.e., retrolisthesis, laterolisthesis, and thin discs.

In general terms, instead of a precise definition of subluxation, chiropractors have resorted to vague terms such as “biomechanical aberration” and “loss of mechanical integrity of the spine” and have attempted to describe the effects of subluxation, such as “histopathology, kinesiopathology, pathophysiology, neuropathophysiology, and myopathology.” Often these definitions of subluxation are proposed by political organizations by consensus instead f by scientific reasoning.

Harsh critics of the usage of the term/entity of subluxation often use cross-sectional studies, instead of longitudinal studies, to try to discredit the use of spinal subluxation in chiropractic terminology. Most symptoms and pathologies take time to develop and take time to resolve. Additionally, these critics of spinal subluxation utilize studies in which the only
“adjustment” was a gross spinal manipulation without regard to pre-alignment and postalignment of the subjects’ spines.

It is the opinion of this panel that practicing Chiropractors have defined subluxation, used it daily in their assessments, in their corrective adjustments and rehabilitative procedures, and in their explanations to patients since 1910. Any definition of subluxation should include the historical concepts used by Chiropractic Clinicians, should be consistent with mathematics and mechanical engineering principles, and it should be valid in terms of the known spinal sciences. It is the consensus of this panel that the original definition of subluxation derived from the Palmers, “Bone out of place causing nerve interference”, is what Chiropractic Clinicians have used daily for approximately 100 years.

Most health care providers accept the average values as “Normal” from a plethora of physiologic, anatomic, and biomechanical measurements (such as normal blood pressure is 120/80). Similarly, average values as “Normal” from healthy subjects for spinal alignment have been determined and published in the scientific literature. Because an average normal spinal model for each region (cervical spine, thoracic spine, and lumbar spine) was not published until recently, the Chiropractic founding fathers did not have access to any such normal values of segmental and/or global alignment. Thus they had only their intuition to guide them. However, this information is available to us at the present time.

From 1996-2003, normal spinal models were published for each region of the spine. These normal spinal models are of two types, average and ideal. These models have been criticized by persons denying the very existence of subluxation, and have been suggested to be solely ideal or theoretical in character without clinical utility. However, average normal spinal models have been developed and published in scientific journals.

In the AP/PA view, the spine should be vertical and all end plate lines should be horizontal including occiput, C1-C7, T1-T12, L1-L5, sacral base, and a line at the tops of the femur heads. These lines are the Gonstead Technique wedge lines or also they are the endplate lines from which perpendiculars are drawn in the Cobb analysis, i.e., all wedge lines are parallel and all Cobb angles are 0° in the AP or PA spinal radiographic view. Another way to express this AP vertical alignment of the vertebrae is to state that all centers of mass are vertically aligned. In the cervical spine, this is equivalent in stating that the upper angle, lower angle, and CD angle on the nasium view are 90°, 90°, and 0°, respectively. In the thoracic and lumbar spines, this is equivalent in stating that all AP Risser-Ferguson angles.

In the sagittal view, average normal rotation angles of each motor unit (two adjacent vertebrae) can be derived from drawing lines along the posterior body margins of every vertebrae and measuring the angle of intersection of each pair. In actuality, these lines represent the slopes in an Engineering analysis of structures taught in Mechanics of Materials. For C1, the sacral base (S1), and the pelvic tilt, lines through these structures are often compared to a horizontal line for an angle of inclination in degrees. Segmental angles formed at adjacent vertebrae are termed Relative Rotation Angles (RRAs), while global angles (Absolute Rotation Angles are termed ARAs) in each region can be formed by comparing a superior vertebra in a sagittal region to an inferior vertebra. In this way an evaluation of the cervical lordosis (ARA C2-C7), thoracic kyphosis (ARA T1-T12 or ARA T2-T11), and lumbar lordosis (ARA L1-L5) can be measured in degrees. These x-ray mensuration methods have been shown to be highly reliable in numerous reliability studies.

There are 6 types of subluxation defined in this document, and these are mechanical descriptions for the allowable spinal displacements that can occur. Using the average normal spinal model, inside normal upright stance, that we precisely defined, these 6 types of displacements can be quantified.
1. **Segmental subluxations**: These are the segmental displacements from C1-S1 measured from the vertebra above relative to an origin located in the vertebra immediately below. These vertebral spinal subluxations are listed in terms of Rx, Ry, Rz, Tx, Ty, Tz.

2. **Postural main motion and coupled motion**: Postural displacements found in neutral resting stance are completely described as rotations and translation displacements of the head, thoracic cage, and pelvis. The majority of these displacements are concomitantly associated with spinal coupling/displacement patterns. Each postural displacement has a unique spinal displacement pattern that is normally associated with it.

3. **Snap-through buckling in the sagittal plane**: The alterations in the regional sagittal curves of cervical or lumbar lordosis to kyphosis and “S”-curves and, to some extent, changes in thoracic kyphosis to hypo-or hyper-kyphosis have been found to be consistent with the engineering Snap-through type of buckling.

4. **Euler buckling in AP/PA view**: This type of structural displacement is generally where the structures of the lower most segments in a spinal region experience some failure, e.g., axial rotation and/or lateral flexion of L4 & L5. These displacements are generally localized to the distal spinal regions of the cervical, thoraco-lumbar, and lumbo-pelvic and are generally associated with sub-catastrophic (non-complete tears) and sometimes catastrophic (macro) tears in the surrounding ligaments.

5. **Scoliosis**: Recently the non-neurogenic forms of scoliosis have been shown to be caused by a ‘slow-loading’ buckling mechanism. There are multiple different types, locations and complexities of scoliosis.

6. **Static or dynamic segmental instability**: These are the segmental displacements depicted in Figure 3 but are at the limit of or outside of the range of motion for the functional spinal unit. These are associated with significant ligamentous trauma.

An important topic when discussing our average spinal models’ application to the human population is a consideration of anatomical variations in a given person’s spinal anatomy. There are several known anatomical variants of human spinal anatomy that affect spinal alignment/geometry, however, there are several variants that do not. Significant progress has been made in understanding the correlations between a variety of anatomical variants and spine geometric alterations; Chiropractic clinicians and research have played a significant role in this area of investigation.

**Review of X-ray Usage and Guidelines by Orthopedic Surgeons, Family Practice Physicians, American Chiropractic College of Radiology (ACCR), and Medical Radiologists (ACR).**

**Radiation Safety: LNT Model versus the Radiation Hormesis Model**

The purpose of this section is to correct the general public’s false impression of the risks of medical/chiropractic x-rays. There are two models of radiation effects on organisms: Linear No-Threshold (LNT) model and the Radiation Hormesis model. Using the huge exposures during the atomic bombing of Japan in the 1940’s, the LNT model was derived by drawing a straight line down to zero exposure and claiming all radiation exposure causes a cancer risk. The LNT model continues to be used to estimate cancer risks from low doses of radiation, such as medical x-rays, without any supporting data. Proponents of the LNT model always omit any Radiation Hormesis information from their commentaries, review articles, and government documents.

There exists incontrovertible evidence that Radiation Hormesis (health benefit) occurs in plants, microorganisms, invertebrates, and experimental animals. In fact, it was proven with statistically significant results from countless studies that benefits from low levels of radiation improved physiologic function from immunity and reproduction to growth and longevity.
Ironically, much of this research came from studies evaluating ‘risks’ from radiation – so author bias was not possible.

In this section, both the LNT model and the Radiation Hormesis model are reviewed. This review indicates that the risks from medical/chiropractic x-rays are zero and there are actually health benefits from such small exposures. Therefore, the conclusion is: the benefits from spinal x-rays outweigh the potential risks, because the risks are zero. In fact few people are aware of natural radiation exposure and the relative risks associated with daily living, which when compared to exposure from medical x-rays, are in the same range.

Reliability of Geometric Line Drawing Radiographic Analysis

Contrary to the personal opinion espoused by a subgroup of DACBRs and Chiropractic Academics, there are more than 150 publications on radiographic geometric line drawing methods. The overwhelmingly majority of these studies report that geometric line drawing on radiographs is highly reliable and in the excellent range. The sheer number of these studies makes geometric line drawing on radiographs one of the most studied topics in the peer-reviewed literature.

Approximately 150 radiographic line drawing reliability studies are reviewed in 12 tables of different regions.

Reliability/Repeatability of Radiographic Positioning

Contrary to the personal opinion espoused by a subgroup of DACBRs and Chiropractic Academics, there are more than 50 publications on radiographic positioning. These studies come from Medical Doctors, Chiropractors, and Dentists. Tables of different regions are presented with reviews of approximately 60 publications on radiographic positioning. The overwhelming majority of the studies report that radiographic positioning is highly repeatable.

Description, Reliability, Validity & Efficacy of Common Chiropractic Radiographic Views

There are numerous spine radiographic views that are utilized by both Medical Doctors and Chiropractors. There are additional radiographic views that are unique to the medical profession for locating pathologies and fractures. Additionally, there are some radiographic views that are unique to the chiropractic profession and utilized for locating and measuring spinal subluxations.

We have determined a set of 17 radiographic views that are utilized in different chiropractic technique methods for the assessment of spinal subluxation. After listing these radiographic views, there is a description of each view with a discussion of reliability, validity, and clinical utility of each view. For convenience of categorization, we have placed these radiographic views into classifications by the region visualized on the film, i.e., cervical, thoracic, lumbar, pelvic, full spine, lower extremity, motion x-ray for trauma.

The sheer number of clinical studies using these 17 radiographic views is overwhelming and to discuss and reference many of these efficacy studies makes this section the largest section in this document.

Contrary to the personal opinion espoused by a subgroup of DACBRs and Chiropractic Academics, there are a plethora of publications on the efficacy of radiographic utilization in chiropractic clinical practice.

Pediatric Radiographic Evaluation in Chiropractic

There are many different ways (birth traumas and impact traumas) that a child may be injured. Several of these traumas are referenced. Additionally, there are certain developmental stages of the spine that the clinician should be aware of why taking x-rays of a child. There are
also some specific child health problems listed. The numerous possible traumas to children, who
often are too young and cannot communicate their symptoms, creates the necessity of a
radiographic examination. There are numerous chiropractic Case studies that report the necessity
of a radiographic examination in the pediatric case.

The Presence of Abnormal Posture and Any Axial or Radicular Pain Requires a
Radiographic Evaluation

In recent decades there has been a plethora of published studies concerning
mechanoreceptors (Types I-IV) in the spinal ligaments (ALL, PLL, ligamentum flavum,
intertransverse, facet capsular, interspinous, and supra spinous) and intervertebral discs. Not only
do these structures (ligaments & discs) have a nerve supply, but these mechanoreceptors inform
the brain of spinal position, and they create reflexes that connect in the spinal cord with the
sympathetic chain. The perception of pain comes from deformed mechanoreceptors. This
deformation comes from the 6 types of spinal subluxations previously defined in this document.

Deformation (strain) is caused by abnormal stresses. Besides pain, Woff’s Law (bone remodels
to stress) and Davis’ Law (soft tissue remodels to stress) indicate that abnormal spinal positions
(the 6 subluxation types) are the cause of many pathologies in the spinal structures.

Thus, the presence of pain is an “Indication” for the necessity of a radiographic
evaluation.

Legal Obligations of a DC for radiographic Use (Case Law, Judge’s Decisions)

An overwhelming majority of states extend broad diagnostic X-ray privileges to licensed
chiropractors by statute, either expressly or impliedly. Many states require their licensure
examinations to test the applicants’ knowledge of X-ray diagnosis and technique. Furthermore,
in several states the eligibility requirements for a license demand a minimum number of hours
spent studying X-ray diagnosis and technique. Our brief search revealed that at least forty (40)
states are characterized by one or more of the previous statements.

This panel conducted a thorough search of federal and state cases involving chiropractors
and their standard of care applicable to both the use and lack of use of diagnostic X-rays. Upon
completing this search the panel concludes that the relevant case law yields no uniform standards
which suggest chiropractors should limit their use of diagnostic X-rays to “Red Flag” cases.

The “respectable minority doctrine.” The most common legal definition of standard of
care is how similarly qualified practitioners would have managed the patient's care under the
same or similar circumstances. This is not simply what the majority of practitioners would have
done. The courts recognize the respectable minority rule. A number of states recognize it as a
malpractice defense that the defendant acted in accordance with the custom of at least a
"respectable minority," or recognized subgroup, of the relevant profession, even though his or
her actions were at odds with mainstream professional practice.

1. Chiropractors are authorized to employ spinal x-ray examinations in all 50 states of the U.S.
2. Statutes, rules and regulations concerning the practice of chiropractic do not explicitly limit
the use of x-ray examinations to cases where “red flags” are present.
3. Some courts have explicitly upheld the use of chiropractic x-rays to detect or determine the
presence of spinal subluxations.
4. Courts generally recognize that standard of care may be established under the respectable
minority rule.