

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.

50 Description of Levels of Evidence

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

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

68
69 Some documents rating evidence will include “Level V” as “Expert Opinion”. In this
70 document we have included this “Expert Opinion” level of evidence. In this document we use
71 Class I-V for Levels I-V because we added some Basic Science, reliability, and validity studies
72 to Class I.

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

79 Background

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

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

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

- 92 • Normal spinal position does not exist,
- 93 • Acute muscle spasms cause cervical and lumbar kyphosis or hypo-lordosis,
- 94 • Normal spinal anatomic variants cause the spine to appear to be subluxated,
- 95 • X-rays should not be taken for biomechanical, screening, and
- 96 • Follow-up treatment x-rays are not warranted,
- 97 • Radiographic line analysis of spinal displacements is unreliable,
- 98 • X-ray positioning of patients is unreliable,
- 99 • 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 of 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

149 “adjustment” was a gross spinal manipulation without regard to pre-alignment and post-
150 alignment of the subjects’ spines.

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

159 Most health care providers accept the average values as “Normal” from a plethora of
160 physiologic, anatomic, and biomechanical measurements (such as normal blood pressure is
161 120/80). Similarly, average values as “Normal” from healthy subjects for spinal alignment have
162 been determined and published in the scientific literature. Because an average normal spinal
163 model for each region (cervical spine, thoracic spine, and lumbar spine) was not published until
164 recently, the Chiropractic founding fathers did not have access to any such normal values of
165 segmental and/or global alignment. Thus they had only their intuition to guide them. However,
166 this information is available to us at the present time.

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

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

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

193 There are 6 types of subluxation defined in this document, and these are mechanical
194 descriptions for the allowable spinal displacements that can occur. Using the average normal
195 spinal model, inside normal upright stance, that we precisely defined, these 6 types of
196 displacements can be quantified.

197

- 198 1. Segmental subluxations: These are the segmental displacements from C1-S1 measured
199 from the vertebra above relative to an origin located in the vertebra immediately below.
200 These vertebral spinal subluxations are listed in terms of Rx, Ry, Rz, Tx, Ty, Tz).
- 201 2. Postural main motion and coupled motion: Postural displacements found in neutral resting
202 stance are completely described as rotations and translation displacements of the head,
203 thoracic cage, and pelvis. The majority of these displacements are concomitantly associated
204 with spinal coupling/displacement patterns. Each postural displacement has a unique spinal
205 displacement pattern that is normally associated with it.
- 206 3. Snap-through buckling in the sagittal plane: The alterations in the regional sagittal curves
207 of cervical or lumbar lordosis to kyphosis and “S”-curves and, to some extent, changes in
208 thoracic kyphosis to hypo-or hyper-kyphosis have been found to be consistent with the
209 engineering Snap-through type of buckling.
- 210 4. Euler buckling in AP/PA view: This type of structural displacement is generally where the
211 structures of the lower most segments in a spinal region experience some failure, e.g., axial
212 rotation and/or lateral flexion of L4 & L5. These displacements are generally localized to
213 the distal spinal regions of the cervical, thoraco-lumbar, and lumbo-pelvic and are generally
214 associated with sub-catastrophic (non-complete tears) and sometimes catastrophic (macro)
215 tears in the surrounding ligaments.
- 216 5. Scoliosis: Recently the non-neurogenic forms of scoliosis have been shown to be caused by
217 a ‘slow-loading’ buckling mechanism. There are multiple different types, locations and
218 complexities of scoliosis.
- 219 6. Static or dynamic segmental instability: These are the segmental displacements depicted in
220 Figure 3 but are at the limit of or outside of the range of motion for the functional spinal
221 unit. These are associated with significant ligamentous trauma.
222

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

230 **Review of X-ray Usage and Guidelines by Orthopedic Surgeons, Family Practice** 231 **Physicians, American Chiropractic College of Radiology (ACCR), and Medical** 232 **Radiologists (ACR).** 233

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

235 The purpose of this section is to correct the general public’s false impression of the risks
236 of medical/chiropractic x-rays. There are two models of radiation effects on organisms: Linear
237 No-Threshold (LNT) model and the Radiation Hormesis model. Using the huge exposures
238 during the atomic bombing of Japan in the 1940’s, the LNT model was derived by drawing a
239 straight line down to zero exposure and claiming all radiation exposure causes a cancer risk. The
240 LNT model continues to be used to *estimate* cancer risks from low doses of radiation, such as
241 medical x-rays, without *any* supporting data. Proponents of the LNT model always omit any
242 Radiation Hormesis information from their commentaries, review articles, and government
243 documents.
244

245 There exists incontrovertible evidence that Radiation Hormesis (health benefit) occurs in
246 plants, microorganisms, invertebrates, and experimental animals. In fact, it was proven with
247 statistically significant results from countless studies that benefits from low levels of radiation
248 improved physiologic function from immunity and reproduction to growth and longevity.

249 Ironically, much of this research came from studies evaluating ‘risks’ from radiation – so author
250 bias was not possible.

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

257

258 **Reliability of Geometric Line Drawing Radiographic Analysis**

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

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

267

268 **Reliability/Repeatability of Radiographic Positioning**

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

274

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

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

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

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

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

293

294 **Pediatric Radiographic Evaluation in Chiropractic**

295 There are many different ways (birth traumas and impact traumas) that a child may be
296 injured. Several of these traumas are referenced. Additionally, there are certain developmental
297 stages of the spine that the clinician should be aware of why taking x-rays of a child. There are

298 also some specific child health problems listed. The numerous possible traumas to children, who
299 often are too young and cannot communicate their symptoms, creates the necessity of a
300 radiographic examination. There are numerous chiropractic Case studies that report the necessity
301 of a radiographic examination in the pediatric case.
302

303 **The Presence of Abnormal Posture and Any Axial or Radicular Pain Requires a** 304 **Radiographic Evaluation**

305 In recent decades there has been a plethora of published studies concerning
306 mechanoreceptors (Types I-IV) in the spinal ligaments (ALL, PLL, ligamentum flavum,
307 intertransverse, facet capsular, interspinous, and supra spinous) and intervertebral discs. Not only
308 do these structures Ligaments & discs) have a nerve supply, but these mechanoreceptors inform
309 the brain of spinal position, and they create reflexes that connect in the spinal cord with the
310 sympathetic chain. The perception of pain comes from deformed mechanoreceptors. This
311 deformation comes from the 6 types of spinal subluxations previously defined in this document.
312 Deformation (strain) is caused by abnormal stresses. Besides pain, Woff's Law (bone remodels
313 to stress) and Davis' Law (soft tissue remodels to stress) indicate that abnormal spinal positions
314 (the 6 subluxation types) are the cause of many pathologies in the spinal structures.

315 Thus, the presence of pain is an "Indication" for the necessity of a radiographic
316 evaluation.
317

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

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

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

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

- 336 1. Chiropractors are authorized to employ spinal x-ray examinations in all 50 states of the U.S.
 - 337 2. Statutes, rules and regulations concerning the practice of chiropractic do not explicitly limit
338 the use of x-ray examinations to cases where "red flags" are present.
 - 339 3. Some courts have explicitly upheld the use of chiropractic x-rays to detect or determine the
340 presence of spinal subluxations.
 - 341 4. Courts generally recognize that standard of care may be established under the respectable
342 minority rule.
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343