

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

RECOMMENDATION

Radiography is indicated for the qualitative and quantitative assessment of the biomechanical components of vertebral subluxation. When using radiography, a baseline value for subluxation displacement should be determined prior to the initiation of and at the cessation of a program of chiropractic treatment interventions. In this manner, patient response to care can be accurately determined.

Supporting Evidence: For all radiographic views combined (not separated out as in Section X): Clinical Levels I-V, Biomechanics, Reliability Class 1 and 2, and Validity.

PCCRP Evidence Grade: Clinical Studies = B, C, and PCCRP Consensus Opinion = D, Biomechanics, Reliability and Validity Studies = a.

A. Introduction to General Radiography

Radiography is a proven procedure for visualizing human anatomy and in particular spinal structures. The goal of radiography in chiropractic is to:

1. Make an assessment of spinal subluxation;
2. Make a determination of spinal health including the presence of any soft tissue injury, presence of any fractures, and the presence of any bony pathologies;
3. Make an assessment of any spinal instabilities;
4. Make an assessment any disc and other degenerative changes.

Historically, Palmer termed the use of radiography in chiropractic to assess the spine as 'Spinography'. The term Spinography provides for a Chiropractic focus and is defined as:

Spinography is the chiropractic art of analyzing x-rays for the following purposes:

1. *Finding potential subluxations.*
2. *Understanding the anatomy to give the most appropriate adjustment.*
3. *Developing the most appropriate plan of care for the patient.*

In the current PCCRP guidelines, we will use the term 'Spinography' and spinal radiography/x-ray analysis by the Doctor of Chiropractic interchangeably; the intended meaning is as defined by Palmer. Since the Doctor of Chiropractic has studied courses in x-ray physics, radiographic positioning, radiographic safety, radiographic diagnosis, and radiographic geometric line drawing analysis, he/she is expected to have a license to practice that is controlled by a government agency (State and Provincial Chiropractic Boards). As such, the chiropractic practitioner is expected to adhere to the local laws pertaining to x-ray equipment, x-ray safety, and all other such items that are concomitant with x-ray privileges granted by a government.

Some specific items of importance for the Chiropractic practitioner are listed here. These items include:

1. Principles of radiation protection, including shielding of various body parts, lead aprons, etc,
2. Proper screens and cassettes,
3. Proper film identification (patient name, age, date, clinic),
4. Proper identification of direction (left, right, oblique, etc),
5. Best visualization with a minimal exposure,

6. Appropriate Collimation,
7. Appropriate technique charts with exposure factors,
8. Radiographs should be reviewed before a patient is released for that day to insure that positioning and film quality is at an optimum.

B. Indications for Spine Radiography in Children and Adults

The main focus of this document is the following list of patient conditions that warrant a radiographic evaluation for the assessment of spinal subluxation. This evaluation for the assessment is independent of any “Red Flags” assessment. For the assessment of spinal subluxations, the Chiropractor becomes aware of conditions which affect the safety and appropriateness of chiropractic care by conducting a consultation that should include a personal history, family history, present complaints, and any recent or past traumas. Additionally, an orthopedic, neurological, range of motion (ROM), and a postural examination may be helpful. Indications for spine radiographic examinations include, but are not limited to:

1. Abnormal posture,
2. Spinal Subluxation (as defined in this document),
3. Spinal deformity (eg, scoliosis, hyper-kyphosis, hypo-kyphosis, etc...),
4. Trauma, especially trauma to the spine,
5. Birth Trauma (eg, forceps, vacuum extraction, caesarean section etc...),
6. Restricted or abnormal motion,
7. Abnormal gait,
8. Axial pain,
9. Radiating pain (eg, upper extremity, intercostal, lower extremity),
10. Headache,
11. Suspected short leg,
12. Suspected spinal instability,
13. Follow-up for previous deformity, previous abnormal posture, previous spinal subluxation/displacement, previous spinal instability,
14. Suspected osteoporosis,
15. Facial pain,
16. Systemic health problems (eg, skin diseases, asthma, auto-immune diseases, organ dysfunction),
17. Neurological conditions,
18. Delayed developmental conditions,
19. Eye and vision problems other than corrective lenses,
20. Hearing disorders (eg, vertigo, tinnitus, etc...),
21. Spasm, inflammation, or tenderness,
22. Suspected abnormal pelvic morphology,
23. Post surgical evaluation,
24. Suspected spinal degeneration/arthritis,
25. Suspected congenital anomaly,
26. Pain upon spinal movement,
27. Any “Red Flag Conditions” covered in previous guidelines.

C. Minimum Spine Radiographic Examination

Since the spine is a contiguous structure that is inseparable in function it should be inseparable in an evaluation using Spinography. A radiographic examination of the spine may include an AP evaluation and a lateral evaluation of the entire spine. Additional views may be indicated in cases involving trauma. It is of some historical interest that the recommendations of Hildebrandt¹ in 1985 are repeated here. In his classic 1985 text *Chiropractic Spinography*, Hildebrandt¹ suggested that there are five projections that comprise a complete full spine analysis:

1. AP full spine
2. Lateral full spine
3. Femoral head view
4. Sacral base view
5. Upper cervical view.

For children younger than 10 years old, some of the five projections may not be needed, and the Chiropractor may use clinical judgment to determine which views are needed. If we pause to understand the reasoning behind Hildebrandt's¹ suggested five views for a complete spine evaluation, we may be able to elaborate on his suggestions.

First, the lateral full spine view will provide an analysis of several possible spinal subluxations:

1. a global view of the sagittal balance of C1, T1, T12, and S1,
2. an evaluation of forward/backward head posture,
3. an evaluation of forward/backward ribcage posture,
4. an evaluation of sagittal posture (from the postural examination) and spinal coupling on the radiograph,
5. an evaluation of cervical lordosis,
6. an evaluation of thoracic kyphosis,
7. an evaluation of lumbar lordosis,
8. an evaluation of pelvic morphology,
9. an evaluation of any retro- or spondylo-listhesis and,
10. an evaluation of spinal degeneration (vertebrae, discs, spinal ligaments).

If the Chiropractor does not have a full spine bucky and cassettes to obtain a full spine lateral x-ray, then three sectional views may substitute for this view. These sectional views are: lateral cervical, lateral thoracic, and lateral lumbo-pelvis.

Second, the AP full spine view will provide an analysis of several possible spinal subluxations including;

1. a global view of the AP balance of C1, T1, T12, S1,
2. an evaluation of segmental subluxations in the cervical, thoracic, and lumbar regions,
3. an evaluation of posture (knowledge from the postural examination) and spinal coupling on the AP radiograph,
4. an evaluation of any cervical scoliosis,
5. an evaluation of any thoracic scoliosis,
6. an evaluation of any lumbar scoliosis, and
7. an evaluation of pelvic and leg length asymmetry.

If the Chiropractor does not have a full spine bucky and cassettes to obtain a full spine AP x-ray, then three sectional views may substitute for this view. These sectional views are: AP cervical, AP thoracic, and AP lumbo-pelvis.

While the items listed above for the AP full spine and lateral full spine analysis may seem straight forward, one might ask why Hildebrandt¹ suggested the femur head view, the sacral base view, and the upper cervical view (Nasium). To change from the fetal C-shape curve, the cervical vertebrae extend and the lumbar vertebrae extend. This extension to eventually assume an upright stance is restricted to the median-sagittal plane. Thus, while the spinal structures in the sagittal view are normally aligned perpendicular to the central ray, this extension of the spine to allow upright stance creates a situation where the AP x-ray beam is at an angle to the plane of the lower lumbar segments (L4-L5-S1) and upper cervical segments (C0-C1-C2) in the AP view. Additionally, any pelvic axial rotation in front of the grid cabinet will project one femur head lower than its twin on the other side. Thus, taken together the femur head view, the sacral base view, and the upper cervical view (Nasium) allow for assessment of the following subluxation types:

1. short leg causing an un-level sacral base and spinal AP curvatures on the short leg view,
2. an evaluation of the SI joints, sacral ala, L5, and L4, and lumbo-sacral angle at the sacral base on the Ferguson projection,
3. an evaluation of the skull-atlas and atlas-cervical spine as upper angle (UA), lower angle (LA), C2 axial rotation, and cervico-dorsal (CD) angle at mid neck on the AP nasium upper cervical view.

Patients expect and deserve a thorough radiographic evaluation of their spines when any of the above indications are present.² By following this minimal radiographic set of views, the vast majority of structural spinal subluxations can be located and measured. However, there are additional radiographic views needed to perform a thorough investigation in trauma and 'deformity' cases. These may include all or part of the following list:

1. Davis Cervical Series:
 - a. AP cervical,
 - b. Lateral cervical,
 - c. AP Open Mouth (APOM),
 - d. Flexion,
 - e. Extension,
 - f. Left oblique,
 - g. Right oblique,
2. Sand bag stress views in cervical lateral bending (alar ligament views),
3. Cervical Motion X-ray during flexion-extension, open-mouth lateral bending, and oblique lateral bending cervical articular facet views,
4. Lumbar flexion-extension,
5. Lumbar oblique,
6. Lumbo-sacral spot views, etc...,
7. Bending and/or postural stress films for flexibility assessment of scoliosis or buckling displacements (see Section V for definitions).

Historical Consistency

Again, it is of historical significance that the above recommendations are consistent with earlier recommendations. For example, in 1964 Jackson⁵¹ discussed that an adequate radiographic examination of the cervical spine is essential for patient diagnosis. She made an argument for the following radiographic views to be made routinely: an antero-posterior view of the upper two vertebrae, an antero-posterior view of the lower five vertebrae, an antero-posterior caudad-angled view to show the posterior structures of the vertebrae, three lateral views (neutral, flexion, extension) made with the patient in the upright position, and right and left oblique views.

D. Follow-up (post-evaluation) Spine Radiographic Examinations

Chiropractors attempting the assessment and correction of spinal subluxations need feedback as to the structural efficacy of their adjustment and spinal rehabilitative forces. If the chiropractor employs radiographic mensuration procedures for biomechanical assessment upon initial examination, follow-up (post) radiographs are appropriate for evaluating patient progress throughout a course of care.^{3-6,8-25}

Chiropractors interested in assessing subluxations and correcting subluxations are attempting to create improvement in spinal alignments with their treatment interventions; as such, the structural improvements measured via radiography are of concern. Analogous to this interest in structural assessment by chiropractic clinicians, is the same interest by orthopedic surgeons. It may be helpful to review the suggested frequency of follow-up radiographs (post treatment views) utilized by Orthopedic surgeons. Orthopedic surgeons often take initial pre-operative radiographs, immediate post-operative, one month, 6-12 months, and long-term follow-up radiographs (total of 5 sets of x-rays) for surgery cases.⁷ In fact, according to Fischgrund (2005, pp 1017 and 1023), "Routine cervical spine radiographs taken for the evaluation of degenerative disc disease and cervical radiculopathy include lateral, anteroposterior, and oblique views."⁷ Following surgical intervention, they state, "Typical follow-up of these patients includes an office visit at 1 week, with routine anteroposterior and lateral radiographs. By 6 weeks, lateral flexion and extension views usually show that the fusion construct is stable...".⁷ Fischgrund further stated that follow-ups are ascertained at 1 year, 2 years, or 5 or more years depending upon the specific study. Therefore, according to Fischgrund, surgery patients receive initial, 1-week post op, 6-week post op, and 1, 2, or 5 year follow ups.⁷

In light of the above information it is the consensus of the PCCRP panel that indications for follow-up (post) radiographs are:

1. Post radiographs are indicated after a specific corrective adjustment to the upper cervical spine where the exact position of the CO-C1-C2 spine needs to be ascertained.⁸⁻¹³
2. Post radiographs are indicated after the placement of an orthotic for the reduction of leg length inequality or sacral base un-leveling in the coronal plane.¹⁴⁻²⁰
3. Post radiographs are indicated after each 2 or 3 month time period of care using structural rehabilitative chiropractic treatment procedures.^{3-6,21-27}
4. Post radiographs may be indicated in a situation where the patient suddenly has an exacerbation during treatment.²⁸
5. Post radiographs may be indicated after significant trauma during a course of treatment.²⁸
6. Post radiographs are suggested at 6 months follow-up, 1 year, and 2 years.²³⁻²⁵

7. For spinal instability, post spinal surgical cases, and recent spinal fracture cases, post radiographs may need to be taken at an increased frequency.²⁸

Early and Late X-rays of a Patient Following Sustained Trauma

Posttraumatic progressive cervical ligamentous instability and spinal deformity may occur in spite of initial apparently normal spine radiographs. Patients at risk for the development of this problem are generally under the age of 25 and have >1.5mm of horizontal displacement and >5° of angular displacement on initial cervical x-rays.²⁸

B. Position on Computerized analysis of radiographs.

Recent advances in computer and radiographic technology has made it possible to both ascertain and analyze spinal x-rays with computer assisted methodology. It is becoming increasingly common for spinal health care providers, such as chiropractors, to use computer assisted methods to analyze spinal displacements. These computer methods are at least as reliable and valid as traditional 'by hand' radiographic analytical techniques. The current PCCRP guideline panel considers computer assisted radiographic analysis to be a reliable and valid procedure for spine analysis.^{21-25,29-47}

C. Position on Videofluoroscopy or Digital Motion X-ray Analysis

Videofluoroscopy can demonstrate different motion patterns between normal and pathologic spines.⁴⁸ Cineradiography adds another diagnostic method of evaluating suspected soft-tissue injuries of the cervical spine by demonstrating motion during active exercise. It is reasonable to anticipate that abnormal motion will accelerate degenerative changes in the spine and will complicate the cineradiographic analysis. The cineradiographic study will have its greatest value in patients who show normal spines on standard roentgenograms and before degenerative changes have occurred.⁴⁹ The incidence of apophysial joint abnormalities detected by cineradiography is higher than by plain roentgenograms. The cineradiographic study is of benefit in demonstrating either excessive or decreased mobility. It has proved of value in localizing the areas of abnormalities which correlate well with symptoms.⁵⁰

Summary

The PCCRP Guidelines developed and put forth above are evidence based recommendations for radiographic analysis of the spine for chiropractors in clinical practice. These PCCRP guidelines are consistent with previous historical works in the chiropractic literature. The remainder of this document provides the scientific rationale, evidence, reliability, validity, and clinical utility of the current PCCRP Guideline for Spine Radiography for the Assessment of Spinal Subluxation in Children and Adults.

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