



By Josh Lawlor, D.C & Brittany Sedar D.C.
Lawlor Family Chiropractic-Eldridge, IA
With special thanks to Kristen Dowell, CT

The importance of the full spine x-ray for proper evaluation of the chiropractic patient is well understood by the seasoned Gonstead practitioner, and quickly appreciated by the fledgling Chiropractor. There has been a continued large shift by the profession into the digital age during the last decade. Direct (DR) and Computed (CR) radiography are progressively taking the place of plain film. This article is to serve as a review of the processes utilized in the chiropractic setting that are necessary for our analysis of the 14 x 36 AP and Lateral films.

The following information will explain the protocol for taking digital full spine films, similar to the steps the doctor would take for plain film exposure. These same processes could be utilized with small modification for digital sectionals that require “stitching” for full spine analysis.

Taking the digital x-ray

Set up the patient file: entering name, date of birth, gender information. The office information is already preset in the system. In the comment section we type in the technique we are using for the patient (kVp and mAs) which is stored with that x-ray image on the system. AP and Lateral x-set up procedures are the same as in the “Gonstead Chapters” with a full spine CR system when the ability to shoot the full 36” view is possible. The following procedure is a brief review with the digital nuances:

Start by making sure the x-ray tube is set at 84” FFD. Have the central ray centered to the bucky and light opened and set before placing patient. The central ray for the typical patient should be at the lower

sternal area. The patient will stand facing forward and take baby steps backward until a part of the body starts to touch and then stop. The patient should then stand in a natural posture. Leave any natural foot flare, make sure heels are parallel. Have the patient’s hands in a relaxed position, but out of the view.

If the patient has an analgic presentation you want to make sure the hips are centered. The collimation should be open all the way. Once the patient is centered start to slowly collimate. The top of the collimation should be just below the eyes and the bottom of the collimation should include all the pelvis. Bring the filter down to the top of the cross (central ray). Position the patient so the maxilla is parallel to the floor, then have them open the jaw straight down (avoid letting the head tilt back or forward). Have the patient take a deep breath in and let the breath all the way out. Take the x-ray.

To process the AP, the selection is “finish and scan” with our software. Choose a selection on the software to scan for anatomy of the spine (ours is called “scoli” view). Choose laterality, select “both” since both sides are touching the film, and scan the whole plate.

Lateral full spine

The lateral is taken as 2 separate images, then processed together as one image. Start by using a 72” FFD. Set collimation, we have marks on our bucky 18” for most and 19” for taller patients. Once the length collimation is set, have the patient step in with their left side towards the bucky. Then, instruct the patient to slowly sidestep until they start to touch (shoulder, hip), there should not be any leaning. The patient should be lined up in the center of the bucky. Centering of the patient may need to be altered if the patient is severely kyphotic in the thoracic spine, severely lordotic in the lumbar spine, or forward analgic. Make sure heels are parallel, do not remove foot flare. The top of the bucky should be just above the ear. Have patient bring arms up (we use a stick that patients can hold). The arms should be at a neutral level in front of them, with elbows slightly bent. The arms should not be fully extended, as this could change the patient’s posture. Patient’s maxilla should be parallel to the floor. Patient is now in position.

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Now you want to line up the central ray. With the pre-collimation you should be able to bring the top central ray to just behind the shoulder. The light field should be just superior to the patient's tragus on the ear, to capture the upper cervical on views. Collimation is key in digital radiography. Collimation should be open enough to line up right in front of the ear and include the shoulder blades. A cervical filter is used to filter the cervical spine during the exposure. You are now able to take the first part of the film. Have the patient take a deep breath in and let it all the way out and hold still. Make the exposure. Let the patient know they can breathe but hold as still as possible. Now, move the bucky up 4" and move the x-ray tube down 14", just as you would with plain film. Make sure the patient is still lined up with the center of the bucky. The center of the central ray should drop down center of the patient (draw a line from the armpit). However, the tube may need to be moved slightly to either side to capture the patient's lower thoracic and lumbosacral spine. If needed, collimate in. Have the patient take a deep breath in then exhale and hold. Make the exposure. Then you can process both films as one image. At the bottom of the screen where the AP film is displayed, select "Add View." Select the anatomy of the spine, select the "left" side of laterality since our patient's left side is contacting the bucky, and scan the whole plate.

Additional Note

Cleaning the plate is necessary on a periodic basis to remove any "stored" exposures on the bucky. This is highly recommended after requiring more mAs to capture an image.

Instructions for Analyzing Digital Full Spine X-Rays in Clarity

Disclaimer: Every film analysis software will be different and include different tools. This information is from our experience using the iCRco software.¹

1. Send digital x-rays from x-ray acquisition software to Clarity (analysis software) which is housed on the x-ray server.

2. Display the two films side by side: Lateral Full Spine

and AP Full Spine (monitors of 32" to 60" work well, hung vertically for viewing).

Lateral Film

3. Select the tool "Spine Labeling" and begin to number the segments on the AP film. To keep the film less congested, you can number every other segment. Then label the segment numbers on the Lateral film. This is critical in maintaining accurate count (note: the stitching procedure does not have the advantage of the 1 shot AP for count, so the doctor must be very particular in the stitch and acquisition of all structures).

4. Put "text" annotations to any specific markings that are on the patient's film. For example, our office tapes metal BB's to the patient's skin where we identify scope readings, and any identifiable skin markings (tattoos, moles, freckles, scars).

5. Low back measurements on lateral

a. On the lateral film, make the lumbosacral angle by using the "angle" tool. Click anterior to the sacral base and extend the line posterior, matching up with the sacral base, then click, and extend the line anterior, matching the inferior aspect of the last lumbar endplate. Move the angle created out of the way so as not to block visibility of anatomy. (note: all lines used can be changed by most software programs to a smaller font, this aids in accuracy)

b. Make the sacral base angle by using the same "angle" tool. Click anterior to the sacral base and extend the line posterior, matching up with the sacral base, then click. Drag the mouse anterior at approximately a straight horizontal line. Before you click to release the line, click "Ctrl" which will modify the line to ensure it is a level horizontal line. Move the angle out of the view of anatomy.

6. Lateral cervical lines

a. Start the process of drawing lines for the cervical spine. Use the "line" tool, the longer the better. We use 12" lines in our office. Create the lines on each segment, C2-T1 to match the inferior border of each vertebral body. Move each segment line, slightly superior, to not be in view of the disc space.

b. Use the "line" tool to create the A-P Atlas Plane Line and Foramen Magnum Line.

c. Make the Odontoid Line by using a smaller measurement of the "line" tool (2").

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d. The Odontoid Perpendicular Line is made by first selecting or clicking on the Odontoid Line. Then choose the “Perpendicular Matching Line” and click anterior through the middle of the axis body. This will create the perpendicular line necessary for lateral atlas listing.

7. Use the “Point” tool to create a cross that you can place in the center of the vertebral segments that would potentially be listed on the AP film.

AP Film

8. Under the Advanced Toolset, select Automatic to start the analysis for the pelvis.

a. These steps occur from the following prompts: femoral head line, selection of orientation of the image (L – R reading of pelvis), lines made at the top of the left then right iliac crest, lines made at the lowest point of the left and right ischial tuberosity, cross at the center of the pubic symphysis, cross at the sacral segment, sacral base line, and left and right lateral side of sacrum. When finished, this will generate pelvic listings.

b. Use the “line” tool on the segments to match the plane of the vertebral body segments. This will allow for lines to produce listings.

c. If you want to use level foundation, select the Sacral Base Line, next select the “Parallel Matching Line” and click somewhere else. This will generate a line parallel to the sacral base line that the doctor can move to each segment on the film to see which levels match.

d. Select the “Text” tool and click anywhere and type, such as to add a listing to a segment.

e. Use the “line” tool to create the Transverse Condyle Line, the Transverse Atlas Plane Line, and the Axis Plane Line.

f. The “Measure” tool allows you to measure the widths of lateral masses to confirm upper cervical rotation.

Additional Notes

9. Make sure to select “Save Study” anytime you stop working on a film to avoid losing any analysis.

10. Under “Report” there is an option called “Save Image” that gives the capability to save the films as a JPEG. Our films are saved with a 2-selection layout to

save the Lateral and AP film on the same JPEG view. This is then uploaded to our electronic healthcare software under the patient account. Then we simply click on the JPEG image each time the patient comes in, rather than opening their films up under the Clarity Software.

Digital x-ray is fantastic, if for no other reason than there is no processing, no chemicals, no storage and there are many more. A few words of caution.

1. As with plain film, the user is KEY! Take time to get to know your machine, technique, and work with your vendors. Plan on 6 months of newness and bugs... if it comes along quicker you’ll be happier. Remember full spine work at 82” and 72” is a whole different animal than sectionals at 40”, so techniques are quite different and the machine and software need to provide the right amount of exposure for the right duration for best outcome.

2. With digital exposures using higher MA and lower times, the images will be better with a quicker exposure. This is different than plain film. The term “bake” usually produced a better film with more time.

3. Collimation is extremely important. The less difference between tissues (thicker tissue vs. black space), the less work the acquisition software must do and the better the image, especially on larger patients.

4. Your source is as important as your acquisition software, don’t expect dealers to understand the full spine work, they are used to films at 40.” Make clear they understand what you want. Visit offices that are taking excellent films in the correct manner, watch the process from beginning to end.

5. Did I mention the user is key! Analyze the FILM!! HAVE A PROCEDURE!! Do not take short cuts. If your system requires a stitch process, then do the analysis beginning to end.

6. Don’t take the lateral view in 1 shot just because the dealer says you can, remember the DISC!- 2 shots are needed here, this is the film Dr. Gonstead preferred of the two.

Have fun and turn the crank!

Video Links:
Taking the AP

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<https://www.dropbox.com/s/zz0lyjobcuy9whn/Taking%20AP%20Xray.MOV?dl=0>

Taking the lateral

<https://www.dropbox.com/s/k4o7wp2us63hwnl/Taking%20Lateral%20Xray.MOV?dl=0>

Analysis

<https://www.dropbox.com/s/y79ahfvs6ean6ig/Clarity%20Analysis.MOV?dl=0>

¹This article is written as a guide to full spine x-ray use in the digital world, with the procedure and protocols specific to the ICRCO iDR Long Bone which allows for full spine x-ray film taking from a digital aspect. The ICRCO uses an acquisition software called XC and an analysis system that is better than any I've reviewed for the full spine analysis, it is called Clarity, with the advanced Gonstead tool set. To set this system up properly, it is advised to use a powerful generator (65 kw), with a high end hospital grade tube. This allows for quality full spine imaging shot at the 72 and 84" distance.

Additionally the reader is directed to Terry Hart and his crew at T&K X-Ray Consultants. Terry and his staff are second to none and can answer all your digital questions as well as an excellent stitching product. Find all of their information here:

<https://www.tk-xc.com/> ✱