

## Pelvic Unleveling and X-ray System Unlevelness

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Weight bearing pelvic and/or femoral head unleveling associated with functional or structural leg length inequality is recognized as a cause of spinal/pelvic pain and/or stress.<sup>1-6</sup> Leg length inequality does not always cause, nor is it the only cause of pelvic/sacral unleveling (tilt).<sup>7,8</sup>

We know that properly taken weight bearing anterior/posterior (AP), and some may argue, posterior/anterior (PA) radiographs of the lumbopelvic area are an important tool to assist us in evaluating pelvis and femur head height relationships. However, little or nothing has been written about x-ray system/floor levelness as quality control issues which can affect the reliability of our iliac crest and femoral head height measurements on the radiographs.

Obviously, accuracy will be compromised if the patient is standing on an unlevel area of floor while being x-rayed. Another possible problem source is a bucky which was not installed level. The films held in such a bucky would not be oriented to true horizontal (level). It is important that the top and bottom edges of the film are level when the x-ray exposure is taken, since either of these edges will be the reference for measuring and comparing the heights of the right versus left iliac crest and femur head images.

It is a good idea to check your system for levelness and accuracy. Use a carpenter's level to see if the floor where the patient stands while being x-rayed is level. You would also do well to check the levelness of the floor in the exam rooms where the patients stand for their postural examinations.

Also, check the floor where your bilateral scales sit. Don't take your bilateral scales to do a posture screening booth without taking along the carpenter's level. Next, set the carpenter's level along the top of the bucky to see if it is level.

It should be pointed out that if your floor and bucky both slant the same direction, this situation tends to be self-compensating in terms of showing pelvis or femur height relationships on the film. However, this situation is less than the ideal filming scenario. Because the patient is not being x-rayed while standing on a neutral (level) surface, the spine may show compensational reaction and appear as having some degree of lateral curvature on the film.

What if you find, as I did, that the floor in your x-ray room is unlevel enough to address? Short of remodeling the floor, here is an option which has worked for me. I had a carpenter build a two-inch thick, two foot by two foot, free-standing wooden platform upon which the patients stand for x-rays. On the bottom of each corner of this platform are small adjustable "feet" (from the hardware store) which can screw in or out to raise or lower each corner. Therefore, the platform can be adjusted to levelness, side to side and front to back. If your bucky is too unlevel to correct yourself, you may need to seek help from an x-ray equipment/installation company.

Whether or not your floor and bucky check out as being level, here is an accuracy check you can do on your overall system. Lower the bucky so that its horizontal center is about three feet above the floor. Extend a yardstick vertically (use a carpenter's level alongside a yardstick to assure verticalness) from the floor up the front of the bucky, near its left edge. Pencil a mark at the top of

the yardstick. Do the same near the right edge of the bucky. Use the yardstick to connect the marks with a pencil line. Tape something metal, such as a metal strip (ideally) or the straight borders of two paper clips, precisely along this pencil line, extending it four inches on either side of the vertical center line of the bucky. (Iliac crest peaks are around eight inches apart.) Attach a right or left film marker to the appropriate side for reference. Load a cassette. (Film should always be placed with good alignment in cassettes.) Place the cassette into the bucky accurately. Accurate placement means precisely aligning the guide marks on the cassette with the guide marks on the cassette holder. (This should be a routine practice, even with 14" x 17" cassettes, since cassettes do not necessarily sit automatically level in the cassette holder.) Expose the cassette (Mas and Kvp settings can be low.) Develop the film. Measure to see if the metal indicator edges on each side of the film are equidistant from the bottom edge of the film. To whatever degree they are not equidistant, your system is off. You would need to correct your system (level your floor and/or bucky) or at the very least, make appropriate compensations when marking your films for pelvic/femur head unleveling.

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