

# Adult spinal deformity diagnosis

[Adult spinal deformity](#) is typically studied with standing full length 36" posterior-anterior, and lateral radiographs and may need to be repeated over time to monitor for curve progression. Cobb angles are measured on these radiographs providing coronal and sagittal alignment and global alignment is measured using plumb line. Dynamic radiographs including flexion-extension views, supine, and prone films also help to assess flexibility of curves and the ability for adjacent segments to compensate. Additional information relating to bony anatomy may be obtained in CT scan, while magnetic resonance imaging of the spine provides additional information about the neural elements, discs and other soft tissues.

Selection of appropriate treatment can be challenging because patients with adult spinal deformity may complain of a heterogeneous group of symptoms. In addition, multiple medical, social, and environmental factors must also be evaluated to determine the best treatment option for each particular patient. Patients with a history of tobacco use, pulmonary, coronary, or vascular disease, diabetes, nutritional deficiencies, osteoporosis, psychiatric disease, or lack of social support have been shown to correlate with increased surgical risk and poor clinical outcomes. When evaluating patients with spinal deformity, it is always important to rule out other potential causes of spinal deformity including traumatic, neuromuscular, or inflammatory etiologies.

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A computer vision-based [posture analysis](#) system can be utilized as a safe, efficient, and convenient CDSS for early diagnosis of spinal posture deformation, including scoliosis <sup>1)</sup>

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There are few radiographic markers to predict presence of radiculopathy. Emerging data suggest that [spondylolisthesis](#), obliquity, [foraminal stenosis](#) and curve concavity may be associated with [radiculopathy](#) in [ADS](#).

## CT / MRI

Both are recommended for the evaluation of symptomatic spondylosis and [ASD](#) to determine extent of neural compression.

## DEXA

(dual-energy X-ray absorptiometry). Patients should be evaluated for osteopenia/osteoporosis prior to surgical planning. Medical treatment may be beneficial in the perioperative period.

Some surgeons use teriparatide (Forteo®) for 3 months to quickly increase osteoporotic bone strength for surgery.

# Radiographs

## Standing scoliosis X-rays

Recommended for the evaluation of global and regional spinal balance. Pre- and postoperative plain films help confirm that alignment objectives are achieved.

Measurements related to sagittal balance are taken from standing scoliosis X-rays (CT & MRI are obtained supine and are not equivalent). Technical requirements for the lateral image:

- X-ray must image from C7 down to the femoral heads
  - the patient needs to try to keep their knees straight (extended)
  - arms should be folded in front of the chest (and they should not lean or hold on to anything)
- Dynamic scoliosis X-rays ("lateral bending films") help determine the degree of curve rigidity preoperatively.

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Full length standing radiographs in both the coronal and sagittal plane that include all segments of the spine as well as the pelvis and hips are essential in the diagnostic evaluation of adults with spinal deformity. From such radiographs the segmental alignment, regional curvatures and global balance can be measured. Pelvic parameters such as [pelvic incidence](#) and [pelvic tilt](#) will also help define compensatory mechanisms of deformity. Focal imaging studies may be necessary to assess for instability (flexion-extension radiographs). Advanced imaging studies (i.e. MRI or CT myelography) may be needed to assess patients with lower extremity symptoms or other neurologic signs or symptoms.

Coronal [deformity](#) is usually less symptomatic than a sagittal deformity because there is less expenditure of energy and hence less effort to maintain upright posture. However, nerve root compression at the fractional curve or at the concave side of the main curve can give rise to debilitating [radiculopathy](#).

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Findings demonstrate significant variability in health-related quality-of-life measures and radiographic parameters between North American and Japanese patients, supporting the need for population-adjusted sagittal modifiers to more accurately classify deformity <sup>2)</sup>.

<sup>1)</sup>

Kim KH, Sohn MJ, Park CG. Conformity assessment of a computer vision-based posture analysis system for the screening of postural deformation. BMC Musculoskelet Disord. 2022 Aug 22;23(1):799. doi: 10.1186/s12891-022-05742-7. PMID: 35996105.

<sup>2)</sup>

Ames C, Gammal I, Matsumoto M, Hosogane N, Smith JS, Protopsaltis T, Yamato Y, Matsuyama Y, Taneichi H, Lafage R, Ferrero E, Schwab FJ, Lafage V. Geographic and Ethnic Variations in Radiographic Disability Thresholds: Analysis of North American and Japanese Operative Adult Spinal Deformity Populations. Neurosurgery. 2016 Jun;78(6):793-801. doi: 10.1227/NEU.0000000000001184. PubMed PMID: 26692107.

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