

Diagnose Sprain Injuries in MVA Cases With Dynamic X-Rays (Pt. 2)

Troy Freiheit, DC

Editor's Note: Part 1 of this article appeared in the [Nov. 15 issue](#).

Lumbar dynamic X-rays are taken in the same manner as cervical X-rays, requiring lateral, flexion and extension views. Lumbar flexion and extension studies require the patient to flex forward or extend back only as far as is tolerable.²⁷ Slippage that increases in flexion and decreases in extension is suggestive of an unstable spondylolisthesis.²⁸

The imaging factors for the lumbar spine dynamic study should be adjusted to reduce the time factor to the extent possible while still acquiring an optimal exposure. Holding the lumbar positions of flexion and extension will likely be painful if injury exists. If you have an X-ray machine that is not capable of taking a motion-free study, referral to an outside imaging facility may be warranted.^{13,28}

Analyze the three views carefully utilizing a clear, straight edge. Any movement noted anterior or posterior from the neutral position should be considered slippage and highly suggestive of ligamentous or disc injury - or both.¹⁴

Anterior slippage can occur without posterior slippage, as can posterior slippage alone; and of course, slippage in both planes is possible as well.¹⁴ A finding of as little as 1 mm of anterior or posterior slippage should be noted in your imaging report.^{14,22} Slippage that occurs lower in the cervical spine demonstrates a more significant impact.¹⁶⁻¹⁷

Pseudosubluxation has been reported as a normally occurring phenomenon in children up to the age of 14 at C2-3 and to a significantly lesser degree at C3-4.^{15,25} *Shaw, et al.*, writing in *Clinical Radiology*, provide a guideline for determining the existence of pseudosubluxation versus traumatic slippage: "A line drawn through the posterior arches of C-1 and C-3 should touch, pass through, or lie within 1 mm anterior to the anterior cortex of the posterior arch of C-2. If none of these conditions is met, then true dislocation should be suspected."²⁶

Vertebral slippages occur in individuals with greater than mild degenerative spondylosis as a direct result of the degenerative condition.¹⁸ A review of the literature fails to prove, however, that patients under the age of 14 or with a greater degrees of degenerative spondylosis are resistant to sprain injuries. Therefore, the chiropractic physician should regard areas of slippage as potential injury sites and render care accordingly.^{19,25}

Angulation between adjacent vertebrae exhibiting slippage is an equally important finding. Draw a line projecting anteriorly on the inferior endplate of the vertebrae in question, and also on the inferior endplates of vertebrae immediately above and below. Angulation measured as greater than 7 degrees in the pediatric population should be considered a sign of ligamentous injury.²⁵ In the adult, angulation greater than 11 degrees at the vertebrae in question is highly suggestive of ligamentous injury or discal injury.²⁰

Combined measurements of anterior and posterior slippage in excess of 3.5 mm or 11 degrees of angulation indicate clinical instability and should be referred to an orthopedist for consultation, as these findings could signify the need for surgical stabilization and may qualify the individual for an impairment rating.²⁰

The results of these imaging procedures will help support your diagnosis of sprain, reduce the potential criticism of overtreatment and potentially prevent a misdiagnosis of the problem. It has been my impression that oftentimes, the true characteristics of an injury from a motor-vehicle accident are not completely evident until approximately the third to fifth week following the accident. The working diagnosis can and often will change.

Proving a sprain injury can be more challenging, and the dynamic X-ray series can objectively support that diagnosis radiographically. Another benefit of utilizing dynamic X-rays at the appropriate time is to alert the chiropractic physician to the possibility of slippages, in order to avoid adjusting hypermobile segments whose treatment by manipulation is a contraindication to care.²¹

The three-view dynamic X-ray is economical and easy to perform in any practice that has access to plain-film imaging. The test may provide valuable information for your personal-injury patients. Dynamic X-ray should be given consideration when the patient's condition is not improving as would normally be expected, based on your experience with similar conditions.²³ It can assist the chiropractic physician in determining the cause of the patient's ongoing symptoms.

References (for Pt. 1 and Pt. 2)

1. Yeomans S. Chiropractic Adjustment. Spine-Health, 2015 September; [click here](#) to access article.
2. Hoffman JR, Wolfson AB, Todd K, Mower WR. Selective cervical spine radiography in blunt trauma: methodology of the National Emergency X-Radiography Utilization Study (NEXUS). *Ann Emerg Med*, 1998 Oct,32(14):461-9.
3. Morris CGT, McCoy E. Clearing the cervical spine in unconscious polytrauma victims, balancing risks and effective screening. *Anaesthesia*, 2004;59:464-482
4. Erich Gasboy. Clearing the Cervical Spine. Wikipedia 2004 July,7. Retrieved from [url=https://en.wikipedia.org/wiki/Clearing_the_cervical_spine#cite_ref-1]https://en.wikipedia.org/wiki/Clearing_the_cervical_spine#cite_ref-1[url]
5. Foreman A, Croft S. *Whiplash Injuries: The Cervical Acceleration/Deceleration Syndrome*. Baltimore: Williams & Wilkins, 1995: pp. 342-343.
6. Foreman A, Croft S, *Op Cit*, pg. 53.
7. Arun Pal Singh (2015, September 08) Flexion and Extension Xrays of Cervical Spine. Bone and Spine Retrieved from [url=<http://boneandspine.com/flexion-extension-xrays-of-cervical-spine/>]http://boneandspine.com/flexion-extension-xrays-of-cervical-spine/[url]

8. Foreman A, Croft S. *Op Cit*, pg. 454.
9. Vertebral Slippage, The Spinal Foundation, Sept. 8, 2015.
10. Croft A. "What Causes Those Symptoms, Doctor?" *Dynamic Chiropractic*, Oct. 23, 1992.
11. Demetrious J. Post-traumatic upper cervical subluxation visualized by MRI: a case report. *Chiropr & Osteopat*, 2997;15:20.
12. Gatterman B. "Guidelines in the Use of Radiography in Chiropractic." *Dynamic Chiropractic*, June 6, 1990.
13. Como J, et al. Cervical spine injuries following trauma. *J Trauma*, 2009 Sep;67(3):651-9.
14. X-Ray Procedure Protocol (2007-2008). Digital Spinal Diagnostics; [click here](#) for protocol.
15. Eggleston S. "Accurate Prognosis in Personal-Injury Cases Using George's Line." *Dynamic Chiropractic*, March 26, 2010.
16. Daley B, et al. "Considerations in Pediatric Trauma." *Medscape*, Aug. 2, 2013.
17. Ivncic PC, Pearson AM, Panjabi MM, Ito S. Injury of the anterior longitudinal ligament during whiplash simulation. *Eur Spine J*, 2004 Feb;13(1):61-68.
18. Graber M, Kathol M. Cervical spine radiographs in the trauma patient. *Amer Fam Phys*, 1999 Jan 15.
19. Sheng-Dan J, Lei-Sheng J, Li-Yang D. Degenerative cervical spondylolisthesis: a systematic review. *Int Orthop*, 2011 Jun;35(6):869-875.
20. Choi SJ, Shin MJ, Kim SM, Bae SJ. Non-Contiguous Spinal Injury in Cervical Spinal Trauma: Evaluation with Cervical Spine MRI. *Korean J Radiology*, 2004 Oct-Dec;5(4):219-24.
21. White A, Panjabi M. *Clinical Biomechanics of the Spine*. Philadelphia: J. B. Lippincott Company, 1978: pp. 224-225.
22. Beck RW, Holt KR, Fox MA, Hurtgen-Grace KL. Radiographic anomalies that may alter chiropractic intervention strategies found in a New Zealand population. *J Manip Physiol Ther*, 2004 (Nov);27(9):554-559.
23. Lin RM, et al. Characteristics of sagittal vertebral alignment in flexion determined by dynamic radiographs of the cervical spine. *Spine*, 2001 Feb 1;26(3):256-61.
24. Foreman A, Croft S, *Op Cit*, pp. 194-95.
25. Yochum T, Rowe L. *Essentials of Skeletal Radiology*. Baltimore: Williams & Wilkins, 1987: pg. 21.
26. Mccall T, et al. "Cervical Spine Trauma in Children: A Review." *Neurosurg Focus*, 2006;20(2):E5; published on Medscape.
27. Shaw M, Burnett H, Wilson A, et al. Pseudosubluxation of C2 on C3 in polytraumatized children - prevalence and significance. *Clin Radiol*, 1999;54:377-380.
28. Radiological Imaging & Other Tests. Spine & Injury Clinic of Laramie, PC: <http://spineandinjuryclinic.com/x-ray.aspx>.
29. "Lumbar X-Rays: A Systematic Approach." *Neurosurgery Basics*; [click here](#) to access content.
30. Insko EK, Gracias VH, Gupta R, et al. Utility of flexion and extension radiographs of the cervical spine in the acute evaluation of blunt trauma. *J Trauma*, 2002;53:426-429.

DECEMBER 2015