

Conservative treatment for common spinal diseases

View from a high-income country

Christopher J. Colloca, DC, PhD

CEO, Neuromechanical Innovations

Chairman, International Spine Research (INSPIRE) Foundation

Chandler, Arizona, USA

The Big 5 African Game



okavango

The Big 5 of Spinal Disorders



Diagnoses and Treatments for Common Musculoskeletal Conditions



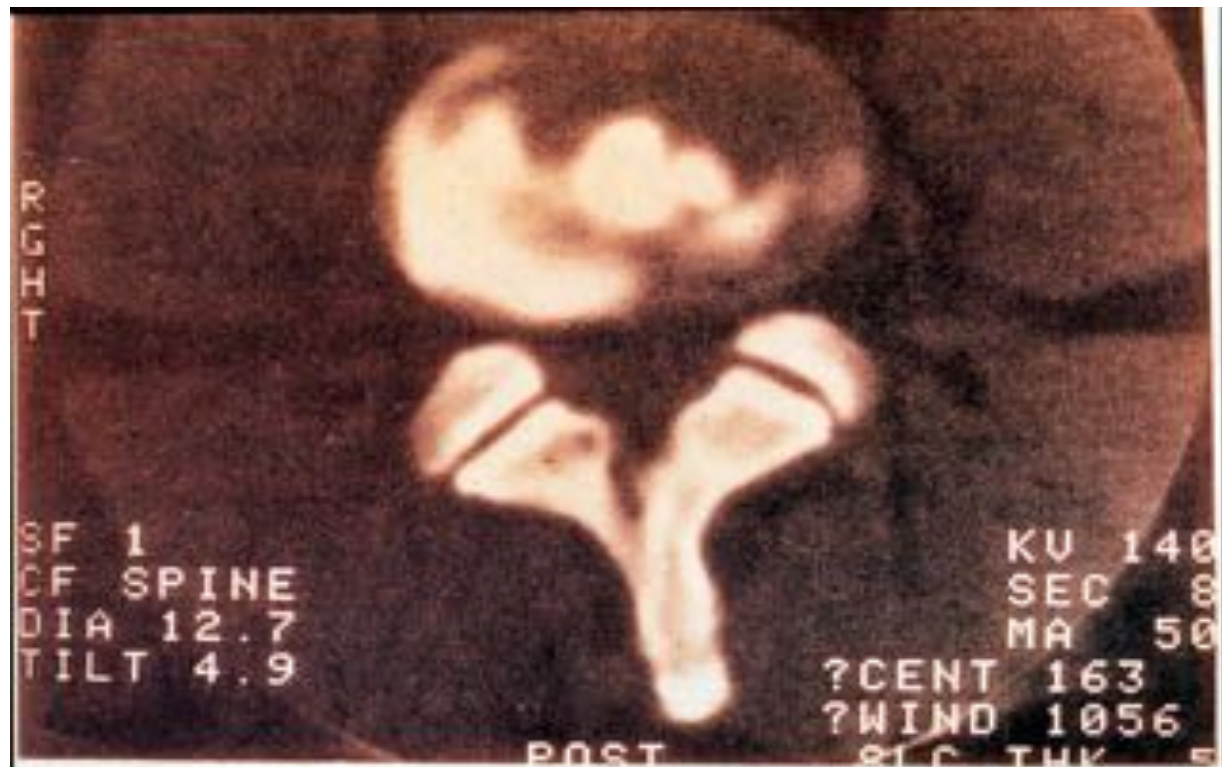
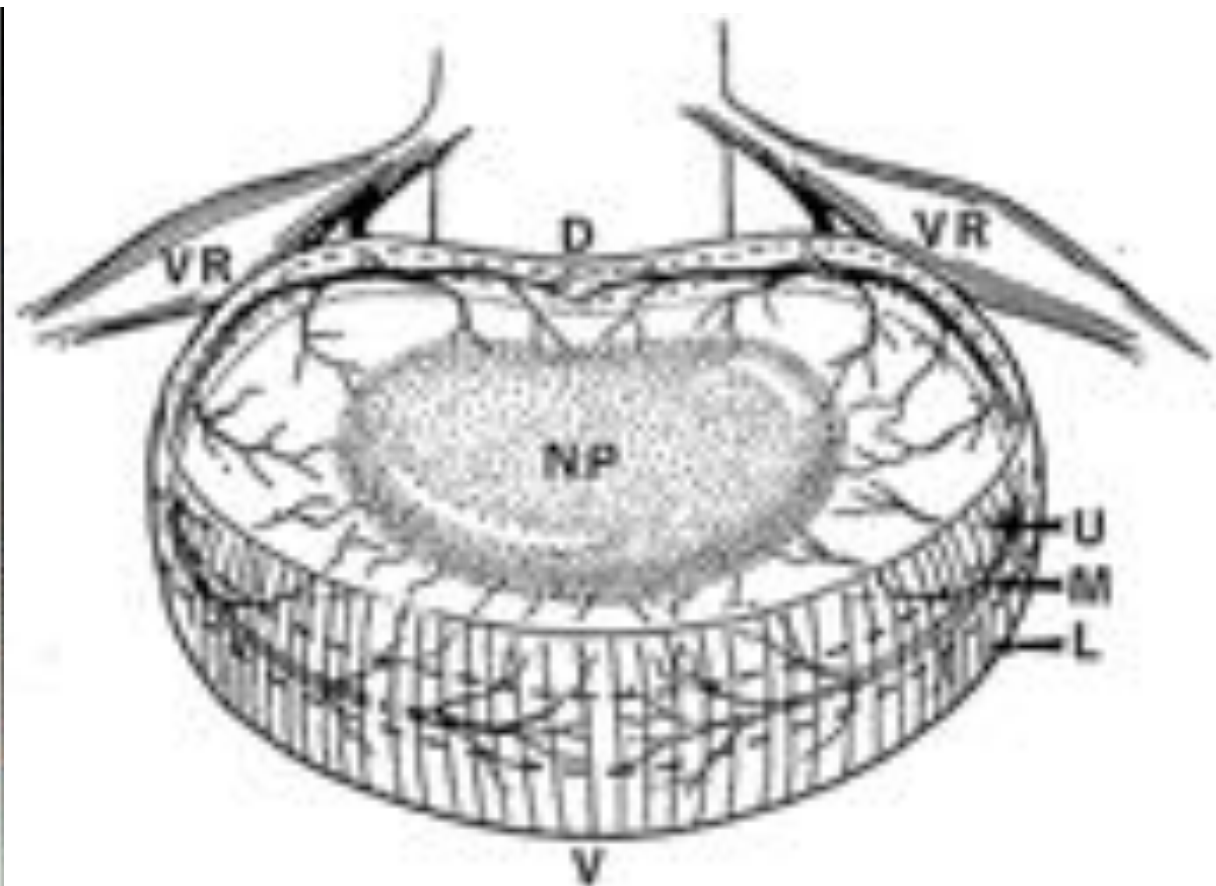


Figure 3. Computed tomography discogram of the L4-L5 disc, demonstrating a grade 4 anular tear on the right side.



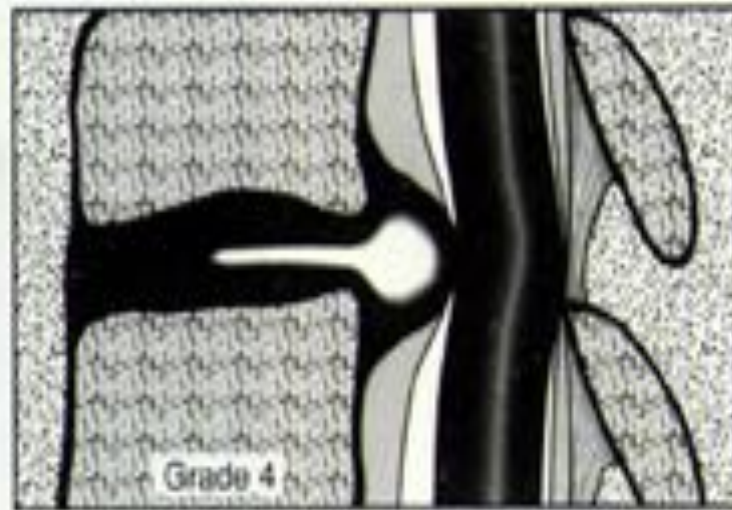
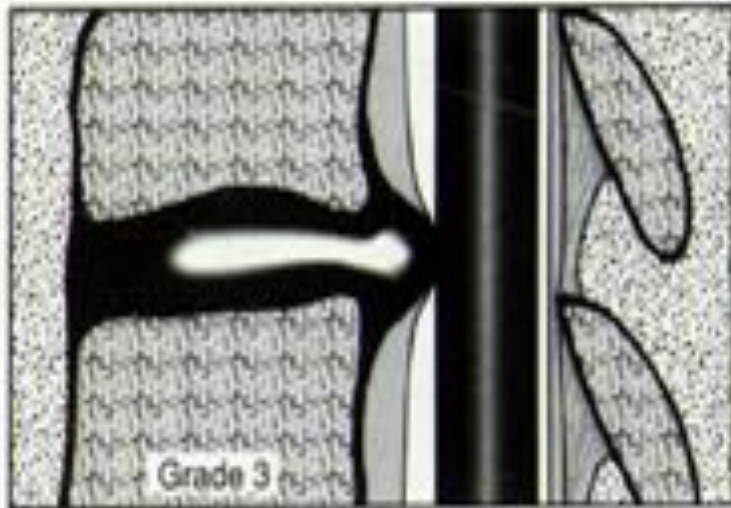
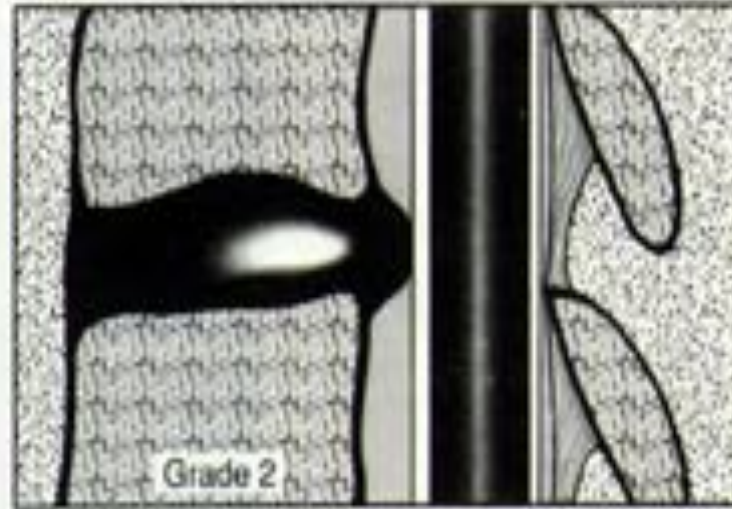
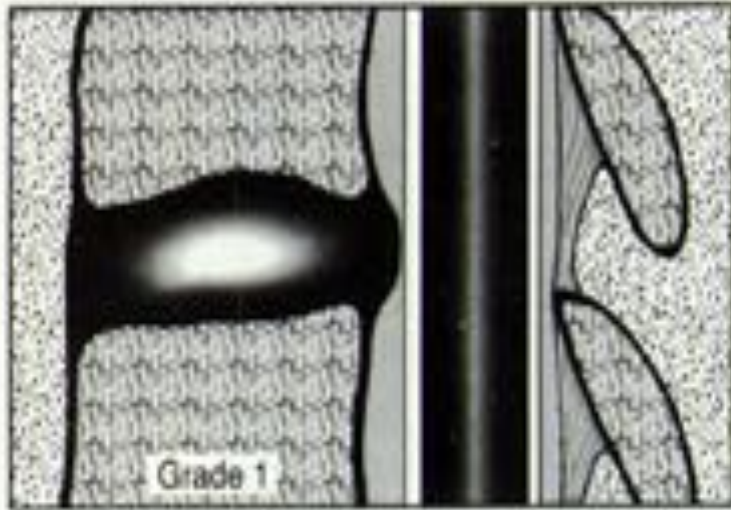
PAIN GENERATION IN LUMBAR AND CERVICAL FACET JOINTS

BY JOHN M. CAVANAUGH, MD, YING LU, MS, CHAOYANG CHEN, MD, AND SRINIVASU KALLAKURI, MS

Facet joints are implicated as a major source of neck and low-back pain. Both cervical and lumbar facet syndromes have been described in the medical literature. Biomechanical studies have shown that lumbar and cervical facet-joint capsules can undergo high strains during spine-loading. Neuroanatomic studies have demonstrated free and encapsulated nerve endings in facet joints as well as nerves containing substance P and calcitonin gene-related peptide. Neurophysiologic studies have shown that facet-joint capsules contain low-threshold mechanoreceptors, mechanically sensitive nociceptors, and silent nociceptors. Inflammation leads to decreased thresholds of nerve endings in facet capsules as well as elevated baseline discharge rates. Recent biomechanical studies suggest that rear-end motor-vehicle impacts give rise to excessive deformation of the capsules of lower cervical facet joints. Still unresolved is whether this stretch is sufficient to activate nociceptors in the joint capsule.

To answer this question, recent studies indicate that low stretch levels activate proprioceptors in the facet-joint capsule. Excessive capsule stretch activates nociceptors, leads to prolonged neural afferent discharges, and can cause damage to the capsule and to axons in the capsule. In instances in which a whiplash event is severe enough to injure the joint capsule, facet capsule overstretch is a possible cause of persistent neck pain.

Disc Protrusion



The New England Journal of Medicine

©Copyright, 1994, by the Massachusetts Medical Society

Volume 331

JULY 14, 1994

Number 2

MAGNETIC RESONANCE IMAGING OF THE LUMBAR SPINE IN PEOPLE WITHOUT BACK PAIN

MAUREEN C. JENSEN, M.D., MICHAEL N. BRANT-ZAWADZKI, M.D., NANCY OBUCHOWSKI, Ph.D.,
MICHAEL T. MODIC, M.D., DENNIS MALKASIAN, M.D., Ph.D., AND JEFFREY S. ROSS, M.D.

Table 3. Number of Subjects with Protrusions, According to the Age of the Subject and the Location of the Protrusion.*

AGE (YR)	LOCATION OF PROTRUSION					PROTRUSION AT LEAST AT ONE LEVEL	
	L1-2	L2-3	L3-4	L4-5	L5-S1	:	
	<i>no. of subjects</i>					<i>no. of subjects (%)</i>	
20-29 (n = 20)	0/0	0/0	0/0	3/2	2/1	5/3	(25/15)
30-39 (n = 28)	1/1	1/1	1/1	5/2	2/2	6/6	(21/21)
40-49 (n = 23)	0/1	0/0	1/0	5/3	4/4	8/7	(35/30)
50-59 (n = 17)	0/0	1/1	2/1	2/4	0/0	5/5	(29/29)
≥60 (n = 10)	0/0	2/1	1/0	4/0	3/1	6/2	(60/20)
Total (n = 98)	1/2	4/3	5/2	19/11	11/8	30/23	(31/23)

*For each pair of data, the first number refers to the first evaluator's result, and the second number to the second evaluator's result.

**MAGNETIC RESONANCE IMAGING OF THE LUMBAR SPINE
IN PEOPLE WITHOUT BACK PAIN**

MAUREEN C. JENSEN, M.D., MICHAEL N. BRANT-ZAWADZKI, M.D., NANCY OBUCHOWSKI, Ph.D.,
MICHAEL T. MODIC, M.D., DENNIS MALKASIAN, M.D., Ph.D., AND JEFFREY S. ROSS, M.D.

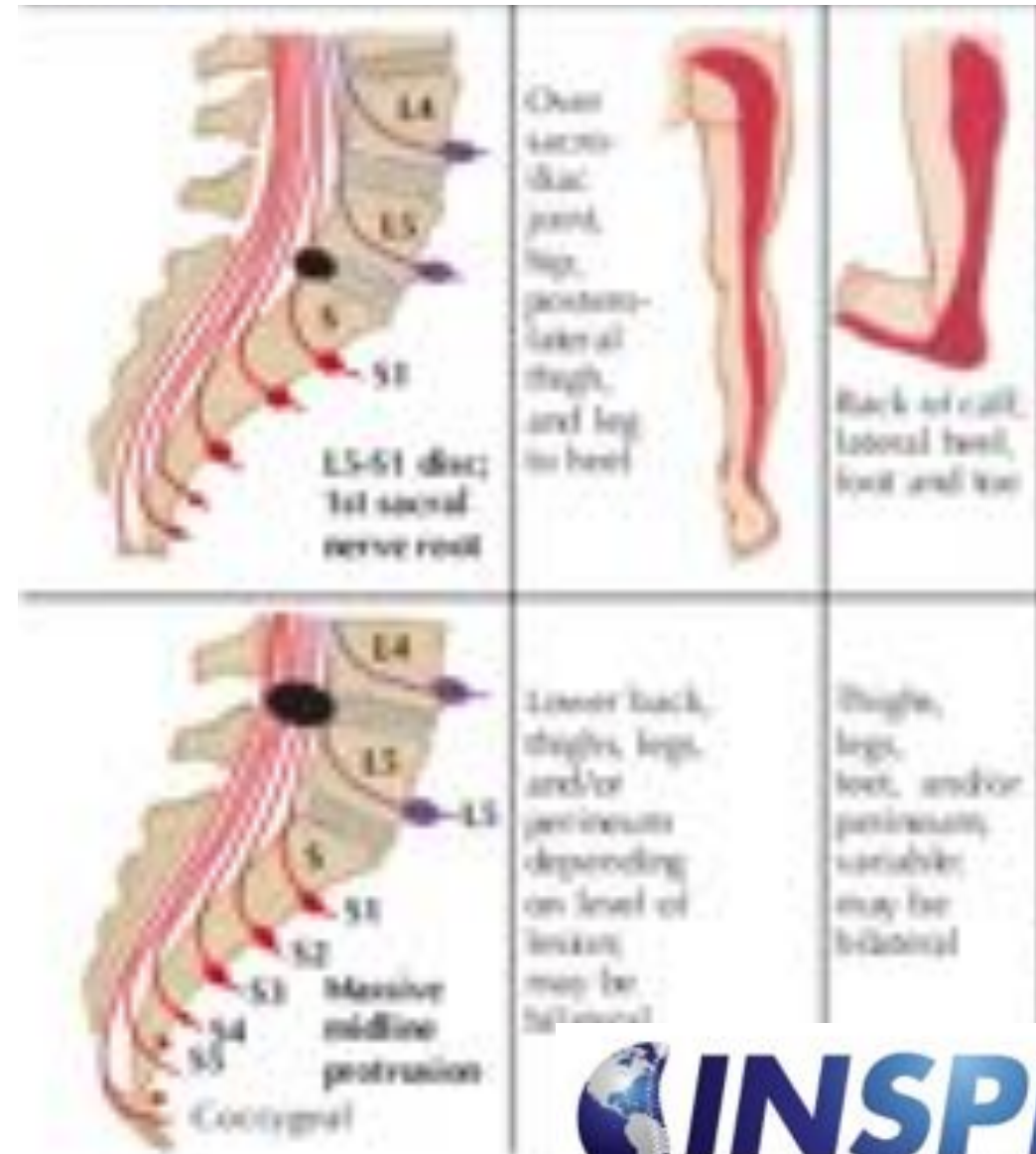
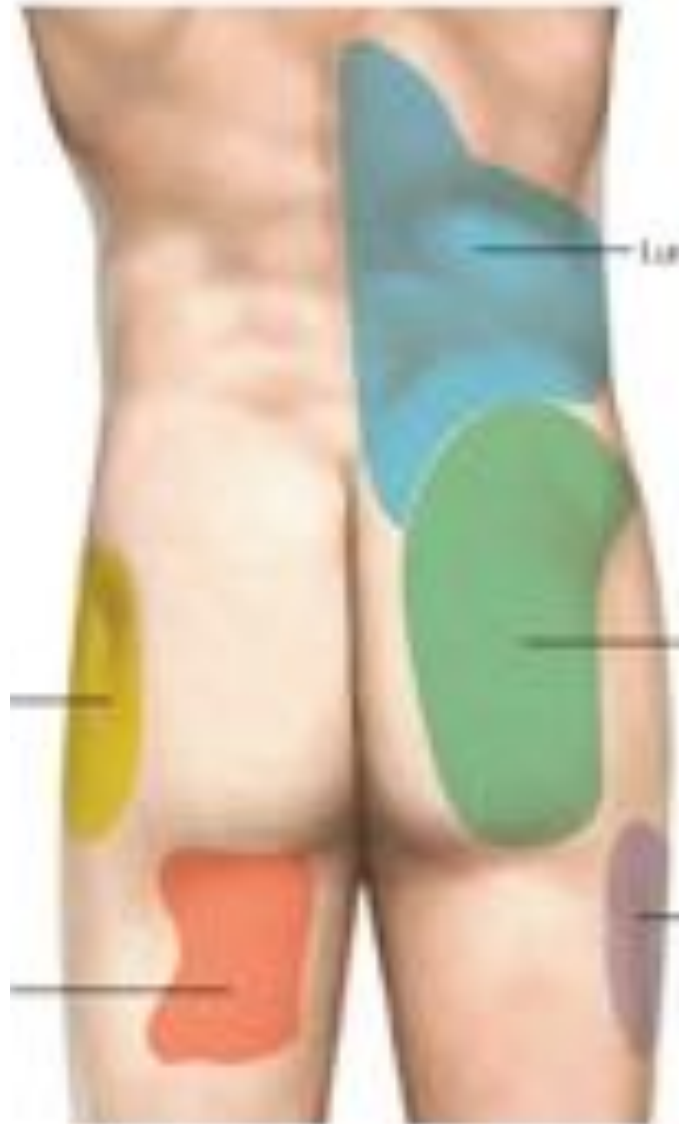
Conclusions. On MRI examination of the lumbar spine, many people without back pain have disk bulges or protrusions but not extrusions. Given the high prevalence of these findings and of back pain, the discovery by MRI of bulges or protrusions in people with low back pain may frequently be coincidental. (N Engl J Med 1994;331:69-73.)

Patient Encounter

- History
- Physical Examination
- Diagnostic Imaging
- Differential Diagnosis
- Outcome Assessments
- Clinical Decision Making



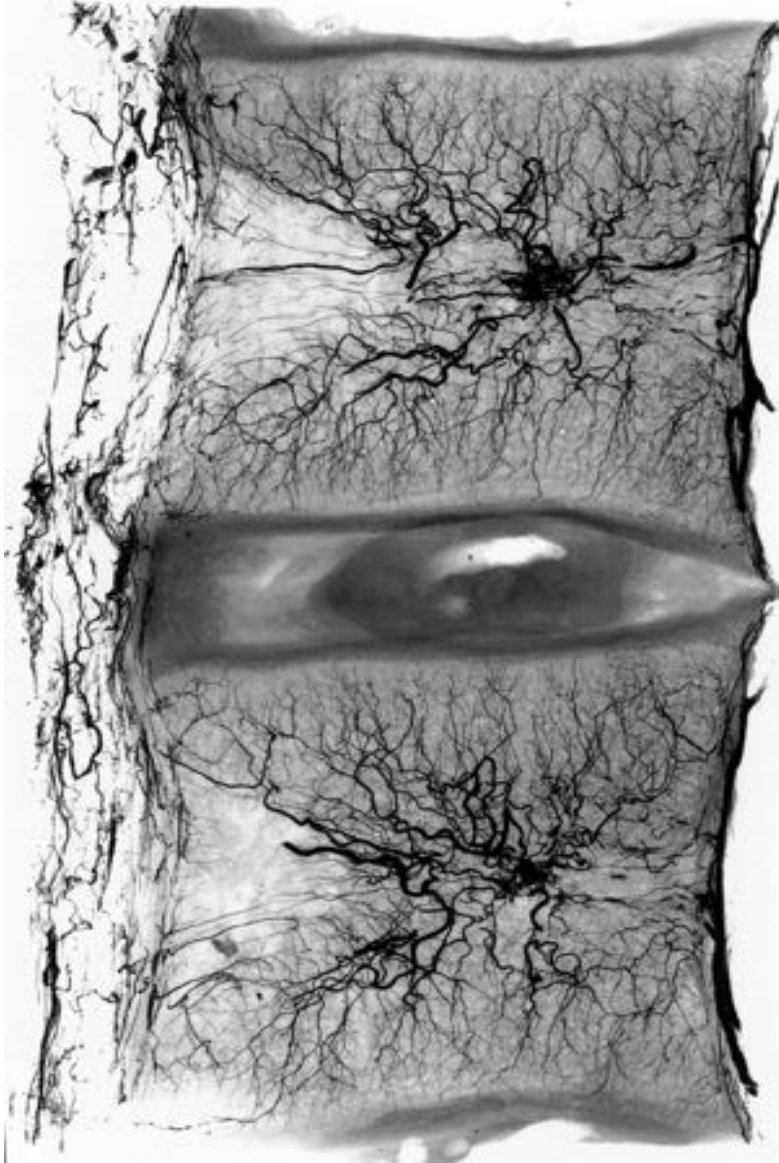
Referred vs. Radicular Symptoms



Centralization vs. Peripheralization



Etiology of Disc Degeneration



Adams MA, Dolan P. Recent advances in lumbar spinal mechanics and their clinical significance. *Clin Biomech* 1995; 10:3-19.

“Lumbar intervertebral discs are particularly vulnerable to fatigue failure because they are the largest avascular structures in the body.”

McNally DS, Adams MA. Internal Intervertebral Disc Mechanics as Revealed by Stress Profilometry. Spine 1992; 17:66-73.

DISC FUNCTION DEPENDENT UPON LOAD

The mechanical behavior of individual disc tissue is dependent not only on their location, but also on the loading and loading history of the disc.

Ohshima H, Urban JPG, Bergel DH. Effect of Static Load on Matrix Synthesis Rates in the Intervertebral Disc Measured In Vitro by a New Perfusion Technique. J Orthop Res 1995; 13:22-9.

- Discal hydration varied with load
- Hydration decreased as load increased

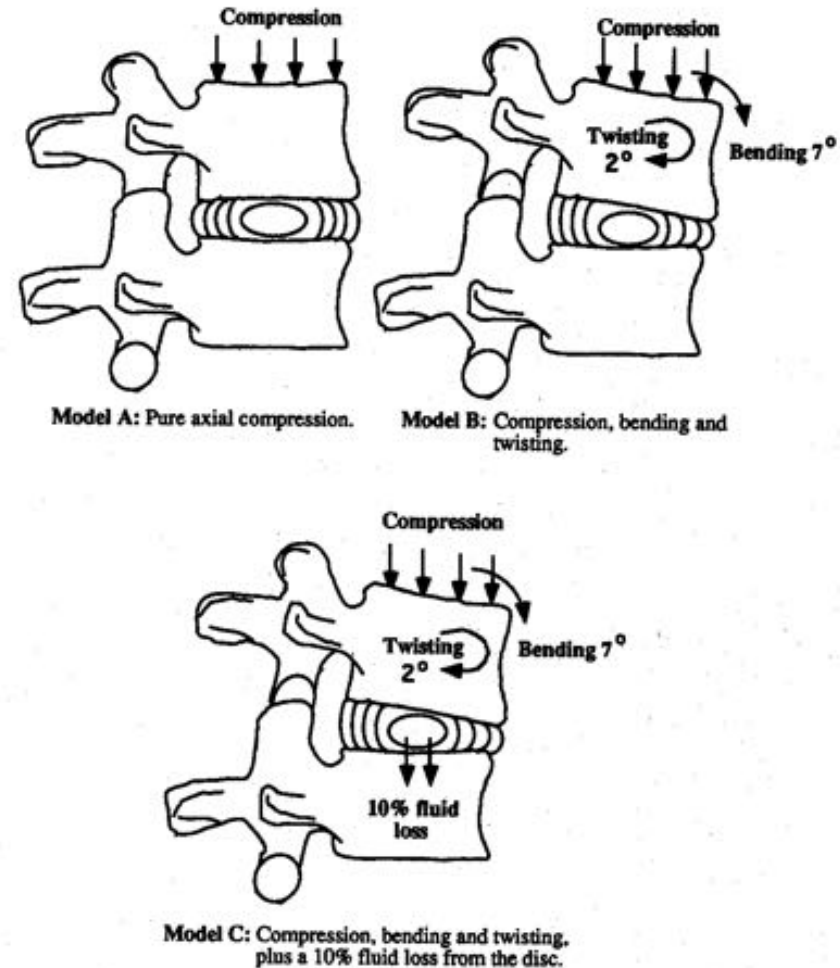


Figure 1. The three models (A, B, and C) that were simulated in the finite element analysis.

Kraemer J, Kolditz D, Gowin R. Water and Electrolyte Content of Human Intervertebral Discs Under Variable Load. Spine 1985; 10:69-71.

- Under load, water and metabolic waste products are pressed out whereas the IVD absorbs water & metabolic substrates when the load is reduced.
- “This pumping mechanism maintains the nutrition and biomechanical function of the intervertebral disc.”

Horst M, Brinckmann P. Measurement of the distribution of axial stress on the end-plate of the vertebral body. *Spine* 1981; 6:217-31.

- Under asymmetrical loading, such as a maintained lateral flexion or flexion angle of adjacent vertebrae, the disc no longer transmits loads uniformly and stress concentrations develop in the outer anulus and ground substance.

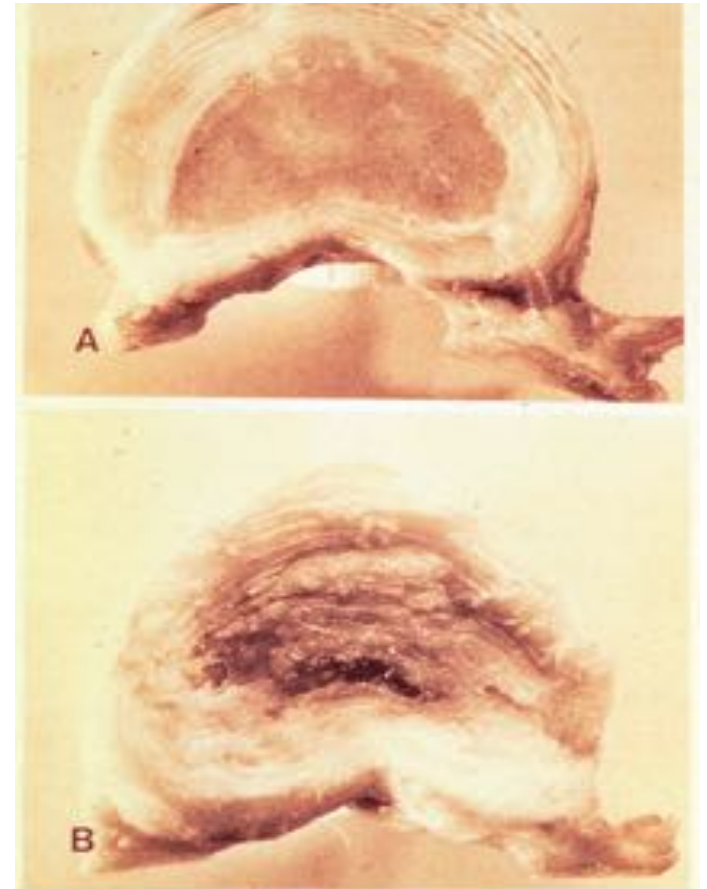
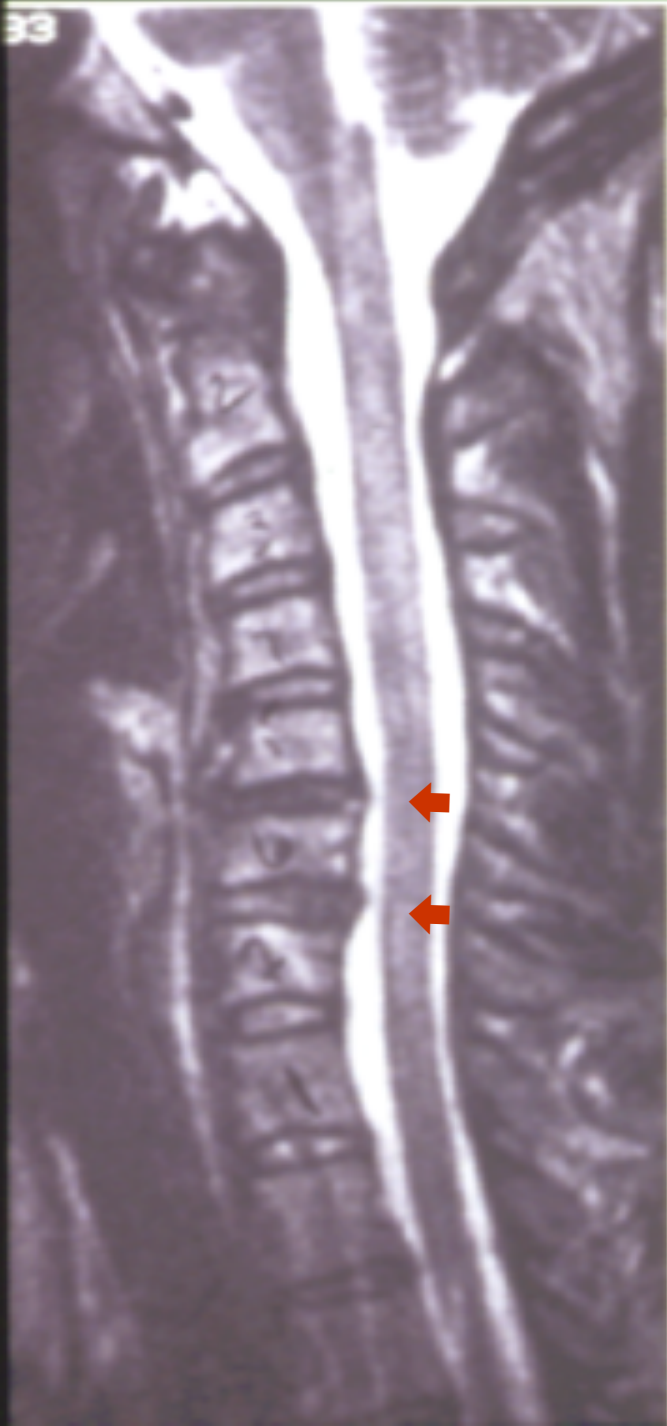


Figure 1. Morphology of (A) a normal porcine intervertebral disc and (B) a similar disc 3 months after scalpel injury. In the injured disc, the nucleus pulposus is small and fibrous. The annular lesion heals by formation of granulation tissue and the lamellar structure is partially destroyed.





10

Dvorak J, Dvorak V. Manual Medicine. Diagnostics. New York: Thieme Medical Publishers, Inc., 1990.

White AA, Panjabi MM. Clinical Biomechanics of the Spine. 2nd ed. Philadelphia: J.B. Lippincott Co,1990.

“Such changes, and spinal joint soft tissue fibrosis, alters the normal instantaneous axis of rotation of these joints.”

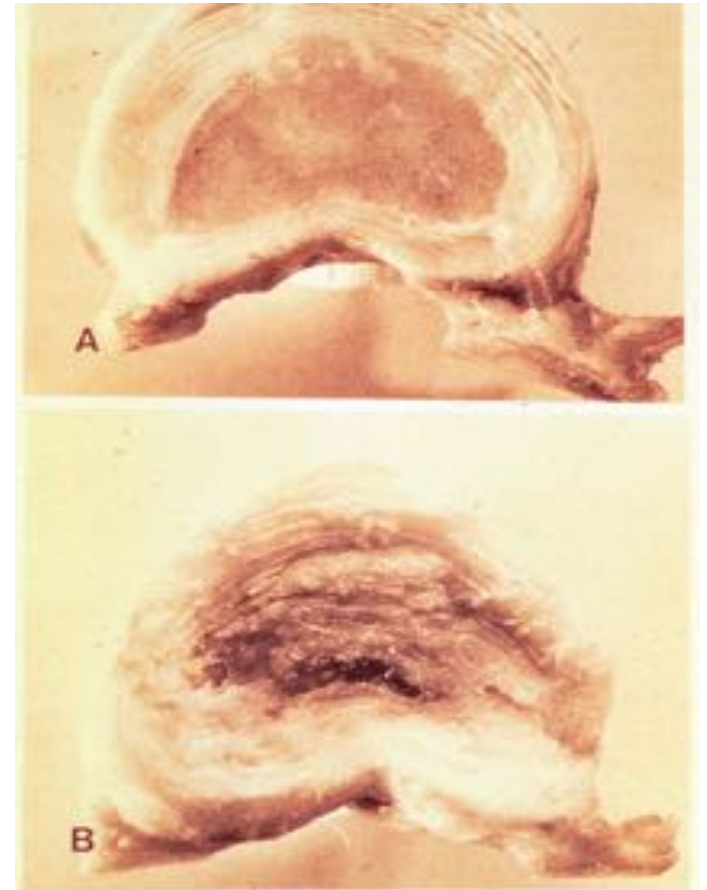
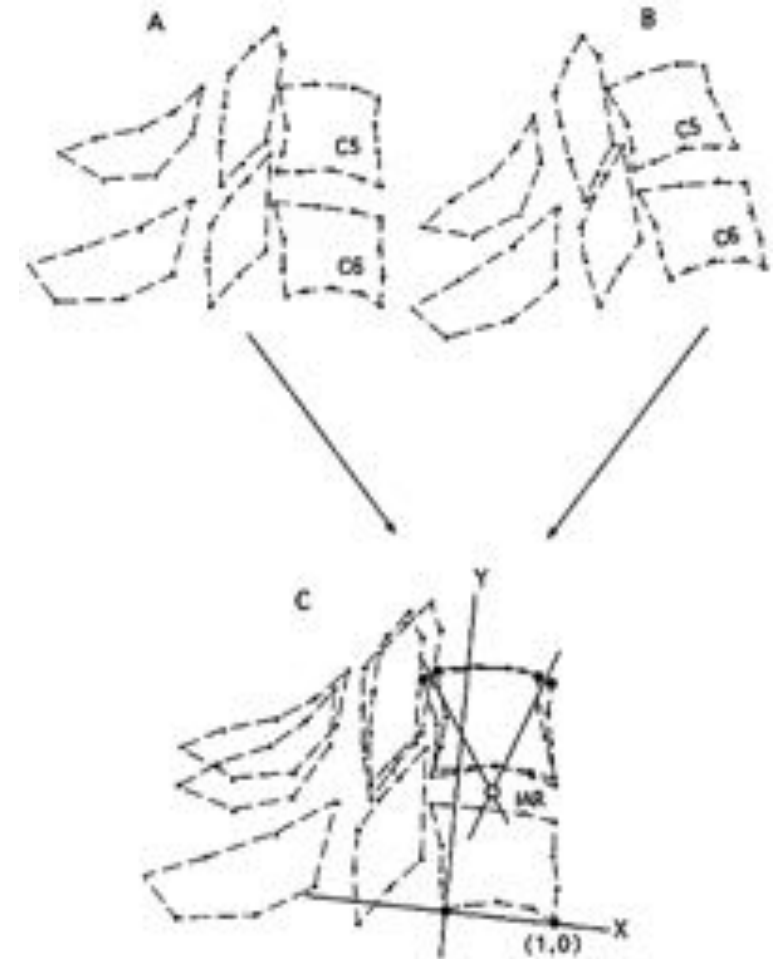


Figure 1. Morphology of (A) a normal porcine intervertebral disc and (B) a similar disc 3 months after scalpel injury. In the injured disc, the nucleus pulposus is small and fibrous. The annular lesion heals by formation of granulation tissue and the lamellar structure is partially destroyed.

Bogduk N, Amevo B, Pearcy M. A biological basis for instantaneous centres of rotation of the vertebral column. Proc Inst Mech Eng 1995; 209:177-83.

**Abnormal
instantaneous axes of
rotation (IARs) have
been shown to correlate
with spinal pain.**



ORIGINAL PAPER

V. Feipel · B. Rondelet · J.P. LePallec · O. DeWitte
M. Rooze

The use of disharmonic motion curves in problems of the cervical spine

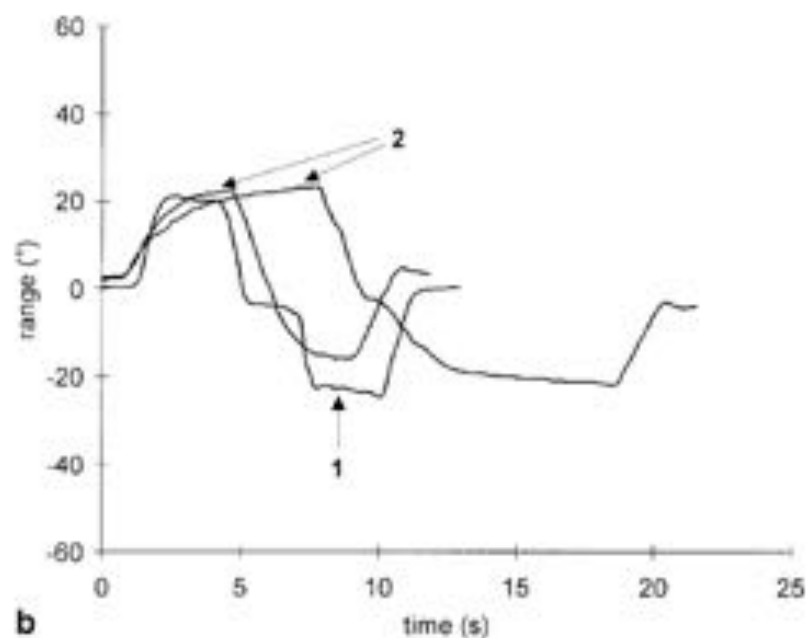
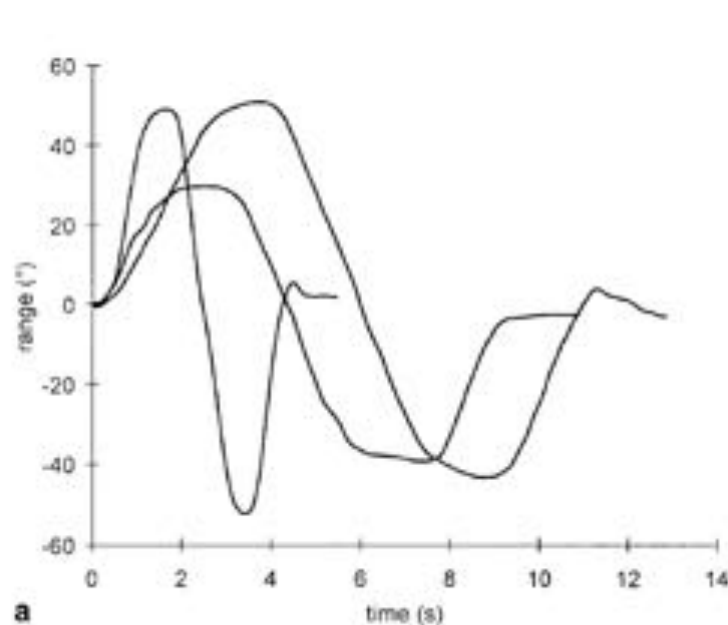
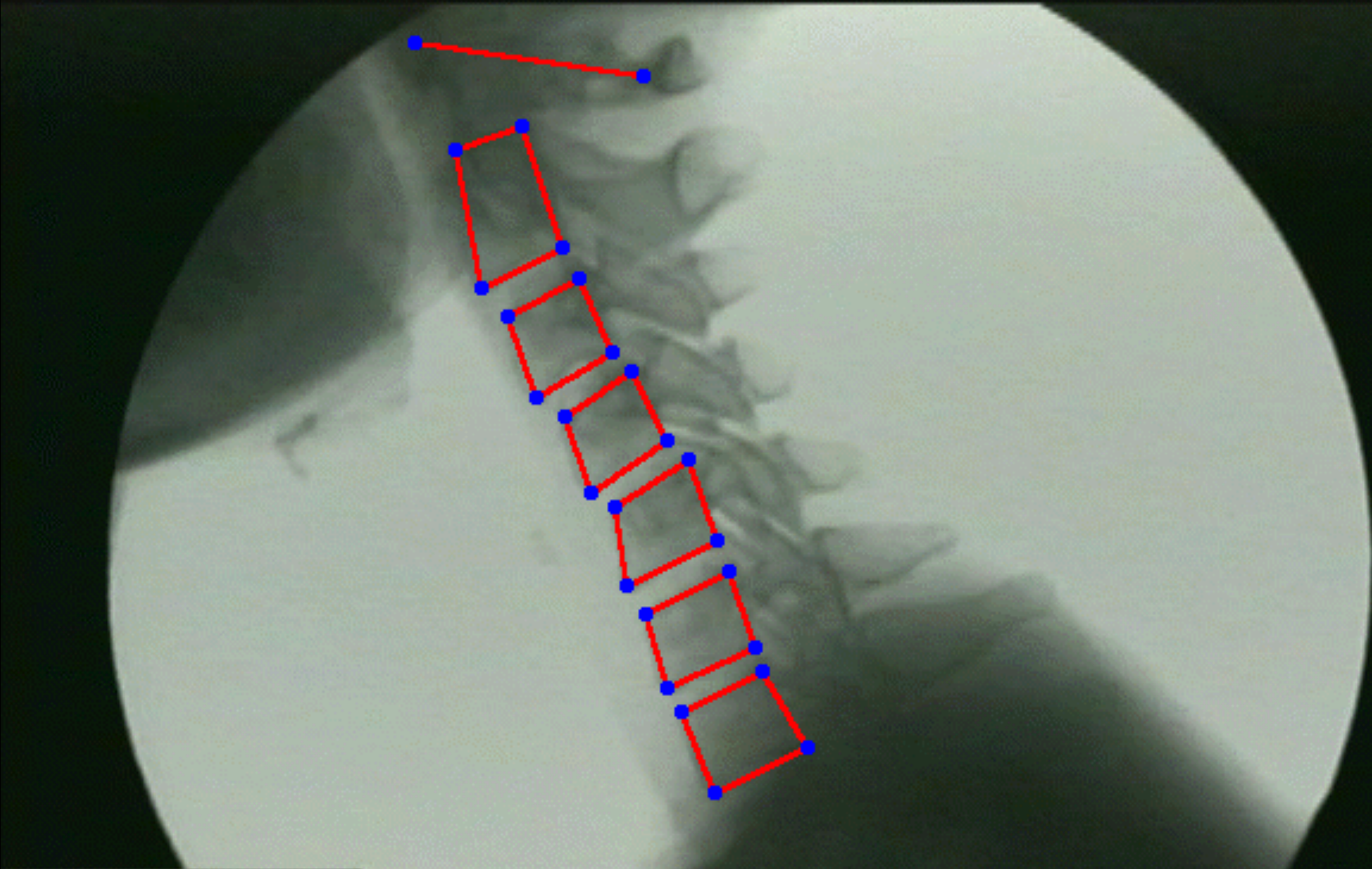
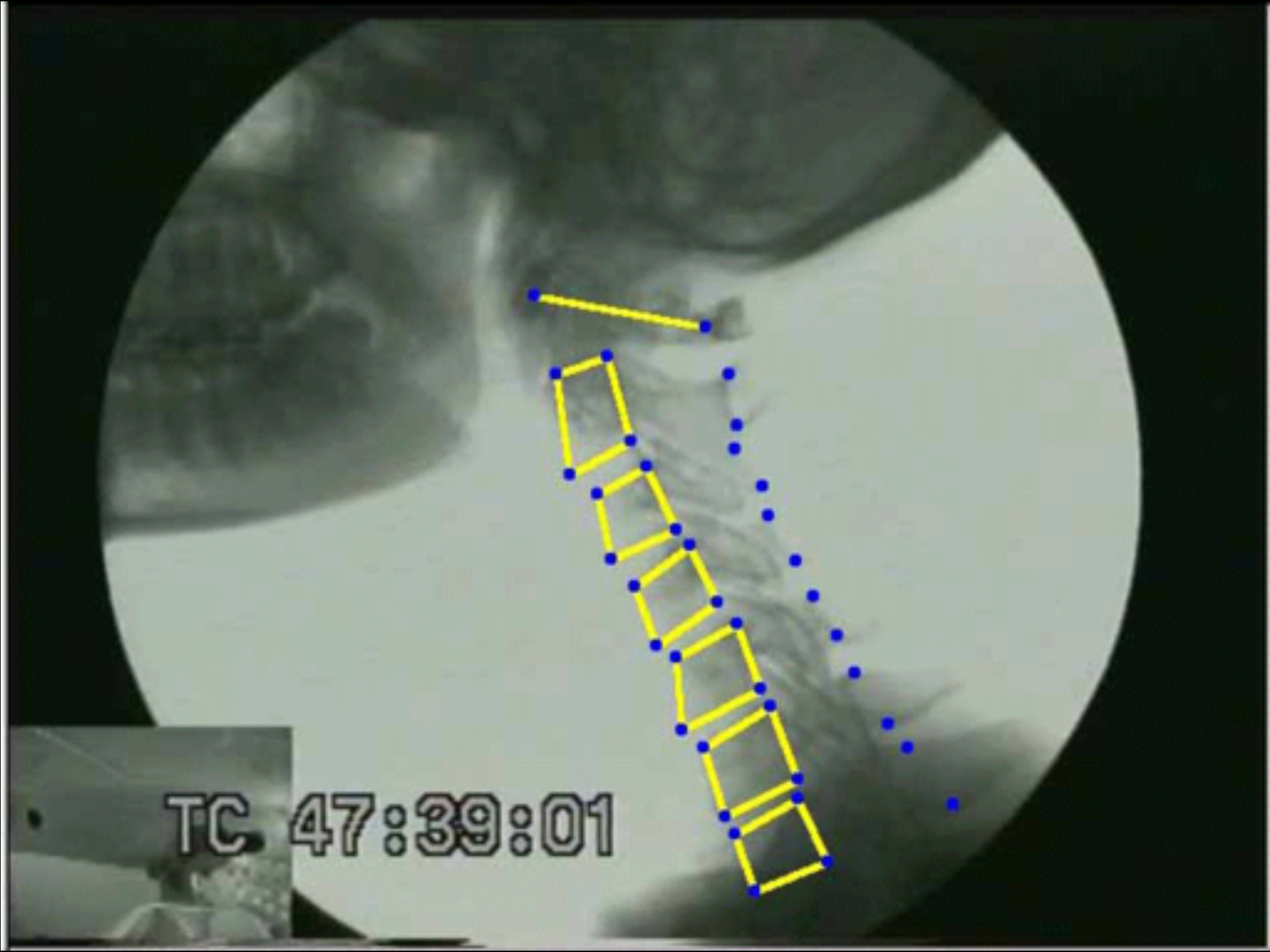


Fig. 2. **a** Flexion extension curves of asymptomatic volunteers. **b** Flexion extension curves of patients. Note the presence of various types of alteration – (1) plateau-like shape, (2) exponential shape

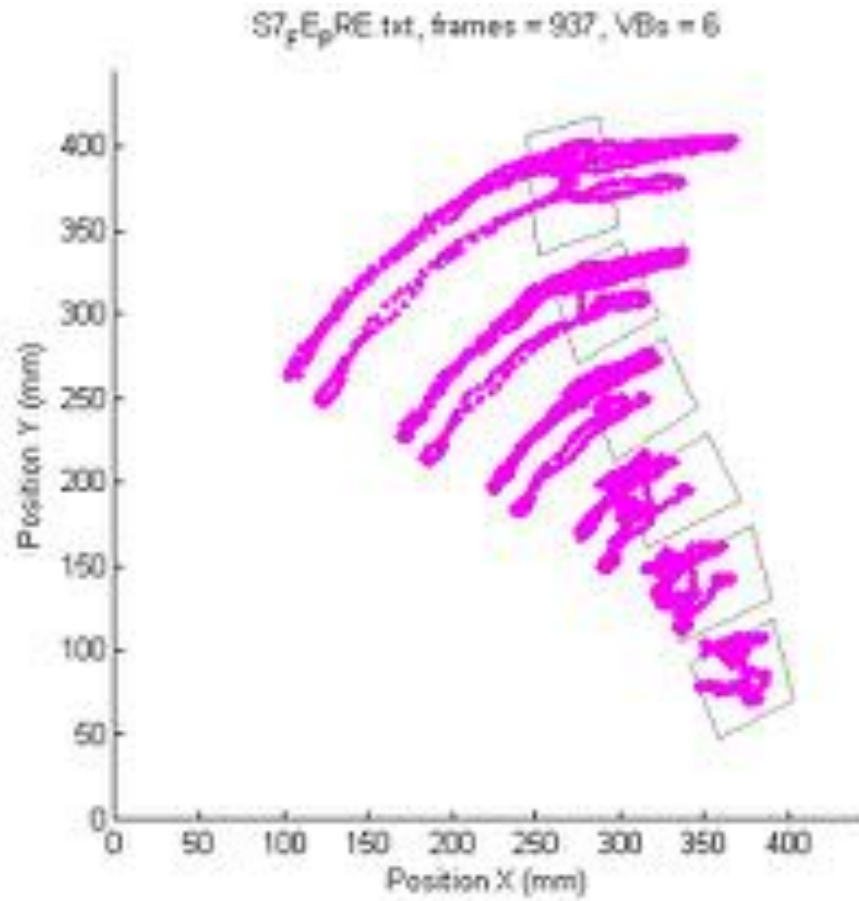


TC 50:05:18

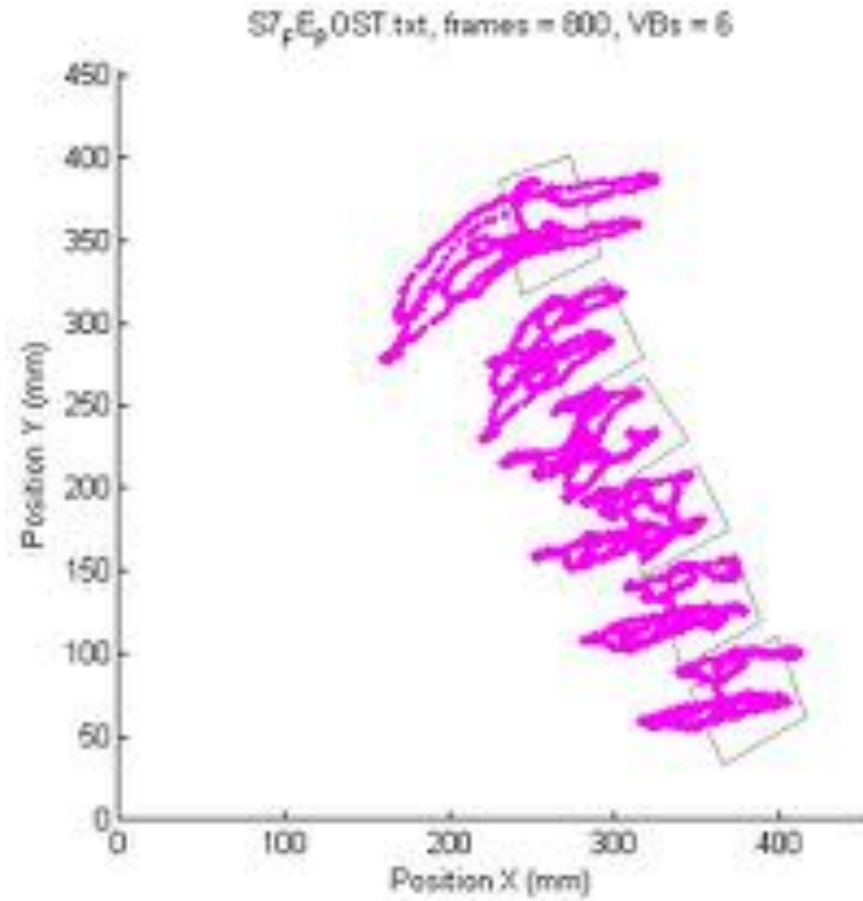


TC 47:39:01

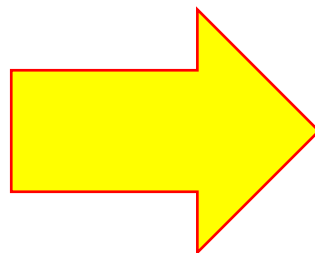
Normal



Dysfunctional



Do Fire Trucks Cause Fires?



Systematic Literature Review of Imaging Features of Spinal Degeneration in Asymptomatic Populations

W. Brinjikji, P.H. Luetmer, B. Comstock, B.W. Bresnahan, L.E. Chen, R.A. Deyo, S. Halabi, J.A. Turner, A.L. Avins, K. James, J.T. Wald, D.F. Kallmes, and J.G. Jarvik

Age-specific prevalence estimates of degenerative spine imaging findings in asymptomatic patients^a

Imaging Finding	Age (yr)						
	20	30	40	50	60	70	80
Disk degeneration	37%	52%	68%	80%	88%	93%	96%
Disk signal loss	17%	33%	54%	73%	86%	94%	97%
Disk height loss	24%	34%	45%	56%	67%	76%	84%
Disk bulge	30%	40%	50%	60%	69%	77%	84%
Disk protrusion	29%	31%	33%	36%	38%	40%	43%
Annular fissure	19%	20%	22%	23%	25%	27%	29%
Facet degeneration	4%	9%	18%	32%	50%	69%	83%
Spondylolisthesis	3%	5%	8%	14%	23%	35%	50%

RESEARCH ARTICLE

The associations between magnetic resonance imaging findings and low back pain: A 10-year longitudinal analysis

Juichi Tonosu¹, Hiroyuki Oka^{2*}, Akiro Higashikawa¹, Hiroshi Okazaki¹, Sakae Tanaka³, Ko Matsudaira²

1 Department of Orthopedic Surgery, Kanto Rosai Hospital, Kanagawa, Japan, **2** Department of Medical Research and Management for Musculoskeletal Pain, 22nd Century Medical and Research Center, Faculty of Medicine, The University of Tokyo, Tokyo, Japan, **3** Department of Orthopedic Surgery, Faculty of Medicine, The University of Tokyo, Tokyo, Japan

RESEARCH ARTICLE

The associations between magnetic resonance imaging findings and low back pain: A 10-year longitudinal analysis

Conclusions

Follow-up MRI findings consistent with Pfirrmann grading ≥ 4 , disc bulging, HIZ, spondylo-
listhesis, and any type of Modic changes were not associated with LBP history during the 10
years between the baseline and follow-up study. The progresses of these findings were also
not associated with the LBP history. In addition, baseline MRI findings were not associated
with LBP history during the 10 years; therefore, our data suggest that baseline MRI findings
cannot predict future LBP.

MRJ Findings of Disc Degeneration are More Prevalent in Adults with Low Back Pain than in Asymptomatic Controls: A Systematic Review and Meta-Analysis

The Amadi, PhD, Debn, MD, J.C. Jans, MD, Carr, PhD, Yalmar, PhD, Murali, and P.P. Jannat

FIG 1

OBJECTIVE: We performed a meta-analysis of studies reporting the prevalence of degenerative lumbar spine MRJ findings in asymptomatic and symptomatic adults (based on age or range) (symptomatic individuals had low back pain with or without radicular symptoms). Two reviewers evaluated each article for the following subtypes: disc bulge, disc degeneration, disc extrusion, disc protrusion, annular fissure, Modic I changes, any Modic changes, central canal stenosis, spondylospondylolisthesis. The meta-analysis was performed by using a random-effects model.

DESIGN: An initial search yielded 26 unique studies (outcomes 5,275) that the inclusion criteria (207 individuals/161 MRJ asymptomatic/166 MRJ symptomatic). Imaging findings with a higher prevalence in symptomatic individuals 50 years of age or younger included disc bulge (OR, 1.34 [95% CI 1.28–1.41], $P < .05$), spondylospondylolisthesis (OR, 1.04 [95% CI 1.04–1.05], $P < .05$), disc extrusion (OR, 4.34 [95% CI 1.09–1.68], $P < .05$), Modic I changes (OR, 4.03 [95% CI 1.91–8.53], $P < .05$), disc protrusion (OR, 2.05 [95% CI 1.53–2.73], $P < .05$), and any degeneration (OR, 1.24 [95% CI 1.19–1.29], $P < .05$). Imaging findings not associated with low back pain included any Modic change (OR, 1.01 [95% CI 0.94–1.07], $P = .85$), spondylospondylolisthesis (OR, 1.04 [95% CI 0.98–1.08], $P = .33$), high posterior cross (OR, 1.10 [95% CI 0.75–1.60], $P = .61$), annular fissure (OR, 1.01 [95% CI 0.97–1.05], $P = .80$), and spondylospondylolisthesis (OR, 1.04 [95% CI 0.74–1.44], $P = .80$).

CONCLUSION: MRJ studies reported demonstrated that MRJ imaging evidence of disc bulge, degeneration, extrusion, protrusion, Modic I changes, and spondylospondylolisthesis are more prevalent in adults 50 years of age or younger with low back pain compared with asymptomatic individuals.

Table II

Prevalence of DD by age strata in men and women

Age strata (years)	Entire spine		Cervical		Thoracic		Lumbar	
	Men	Women	Men	Women	Men	Women	Men	Women
<50	71.0	77.0	26.3	27.9	15.7	11.4	55.2	71.2
50–59	91.5	93.1	47.4	49.1	49.1	35.3	86.4	91.3
60–69	98.4	95.5	66.1	54.4	61.5	63.2	96.9	94.3
70–79	96.8	99.4	80.9	72.0	73.0	79.6	96.6	96.5
≥80	93.2	97.4	86.3	85.5	79.4	88.9	82.1	84.5

Values are percentage.

Teraguchi et al. Prevalence and distribution of intervertebral disc degeneration over the entire spine in a population-based cohort: the Wakayama Spine Study. *Osteoarthritis Cartilage* 2014;22(1):104-10.

Aging of the Cervical Spine in Healthy Volunteers

A 10-Year Longitudinal Magnetic Resonance Imaging Study

Ejiro Okada, MD,* Morio Matsumoto, MD,† Daisuke Ichihara, MD,* Kazuhiro Chiba, MD,*
Yoshiaki Toyama, MD,* Hirokazu Fujiwara, MD,‡ Suketaka Momoshima, MD,‡
Yuji Nishiwaki, MD,§ Takeshi Hashimoto, MD,¶ Jun Ogawa, MD,||
Masahiko Watanabe, MD,** and Takeshi Takahata, MD††



- Progression of degeneration of cervical spine on MRI was frequently observed during 10-year period with development of symptoms in 34% of subjects.
- No factor related to progression of degeneration of cervical spine was identified except for age.
- Patients who developed clinical symptoms during 10 years, including neck pain, stiff shoulder, and numbness in the upper extremities, demonstrated significantly more frequent progression of disc degeneration on MRI than those without the clinical symptoms.

LUMBAR DISC DEGENERATION: EPIDEMIOLOGY AND GENETICS

MICHELE C. BATTIÉ; TAPIO VIDEMAN

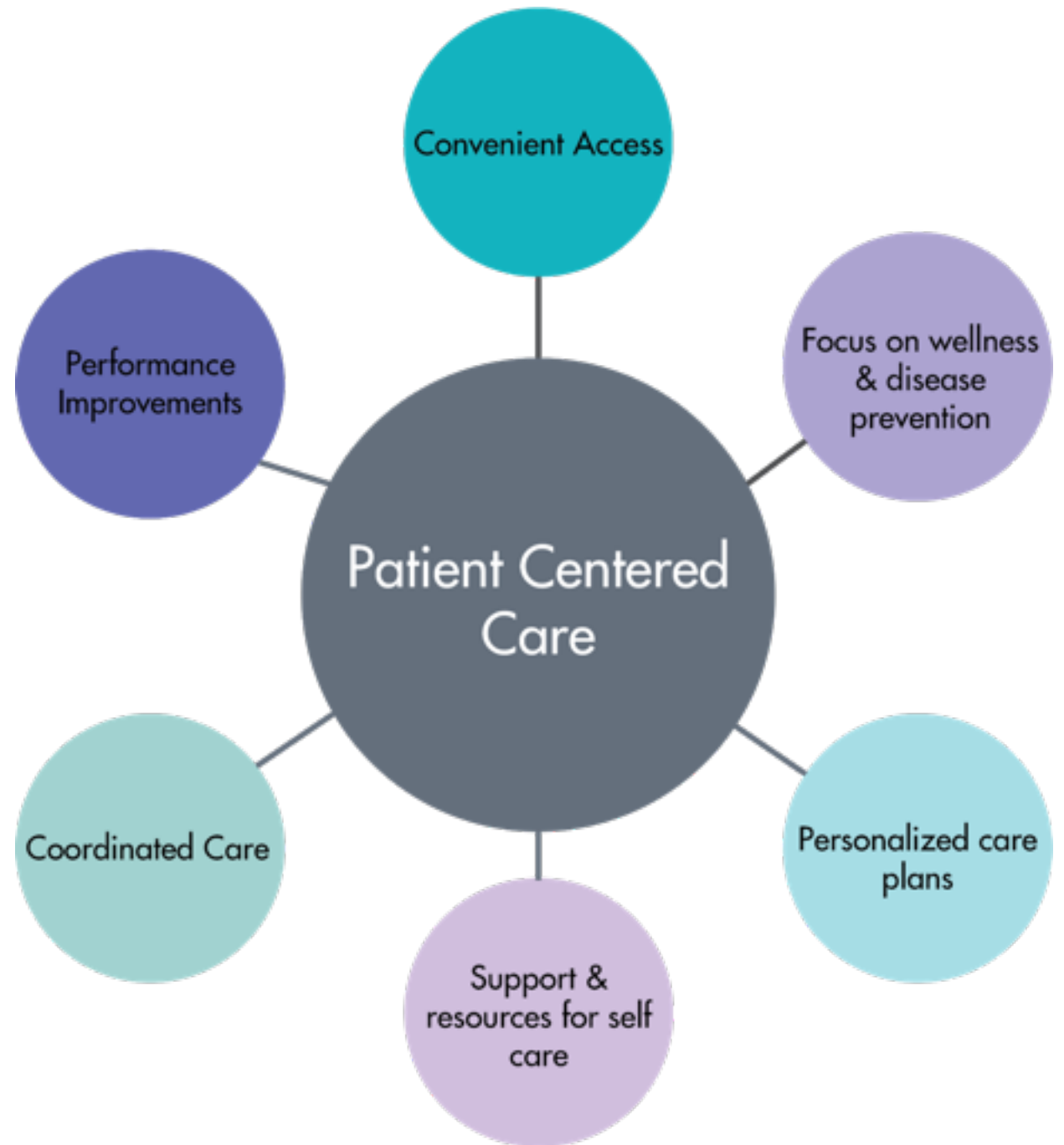
- Previously, heavy physical loading—often associated with occupation—was the main suspected risk factor for disc degeneration, commonly viewed as a wear-and-tear phenomenon exacerbated by the precarious nutritional status of the disc.
- However, results of studies on twins suggest that physical loading specific to occupation and sport plays a relatively minor role in disc degeneration.
- Recent research indicates that heredity has a dominant role in disc degeneration, which would explain the variance of up to 74% seen in adult populations.
- Since 1998, genetic influences have been confirmed by the identification of several gene forms associated with disc degeneration.
- This research is paving the way for a better understanding of the biologic mechanisms through which disc degeneration occurs, including specific interactions between genes and environment.



DECISIONS

Snap a picture or warn your child of impending danger? Hard Choice.

Move from Pathology focus to ...



Biopsychosocial model of pain





For **chronic low back pain**, effective therapies versus placebo, sham, no treatment, usual care, or wait list are:

- NSAIDs, opioids, tramadol, duloxetine, multidisciplinary rehabilitation, acupuncture, and exercise (SOE: moderate) and benzodiazepines, psychological therapies, massage, yoga, tai chi, and low-level laser therapy (SOE: low);
- Spinal manipulation was as effective as other active interventions (SOE: moderate).

Chou et al. Noninvasive treatments for low back pain. Effective Health Care Program, Comparative Effectiveness Review, No. 169. Agency for Healthcare Research and Quality, 2016.



Evidence on effects of pharmacological therapies for radiculopathy was extremely limited (Table E). There were no differences in pain or function between systemic corticosteroids versus placebo, and evidence was insufficient to determine effects of gabapentin or pregabalin.

Pharmacological therapies were associated with an increased risk of adverse events versus placebo. However, serious harms were rare in clinical trials, with no clear increase in risk based on clinical trials. In particular, trials of opioids were not designed to assess for serious harms, such as overdose, abuse, and addiction. Such harms have been reported in observational studies of opioids for chronic pain, although such studies did not meet inclusion criteria because they were not restricted to patients with low back pain.²⁶

Diagnosis and Treatment of Low Back Pain: A Joint Clinical Practice Guideline from the American College of Physicians and the American Pain Society

Roger Chou, MD; Amir Qaseem, MD, PhD, MHA; Vincenza Snow, MD; Donald Casey, MD, MPH, MBA; J. Thomas Cross Jr., MD, MPH; Paul Shekelle, MD, PhD; and Douglas K. Owens, MD, MS, for the Clinical Efficacy Assessment Subcommittee of the American College of Physicians and the American College of Physicians/American Pain Society Low Back Pain Guidelines Panel*

Recommendation 7: For patients who do not improve with self-care options, clinicians should consider the addition of nonpharmacologic therapy with proven benefits—for acute low back pain, spinal manipulation; for chronic or subacute low back pain, intensive interdisciplinary rehabilitation, exercise therapy, acupuncture, massage therapy, spinal manipulation, yoga, cognitive-behavioral therapy, or progressive relaxation (weak recommendation, moderate-quality evidence).

SYSTEMATIC REVIEW

Clinical practice guidelines for the noninvasive management of low back pain: A systematic review by the Ontario Protocol for Traffic Injury Management (OPTIMA) Collaboration

J.J. Wong^{1,2}, P. Côté^{1,3,4}, D.A. Sutton^{1,2}, K. Randhawa^{1,2,5}, H. Yu^{1,2,5}, S. Varatharajan^{1,2,5}, R. Goldgrub⁶, M. Nordin⁷, D.P. Gross^{8,9}, H.M. Shearer^{1,2}, L.J. Carroll¹⁰, P.J. Stern¹¹, A. Ameis¹², D. Southerst^{1,13}, S. Mior^{2,4}, M. Stupar¹, T. Varatharajan^{1,14}, A. Taylor-Vaisey¹

SYSTEMATIC REVIEW

Clinical practice guidelines for the noninvasive management of low back pain: A systematic review by the Ontario Protocol for Traffic Injury Management (OPTIMA) Collaboration

J.J. Wong^{1,2}, P. Côté^{1,3,4}, D.A. Sutton^{1,2}, K. Randhawa^{1,2,5}, H. Yu^{1,2,5}, S. Varatharajan^{1,2,5}, R. Goldgrub⁶, M. Nordin⁷, D.P. Gross^{8,9}, H.M. Shearer^{1,2}, L.J. Carroll¹⁰, P.J. Stern¹¹, A. Ameis¹², D. Southerst^{1,13}, S. Mior^{2,4}, M. Stupar¹, T. Varatharajan^{1,14}, A. Taylor-Vaisey¹

According to high-quality guidelines:

- Patients with **acute LBP** should be encouraged to return to activity and may benefit from paracetamol, nonsteroidal anti-inflammatory drugs (NSAIDs), or spinal manipulation;
- the management of **chronic LBP** may include exercise, paracetamol or NSAIDs, manual therapy, acupuncture, and multimodal rehabilitation (combined physical and psychological treatment); and
- patients with **lumbar disc herniation with radiculopathy** may benefit from spinal manipulation.




[European Spine Journal](#)

July 2016, Volume 25, [Issue 7](#), pp 2000–2022

Management of neck pain and associated disorders: A clinical practice guideline from the Ontario Protocol for Traffic Injury Management (OPTIMa) Collaboration

[Authors](#)

[Authors and affiliations](#)

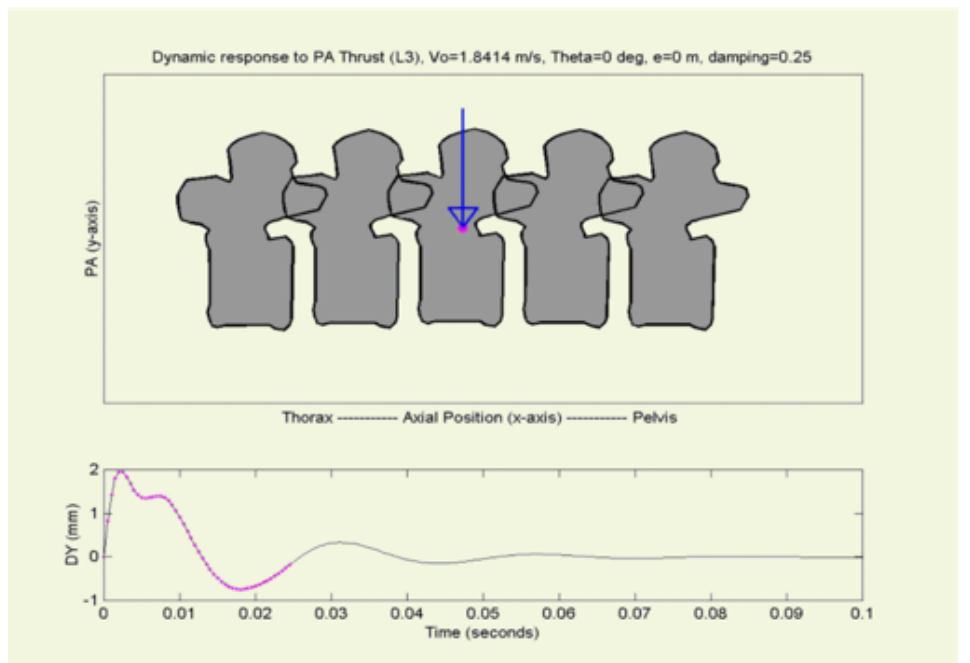
Pierre Côté , Jessica J. Wong, Deborah Sutton, Heather M. Shearer, Silvano Mior, Kristi Randhawa, Arthur Ameis, Linda J. Carroll, Margareta Nordin, Hainan Yu, Gail M. Lindsay, Danielle Southerst, Sharanya Varatharajan, Craig Jacobs, Maja Stupar, [show 14 more](#)

Recommendation 4

- For **NAD grades I–II ≤3 months duration**, clinicians may consider structured patient education in combination with: range of motion exercise, multimodal care (range of motion exercise with manipulation or mobilization) ...

Recommendation 5

- For **NAD grades I–II >3 months duration**, clinicians may consider structured patient education in combination with: range of motion and strengthening exercises, qigong, yoga, multimodal care (exercise with manipulation or mobilization



Waddell G. Keynote address for primary care forum. low back pain: twentieth century health care enigma. Spine 1996; 21:2820-5.

“Medical care for low back pain in the United States is specialist-oriented, of high technology, and of high cost, but 40% of American patients seek chiropractic care for low back pain instead.”



The Global Spine Care Initiative: applying evidence-based guidelines on the non-invasive management of back and neck pain to low- and middle-income communities

Roger Chou^{1,2} · Pierre Côté^{3,4} · Kristi Randhawa^{3,4} · Paola Torres⁵ · Hainan Yu^{3,4} · Margareta Nordin^{6,7} · Eric L. Hurwitz⁸ · Scott Haldeman^{9,10,11} · Christine Cedraschi^{12,13}

Conclusion Guidelines developed for high-income settings were adapted to inform a care pathway and model of care for medically underserved areas and low- and middle-income countries by considering factors such as costs and feasibility, in addition to benefits, harms, and the quality of underlying evidence. The selection of recommended conservative treatments must be finalized through discussion with the involved community and based on a biopsychosocial approach. Decision determinants for selecting recommended treatments include costs, availability of interventions, and cultural and patient preferences.

An aerial photograph of a large, clear blue lake. A prominent peninsula with a mix of green trees and yellowish-brown fields extends into the water. A boat is visible on the lake, leaving a white wake. The surrounding area is densely forested with green trees. The text "Thank You" is overlaid in the center in a large, white, sans-serif font.

Thank You