The Placebo Response:
What’s new?

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Placebos without Deception: A Randomized Controlled Trial in Irritable Bowel Syndrome

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Catechol-O-Methyltransferase val158met Polymorphism Predicts Placebo Effect in Irritable Bowel Syndrome

Kathryn T. Hall, Anthony J. Lembo, Irving Kirsch, Dimitrios C. Ziogas, Jeffrey Douaihy, Karen E. James, Lisa A. Conboy, John M. Kelley, Efthimios Kokkotou, Ted J. Kaptchuk


IBS is one of a number of conditions known to have a high placebo response rate with an average placebo-related global improvement of approximately 40%

Catechol-O-Methyltransferase (COMT)

- The gene encoding an enzyme that metabolizes dopamine and other catecholamines
- Rs4680 encodes a valine (val)-to-methionine (met) change at codon 158 (val158met), resulting in a 3-4 times reduction in enzymatic activity
- Homozygotes of the less-active met allele have been associated with higher levels of dopamine in the prefrontal cortex
Met/met individuals have . . .

Higher levels of performance in cognitive tests which is related to increased sensitivity to experimental and chronic pain relative to val/met and val/val individuals.

Popping and Gapping: 
*The Chiropractic Dance*

Questions . . .

- What causes the sound?
- Is it helpful or harmful?
- Is it necessary to indicate successful treatment of a joint?
Three theories . . .

1. Cavitation

2. Snapping of ligaments/tendons

3. Breaking of intra/extra-articular adhesions

“Cavitation is the process of cavity formation in a fluid when subjected to negative pressure that surpasses the vapor pressure of the liquid”

Cavitation sequence . . .

- Rapid increase in joint volume
- Drops partial pressure of CO₂ within synovial fluid
- Released as gaseous bubbles into the joint space
Change in intraarticular pressure as a result of manipulation leaves it closer to atmospheric pressure.

Cavitation of the synovial fluid is determined by . . .

1. the viscosity of the synovial fluid
2. the state of the joint at the time of the manipulation
3. the relative laxity of the periarticular ligaments
4. the velocity of the manipulation

Determining cavitation location during lumbar and thoracic spinal manipulation: Is spinal manipulation accurate and specific?

Ross JK, Bereznick DE, McGill SM.

Purpose & Design . . .

- Locate the joints that produce an audible sound in response to manipulation (cavitation) during spinal manipulative procedures
- Compare for accuracy
- 64 asymptomatic individuals; 28 clinicians
- Accelerometers were secured to the skin over the spinal column, and the relative time at which each accelerometer detected the vibration from the cavitation associated with the SMT was used to calculate the source of the vibration

Results . . .

- Average error from target of 124 cavitations in lumbar procedures was 5.29 cm (at least one vertebra away from target)
- Of these 124 cavitations, 57 were deemed to be accurate and 67 were deemed to be inaccurate
- In the lumbar spine, SMT was accurate about half the time
- Most procedures were associated with multiple cavitations

Bilateral and multiple cavitation sounds during upper cervical thrust manipulation.

Dunning J, Mourad F, Barbero M, Leoni D, Cescon C, Butts R.

Specificity?

- Bilateral popping sounds were detected in 34 (91.9%) of 37 manipulations while unilateral popping sounds were detected in just 3 (8.1%) manipulations
- Of the 132 total cavitations, 72 occurred ipsilateral and 60 occurred contralateral to the targeted C1–2 articulation
- Therefore, statistically cavitation was no more likely to occur on the ipsilateral than the contralateral side (P = 0.294)


SMT = resisted mammillary-push technique

Conclusion from Cramer et al. 2002 study on gapping

“Spinal adjusting produced increased separation (gapping) of the Z joints. Side-posture positioning also produced gapping, but less than that seen with lumbar side-posture adjusting.”

Quantification of cavitation and gapping of lumbar zygapophyseal joints during spinal manipulative therapy.


Findings . . . .

- Upside SMT and SPP joints gapped more than downside joints
- Upside joints gapped more in men than in women
- Cavitated joints gapped more than those that did not
- Cavitation indicated that a joint had gapped but not how much a joint had gapped.
- SMT resulting in greater gapping than SPP alone

Magnetic Resonance Imaging Zygaphyseal Joint Space Changes (Gapping) in Low Back Pain Patients following Spinal Manipulation and Side Posture Positioning: A Randomized Controlled Mechanisms Trial with Blinding

Cramer GD, Cambron J, Cantu JA, Dexheimer JM, Pocius JD, Gregerson D, Fergus M, McKinnis R, Grieve TJ


Positioning for MRI and Intervention

<table>
<thead>
<tr>
<th>Protocol 1 SPP Group</th>
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NSL = neutral side-lying; SPP = side-posture positioning; SMT = spinal manipulative therapy (adjustment)
Interestingly . . .

For the Protocol 3 group (SMT followed by SPP)

- Only protocol group to show significant improvement in pain, whereas those subjects receiving side-posture SMT and then placed on their backs (Protocol 2) had almost no change in pain following the intervention.
- Lumbar side-posture position may have therapeutic benefit in acute LBP, increasing gapping in patients in acute pain (Protocol 1), and enhancing pain reduction following SMT (Protocol 3).

- The increased gapping that occurred with prolonged SPP (i.e., SPP of approximately 12 minutes) could conceivably promote the break-up of intra-articular Z joint adhesions.
- SMT followed by SPP may also reduce pain by stimulating mechanoreceptors in the Z joint capsules and paraspinal muscles.

Conclusions . . .

- Side-posture positioning showed greatest gapping at baseline.
- After 2 weeks, SMT resulted in greatest gapping.
- Side-posture positioning appeared to have additive therapeutic benefit to SMT.
Side-posture positioning may have added value to SMT in the lumbar spine
There is a relationship to gapping and cavitation
Viscosity can be utilized to allow greater ease in manipulation
Multiple cavitations are common with manipulation
Specificity is not entirely attainable

“Hypomobility results in time-dependent ADH development within the Z joints. Such ADH development may have relevance to spinal manipulation, which could theoretically break up Z joint intra-articular ADHs”
Do Mechanical Characteristics Define Who Responds to Spinal Manipulative Therapy?

Do Participants With Low Back Pain Who Respond to Spinal Manipulative Therapy Differ Biomechanically From Nonresponders, Untreated Controls or Asymptomatic Controls?

Arnold Y. L. Wong, PT, MPhil, PhD, Eric C. Parent, PT, PhD, Sukhvinder S. Dhillion, MB, ChB, CCST, Narasimha Prasad, PhD, and Gregory N. Kawchuk, DC, PhD

SPINE Volume 2015 40, Number 17, pp 1329-1337

Biomechanical Measures . . .

- Spinal Stiffness
- Multifidus Muscle Contraction
- Disc Diffusion
Within- and between-day reliability of spinal stiffness measurements obtained using a computer controlled mechanical indenter in individuals with and without low back pain.

Wong AY, Kawchuk G, Parent E, Prasad N.

Comparison of posteroanterior spinal stiffness measures to clinical and demographic findings at baseline in patients enrolled in a clinical study of spinal manipulation for low back pain.

Owens EF Jr, DeVocht JW, Gudavalli MR, Wilder DG, Meeker WC.


A = Aponeurosis
MT = multifidus muscle
Z = zygapophyseal joint
The thickness ratio calculated as:

\[
\text{thickness contracted (TC) minus thickness at rest (TR) divided by thickness at rest times 100%},
\]

\[
TC - TR / TR \times 100\%
\]

The L3 facet joint was located using US

Reliability of 2 ultrasonic imaging analysis methods in quantifying lumbar multifidus thickness.

Wong AY, Parent EC, Kawchuk GN.

A systematic review of the reliability of rehabilitative ultrasound imaging for the quantitative assessment of the abdominal and lumbar trunk muscles.

Hebert JJ, Koppenhaver SL, Parent EC, Fritz JM.

A specific type of MR imaging referred to as DWI Diffusion Weighted Imaging

Sagittal images were acquired

A specific calculation termed the apparent diffusion coefficient or ADC has been reliably used as a proxy measure of disc diffusion;

the higher the ADC value the more diffusion in the IVD
The within–session change in low back pain intensity following spinal manipulative therapy is related to differences in diffusion of water in the intervertebral discs of the upper lumbar spine and L5–S1.


Comparison of Apparent Diffusion Coefficient and T2 Relaxation Time Variation Patterns in Assessment of Age and Disc Level Related Intervertebral Disc Changes


CPR for Responsiveness to SMT

1. Duration of current episode of symptoms < 16 days
2. Location of symptoms not extending distal to the knee
3. Scores on the Fear Avoidance Behavior Questionnaire (FABQ) work subscale < 19 points
4. At least 1 lumbar spine segment judged to be hypomobile
5. At least 1 hip with more than 35 degrees of medial rotation range of motion (ROM)
Subgrouping Patients With Low Back Pain
Hebert JJ, Koppenhaver SL, Walker BF - (2011)

A posterior-inferior thrust to the patient's pelvis.
A maximum of 2 thrusts were delivered to each side of the subject during each session.

At day 7, individuals in the manipulated group were classified as responders or non-responders based on their self-reported scores on the modified ODI.
Results summary . . .

After SMT application on session 1, decreases in spinal stiffness of participants with LBP were significantly associated with an increased LM thickness ratio at all measured levels as well as with ADC values in the discs of L3–L4 and L4–L5.

Responders to manipulation demonstrated . . .

- Spinal Stiffness
- Multifidus Muscle Contraction
- Disc Diffusion

How often should patients be treated?
Dose-response for chiropractic care of chronic low back pain
Mitchell Haas, DC, Elyse Groupp, PhD, Dale F. Kraemer, PhD


All groups treated chiropractically improved

The effect was strongest for those treated 3-4 times/week and at 3 weeks potentially allowing earlier function than natural history or treatment at fewer frequencies

Positive spin . . .

Dose-response and efficacy of spinal manipulation for care of chronic low back pain: a randomized controlled trial
Mitchell Haas, DC, Darcy Vavrek, ND, David Reavers, DC, Nupur Patel, PT, RN, Dana J. Vavrek, DSc

The Spine Journal 2013
400 participants with nonspecific chronic LBP were randomized.

Four groups of 100 patients assigned... . . .

To receive a dose of 0, 6, 12, or 18 SMT sessions

Two types of treatments . . .

Real Treatment
Spinal manipulative therapy was performed at the assigned number of visits

Sham Treatment
A brief light massage control was performed at non-SMT visits
Example: For a patient assigned to the 12 SMT dose group . . . .

Typical visit . . .

Pain intensity and functional disability at 12- and 24-week end points
Bottom Line?

There were no statistically significant group differences.

Manipulation’s effect was most significant at 12 weeks and at 12 SMT visits.

Pain Reported on a 100 Point Scale

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<th>SMT18</th>
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<td>6 Weeks</td>
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<td>50</td>
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<td>20</td>
<td>10</td>
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</tbody>
</table>
Pain Reported on a 100 Point Scale

- 4 Weeks
- 12 Weeks
- 24 Weeks
- 39 Weeks
- 52 Weeks

Kemp’s Test for Lumbar Facet Joint Pain

*What is it's value?*

Kemp’s Test *aka*...

- Quadrant Test
- Extension-Rotation Test
In a recent survey of Ontario chiropractors stated that they “often/almost always” use the Kemp’s test as a diagnostic procedure for the . . .

Cervical Spine – 82.4%
Thoracic Spine – 69.8%
Lumbar Spine – 82.2%

. . . a multidisciplinary panel of experts consisting of physicians, surgeons, and physical therapists based in Australia and New Zealand was asked to identify indicators of facet joint pain,

One of the items that achieved consensus was
“pain in extension, lateral flexion, or rotation to the ipsilateral side”

A survey at the 2008 annual congress of The European Chiropractors Union indicated that a majority of the European chiropractors in attendance felt that a positive Kemp’s test would be helpful in diagnosing facet syndrome
Yet... a recent survey of faculty members at an American chiropractic college revealed almost half of respondents disagreed with the following statements:

“A positive Kemp's test is a strong indicator that facet syndrome is present” and “A negative Kemp's test is a strong indicator that facet syndrome is not present.”

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Why?

41.5% of respondents considered a positive Kemp's test to be a strong indicator of the presence of a lateral disc lesion, compared to 26.8% who considered it to be a strong indicator of facet syndrome.

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The diagnostic accuracy of the Kemp’s test:
A systematic review

Kent Stuber, BSc, DC, MSc
Caterina Lereide, BSc, DC
Kevyn Kristiansen, BSc, DC
Sandy Sajko, BPE, DC, MSc, RCCSS
Paul Bruno, DC, PhD

J Can Chiropr Assoc 2014; 58(3)
How many articles qualified?

Only 5 articles!

None called the test "Kemp's Test" or "Quadrant Test" all studies referred to the test as extension-rotation test.

None were found for the cervical spine; all were lumbar facet studies.

In innervation of deep spinal structures and facets.

Single diagnostic blocks result in high false-positive rates ranging from 27% to 63%.
Of the five studies . . .

Three studies applied double block injections as the reference standard. The remaining two studies used single block injections as the reference standard. In two of the studies the authors qualified a positive result as the absence of pain exacerbation on extension-rotation.

What do likelihood ratios mean?

LRs = Diagnostic Weights

<table>
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<tr>
<th>LR</th>
<th>Probability Change</th>
<th>Power to RULE IN</th>
<th>Power to RULE OUT</th>
<th>% Change in Probability</th>
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<td>Strong positive test</td>
<td>45%</td>
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<td>LR &gt; 1</td>
<td>No diagnostic value</td>
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<tr>
<td>LR &lt; 0.1</td>
<td>Strong negative test</td>
<td>15%</td>
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Interpreting LRs
However...

The highest $+ \text{LR was } 1.29$
(using 95% pain relief as standard)

The lowest $- \text{LR was } 0.00$
(using 95% pain relief standard)

The best positive predictive value = 43.5% and
the highest negative predictive value was
around 100%

But.....

Sensitivity values averaged across
studies were

$< 50$

and...

The average negative predictive value
was approximately 60%

How is the test performed?

Seated or standing?

Passive or active?

For facet joint or lateral disc?
The researchers’ conclusion . . .

“Currently, the literature supporting the use of the Kemp’s test and indicates that it has poor diagnostic accuracy. It is debatable whether clinicians should continue to use this test to diagnose facet joint pain”.

Derivation of a Clinical Decision Guide in the Diagnosis of Cervical Facet Joint Pain

Geoff M. Schneider, PT, PhD; Guendolen Joll, PT, PhD; Kenneth Thomas, MD, MHS; Ashley Smith, PT; Cameron Travers, PT, PhD; Peter Farris, PhD; Chad Cock, PT, MBA; BS; Ewen Frizzell, MD; Paul Salo, MD

Archives of Physical Medicine and Rehabilitation 2014;95:1695–70

The Clinical Exam Cluster

- Palpation for segmental tenderness [PST]
- Extension–rotation [ER] test
- Manual spinal examination [MSE]
What is the best combination?

Testing positive on all 3 clinical tests, the LR was 4.94 (95% CI, 2.8–8.2), and the posttest probability of a diagnosis of facet joint pain increased from 42% to 78%.

If tested negative on the PST, the LR was .08 (95% CI, .03–.24), and the posttest probability of a diagnosis of facet joint pain decreased to 5%.

Summary . . .

Potential screening tests prior to referring a patient for facet joint blocks include the MSE and PST due to their high sensitivity and a low LR.

The lowest LR was associated with the PST test.

No value based on studies, but possible value as a cluster.

Test in my own practice.
### Patients with Low Back Pain

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<th>Gender</th>
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**Legend:**
- 1 = yes or positive
- 0 = no or negative

**TEST POSITIVE**

**Improved with Manipulation**
Chiropractic Visits and VBA Stroke in the U.S.

Chiropractic care and the risk of vertebrobasilar stroke: Results of a case-control study in U.S. commercial and Medicare Advantage populations

Thomas M Kosloff, David Elton, Jiang Tao, and Wade M Bannister


NECK PAIN

16.4 million visits or 1.5% of all health care visits to hospitals and physician offices
11 million visits
• over 1 million outpatient hospital visits
• 3.3 million emergency department visits
• 445 thousand inpatient hospitalizations

Manipulation and serious adverse events

5 strokes/100,000 manipulations
1.46 serious adverse events/10,000,000 manipulations
2.68 deaths/10,000,000 manipulations

Safety of chiropractic interventions: a systematic review.
Gouveia L, Castanho P, Ferreira J.

Risk of Vertebrobasilar Stroke and Chiropractic Care:
Results of a Population-Based Case-Control and Cross-Over Study
Cassidy JD, Boyle E, Cote P, et al.
Spine 2008;33:S176–S183
There were only 818 VB strokes who were hospitalized!

Matching of hospital records indicating VB stroke with the same patient’s record of a visit to a chiropractor and/or a primary care medical practitioner

Take-Home Points
- In those < 45 years old, individuals were three times more likely to see a chiropractor OR a primary care practitioner (PCP) before their stroke compared to controls.
- There was no increased association between VB stroke and chiropractic visits in those > age 45.
- There was an association between VB stroke and patients of all ages visiting a PCP prior to stroke.
To replicate the case-control epidemiological design published by Cassidy, et al.

Study the association between chiropractic care and VBA stroke

Compare the association between recent PCP care and VBA stroke in samples of the U.S. commercial and Medicare Advantage (MA) populations

Determine the value of utilizing chiropractic visits as a proxy measure for exposure to spinal manipulation

Purpose...

Cause was not studied only the association between stroke, time, and a visit to either a chiropractor or medical doctor

Average annual members

14.7 million for commercial group

1.4 million for the MA group

over the three year study period which is ~5% of the total US population
35,726,224 unique commercial

3,188,825 unique MA members

The largest case–control study to investigate the association between chiropractic manipulation and VBA stroke with a total of 1,829 cases

The designated hazard period in this study was 0 to 30 days prior to the stroke event with analysis at day 1, 7, 14, 30
Prevalence of VBA Stroke

0.021%  0.0032%

Commercial - Most Recent DC Visit

Commercial - Most Recent PCP Visit
Only hypertension had a positive association to dissection.

Cases in both the commercial and MA populations were more likely to have at least one co-morbid condition.
The data indicates that there is no association between chiropractic visits and VBA stroke regardless of age stratification (< 45 or > 45 y/o) in either the commercial or MA populations. There was a significant association between PCP visits and VBA stroke regardless of length of hazard period.

Limitations due to rarity of reporting VBA stroke . . .

Not able to compute estimates specifically for headache and neck pain diagnoses due to small numbers. Insufficient data to calculate estimates and confidence intervals for seven measures for chiropractic visits.

Some limitations . . .

Don’t know which regions were manipulated on each visit.

Don’t know what type of manipulation was used at each visit.

Whether manipulation was even utilized.

What actually occurred at the visit.
What we do know . . .

SMT was not reported by chiropractors in more than 30% of commercial cases

< 70% of stroke cases (commercial and MA) associated with chiropractic care included SMT

And for control groups (commercial = 76%; MA = 88%)

Stated another way . . .

In the commercial population, 20.5% of all VBA stroke cases were associated with either a DC or PCP visit, however, with DC visits it was only 1.6% but for PCP visits it was 18.9%

What about the other 79.5% of cases?

Stated another way . . .

In the Medicare population, 21.6% of all VBA stroke cases were associated with either a DC or PCP visit, however, with DC visits it was only 0.3% but for PCP visits it was 21.3%

What about the other 78.4% of cases?
What about ≈80% of stroke cases not associated with DC or PCP visits?

In the Medicare population only 3 strokes occurred in the 30 day period and none in the first 7 days.

Vertebral artery strains during high-speed, low amplitude cervical spinal manipulation

W. Herzog, T.R. Leonard, B. Symons, C. Tang, S. Wuest

Strain Forces at V1 and V4 Comparing ROM Testing and SMT Testing

Microstructural damage in arterial tissue exposed to repeated tensile strains. 
Rassier D, DiFrancesco LM, Herzog W. 

No damage at 6% strain but . . .

It took 1000 cycles of 30% strain to cause significant microstructural damage to the arterial tissue.
According to the available literature... 

SMT strains range from 0.9–6.2%!

Internal Carotid Artery Strains During High-Speed, Low-Amplitude Spinal Manipulations of the Neck.

Herrex H, Tans C, Leonard T

Similar to VBA testing, ROM testing strains were significantly greater than the corresponding maximal strains for the SMTs.
The mean of all maximal ICA strains obtained with SMTs was 28% of that measured during the ROM testing and was only 10% of the failure strain of the ICA.

Chung CL, Côté P, Stern P, L’espérance G.
J Manipulative Physiol Ther 2014

- Found no epidemiologic studies that measured the incidence of cervical spine manipulation and ICA dissection.
- Found no studies that determined whether cervical spine manipulation is associated with ICA dissection.
- Only several case studies and series that raise the hypothesis.

Basic science evidence AGAINST CMT as potential cause . . .

- Evidence that blood flow is not decreased with rotation.
- Evidence that the strain forces with CMT do not exceed failure rates of arteries.
- Evidence that strain forces with CMT are no greater than normal activities.
The NASS Evidence-Based Guidelines for the Diagnosis and Treatment of Lumbar Radiculopathy

Spine J. 2014 Jan 1;14(1)
An evidence-based clinical guideline for the diagnosis and treatment of lumbar disc herniation with radiculopathy.


The North American Spine Society (NASS) is a group that has historically been a collaborative group of physicians, surgeons, chiropractors, and physical therapists. It has included individuals such as Robin McKenzie, Scott Haldeman, and more recently Anthony Lisi.

Dr. Lisi is the only DC on this guideline workgroup panel.
What constitutes a diagnosis of lumbar radiculopathy?
What is the natural history for lumbar radiculopathy?
What is the evidence for a multitude of commonly used approaches including manipulation, surgery, medication, exercise, etc.?

Question 8: What is the role of spinal manipulation in the treatment of lumbar disc herniation with radiculopathy?

Spinal manipulation is an option for symptomatic relief in patients with lumbar disc herniation with radiculopathy.
Results?

SMT Patients

76.5% (39/51) reported being "much better" or "better" (OR, 1.93) (95% CI, 0.82–4.56)

NRI Patients

62.7% (32/51) reported being "much better" or "better" (OR, 0.52) (95% CI, 0.22–1.23)

Results . . . numerical pain scale

Both treatment groups had significant decreases in their NRS scores at 1 month

60% reduction for the SMT patients

53% reduction for the NRI patients
A Swiss study
A single chiropractic practice in Zürich, Switzerland using a standardized treatment approach
3 doctors of chiropractic
Work closely with the university chiropractic medicine program

Where and Who?

Purpose of study . . . .

A prospective, cohort design:

1. To evaluate patients with LBP and leg pain due to disc herniation treated with HVLA spinal manipulation using outcomes including self-reported global impression of change and pain levels at various time points up to 1 year

2. To determine if outcomes differ between acute and chronic patients
Strength of this study is in the design to compare and confirm examination findings with MRI findings so that other causes of radiation were not likely

Evaluation . . .

- A neurologic assessment consisting of:
  - deep tendon reflexes (L4, L5, and S1)
  - dermatomal sensory testing
  - motor function testing of the lower limb
- A baseline orthopedic examination was also performed including nerve tension signs such as straight leg raising, Bowstring, Braggards, and a Valsalva maneuver
- This was repeated at every follow-up visit

Acute vs. Sub-Acute vs. Chronic

- Acute 54%
- Sub-Acute 21%
- Chronic 25%
Patient Global Impression of Change (PGIC) scale

The PGIC scale is a 7-point verbal scale

1. Much Better
2. Better
3. Slightly Better
4. No Change
5. Slightly Worse
6. Worse
7. Much worse

Only patients with scores of 1 or 2 were considered improved in this study.

Manipulation based on type of herniation?

**Modified Push Adjustment With a Kick**
- Affected side down
- Mammillary contact
- Push from P to A

**Pull Adjustment With a Kick**
- Non-affected side down
- Spinous process contact
- Pull with a kick

**Intraforaminal Disk Herniation**

**Paramedian Disk Herniation**
Foraminal Herniation
Paramedian Herniation

- Gap the foramen on the affected side thereby:
  - inducing more normal movement patterns
  - decreasing the pressure on the disc and nerve
  - releasing adhesions
  - allowing efflux of chemical irritants, and
  - stimulating the receptors in the surrounding tissues
- This is all hypothetical

- Gap the unaffected side but with the same therapeutic goals
- The opening of the foramen was felt to be of lesser importance for these disc herniations

2 Weeks — 4 Weeks — 12 Weeks

- 90%
- 80%
- 70%

Differences . . . .

Although improvements for acute patients seem to stabilize at 3 months, for chronic patients higher percentages of “improvement” occurred at both 6 months (88.6%) and 1 year (89.2%)
The pain and disability scores continued to decrease substantially for both groups up to 3 months.

Stabilized at the 6-month and 1-year time points.

These changes were faster and more dramatic for the acute patients.

Acute patients were 73% more likely to "improve" at 2 weeks.

At both 3 and 6 months, the only predictor of "improvement" was the baseline OPDQ score.

The natural history of sciatica in acute disc herniation patients is normally quite favorable:

36% report major improvement after 2 weeks.

73% having resolution of their leg pain by 12 weeks.
The other patients . . .

- A little over 2% of patients reported feeling worse or slightly worse at 3 months and 1 year follow-up.
- There were no cases of cauda equina.
- 3 patients elected to have surgery even though they reported improvement at one month.
- 1 patient elected to have an epidural injection.
In one recent study . . . . Approximately 63% of patients had a natural reduction in the size of their disk herniation.

Process of resorption . . .

The resorption process requires matrix metalloproteinases (MMPs).

Previously these were called collagenases, gelatinase, stromelysin, and elastase.

Now these are termed MMP-1, MMP-2, MMP-3, and MMP-12 respectively. Specifically, (MMP-3) may be particularly important in disc resorption by generating a bioactive macrophage chemoattractant. This process is terminated by Tissue Inhibitors of metalloproteinases (TIMPs).

MMP/TIMP balance is essential for restoring balance.

Modic changes . . .

Modic changes represent “signal” changes on MRI that indicate endplate and subchondral bone effects that have been tied to disk herniation.
Modic Changes (MC): 3 Types

- **Type I** - decreased signal intensity on T1 and increased signal intensity on T2 weighted images
- **Type II** - increased signal intensity on T1-weighted images and slightly increased or isointense intensity on T2-weighted images
- **Type III** - decreased signal intensity on both T1 and T2-weighted MR images.
Modic Type III Changes

Other features . . .

- Type I MCs are most associated with disc herniations that contain hyaline cartilage from the vertebral endplate.
- MCs in the presence of LDH increase the risk of bacterial infection of the disc.
- May involve loss of proteoglycans from herniated tissue that then "swells" allowing invasion by blood-derived cells that set up an inflammatory reaction with varying degrees of vascularization based on the components of the herniated disc tissue with then may influence resorption.
- Hyaline cartilage, which does not normally swell, will be more resistant to resorption.

Spontaneous Resorption of Lumbar Disc Herniation Is Less Likely When Modic Changes Are Present

Zhi Shan, MD, Shunwu Fan, MD, Qing He, MD, Tim Collect, MD, John Lee, MD, Chang Hong, MD, Song Yang, MD

SPINE 2014; Volume 39 , Number 9 , pp 736 - 744
The type of MCs did not correlate with VAS or ODI scores before or after surgery.

How Long Does It Take For Sensory Complaints To Resolve After Nerve Root Decompression?

The Efficacy of Systematic Active Conservative Treatment for Patients With Severe Sciatica: A Single-Blind, Randomized, Clinical, Controlled Trial

Hanne B. Albert, PT, MPH, PhD, and Claus Manniche, MD, PhD, Med Sci

SPINE 2012, volume 37, number 7, pp 531-542
Most patients in this study would be considered by many medical physicians as *surgical candidates*. 65% of them had 3 or 4 positive nerve root compression signs and 30% had 2 positive signs.

**Comparisons**

**Symptom-Guided**
- **End of Tx:**
  - Motor deficit: 14%
  - Sensory deficit: 35%
- **At 1-Year Follow-Up**
  - Motor deficit: 14%
  - Sensory deficit: 32%

**Sham**
- **End of Tx:**
  - Motor deficit: 37%
  - Sensory deficit: 34%
- **At 1-Year Follow-Up**
  - Motor deficit: 30%
  - Sensory deficit: 48%

The *recovery rate* of sensory symptoms like pain, paresthesia, and numbness after surgical decompression has not been reported in the literature!

Huang P1, Sengupta DK.


Patients divided into STC and LTC

**Short-Term Compression**
- 30/85 patients
- < 6 months
- All patients in the STC group had a HNP and had only discectomy

**Long-Term Compression**
- 55/85 patients
- > 6 months
- 50 patients had lumbar spinal stenosis with or without degenerative spondylolisthesis, and were treated with decompressive lumbar laminectomy with spinal fusion
- Only 5 were treated for HNP with discectomy

Pre-Surgery Complaints by Percentage
Pain Scores at Baseline

Numbness and Paresthesia Scores at Baseline

Improvement Across Both Groups in the Short-Term (6 weeks)

55% decrease in pain
Numbness Score decreased from 78 to 62
Paresthesia Score decreased from 35 to 22
The slope of recovery of paresthesia reached a plateau at 3 months of follow-up, but the numbness recovery slope continued to improve slowly until 1-year follow-up.

Mean Score Improvement at 1-Year

Pain scores decreased by 65%
Numbness scores and paresthesia scores decreased by 37% each

All sensory complaints tended to trend toward faster recovery in the STC group compared to the LTC group.
Percent of Patients with Resolution at 6 Weeks

Inflammation with Acute Compression

The inflammatory irritation with disc herniation may produce a state of hyperexcitability of the nerve tissue causing spontaneous firing.

Removal of the compression combined with a decrease in the local inflammatory reaction may quickly allow nerves to function sooner and symptoms to resolve more rapidly.

The Stenosis Effect
Mechanical Compression

Nerve fiber deformation and demyelination is the main reason for numbness or paresthesia. After decompression, regeneration and remyelination take time to occur delaying recovery even after mechanical compression is relieved.

This may explain the delayed resolution of numbness/paresthesias compared to pain.
Cervical Spine Manipulation for Radiculopathy

OUTCOMES FROM MAGNETIC RESONANCE IMAGING–CONFIRMED SYMPTOMATIC CERVICAL DISK HERNIATION PATIENTS TREATED WITH HIGH–VELOCITY, LOW–AMPLITUDE SPINAL MANIPULATIVE THERAPY: A PROSPECTIVE COHORT STUDY WITH 3–MONTH FOLLOW–UP

Cynthia K. Peterson, RN, DC, M.Med.Ed.a Christof Schmid, DC,b Serafin Leemann, DC,b Bernard Anklin, DC,b and B. Kim Humphreys, DC, PhD

J Manipulative Physiol Ther 2013;36:461–467

63% of asymptomatic athletic males older than 40 years had protruding disks in the cervical spine
Inclusion Criteria

- 18-65 years old
- No contraindications to cervical manipulation
- Neck pain and moderate to severe arm pain in a dermatomal pattern, sensory, motor, or reflex changes corresponding to the involved nerve root
- One of the following positive orthopaedic tests for cervical radiculopathy was required:
  - Positive upper limb tension test
  - Positive cervical distraction test
  - Positive Spurling test
  - Cervical rotation less than 60°
- CDH at the corresponding spinal segment

Exclusion Criteria

- Tumors
- Infections
- Inflammatory spondylarthropathies
- Acute fractures
- Paget disease
- Severe osteoporosis
- Previous spinal surgery
- A history of strokes
- Signs of cervical spondylotic myelopathy or spinal stenosis
- Pregnancy

Measurement Tools

- Numerical Pain Scale
- Neck Disability Index
- Patient Global Impression of Change

When?

- Baseline Measure
- At 2 weeks, 1 month, and 3 months
The PGIC scale is a 7-point verbal scale:

1. Much Better
2. Better
3. Slightly Better
4. No Change
5. Slightly Worse
6. Worse
7. Much worse

*Only patients with scores of 1 or 2 were considered improved in this study.*

**How often?**

3 to 5 times per week for the first 2 to 4 weeks

*and then*

1 to 3 times per week thereafter

until the patient was *asymptomatic.*
Reductions in NRS neck and arm pain scores as well as the NDI scores at 3 months were approximately between 66% and 75%.


Kolstad F, Leivseth G, Nygaard OP.


A higher proportion of acute (< 4 weeks) patients improved faster than those who were sub-acute or chronic.
Predictors of improvement in patients with acute and chronic low back pain undergoing chiropractic treatment.
Peterson CK, Bolton J, Humphreys BK.

One Swiss study concluded that radiculopathy was not a negative predictor of improvement with chiropractic management.

Based on the results of this study . . .

For patients with cervical radiculopathy HVLA is . . .

Safe
Effective