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Prolotherapy is a treatment for chronic nonspecific low-back pain that involves a protocol of ligament injections, exercises, and vitamin and mineral supplements. It is based on the premise that back pain results from weakened ligaments and that these ligaments can be strengthened by the injection into them of irritant proliferant solutions. These solutions variously contain phenol, glycerine, or hypertonic glucose, mixed with local anesthetic, and aim to induce inflammation and deposition of collagen fibers in the weak ligaments. The supplementary regimen of exercises and oral vitamins and minerals ostensibly promote collagen growth to induce optimal strengthening of the treated ligaments.

Conclusions. In chronic non-specific low-back pain, significant and sustained reductions in pain and disability occur with ligament injections, irrespective of the solution injected or the concurrent use of exercises.
The term “lumbosacral transitional vertebra: refers to a total or partial unilateral or bilateral fusion of the transverse process of the lowest lumbar vertebra to the sacrum. An increased prevalence of disc protrusion or extrusion in the disc above the transitional L5 vertebra has been found in patients with low back pain (LBP). Transitional L5 vertebra, a high intercristal line in relation to the L5 vertebra, and a long transverse process were associated with an increased prevalence of disc degeneration at L4-L5. Transitional vertebra L5 may affect the loading conditions at the adjacent motor units and also the degree of disc degeneration and the distribution of degenerative changes. It has been suggested to act as an antitorsional device protecting the L5-S1 disc.

Conclusions. Lumbosacral transitional vertebra increased the risk of early degeneration in the upper disc.
Conclusions: Results of the study supported the retention of the 13 proposed items in a whiplash-specific disability questionnaire. Dependent on the results of further psychometric testing, the WDQ is likely to be an appropriate outcome measure for patients with whiplash.
Scoliotic Curve Patterns in Patients with Chiari I Malformation and/or Syringomyelia  David A. Spiegel  SPINE Volume 28, Number 18, pp2139-2146

A subset of both juvenile and adolescent patients with presumed “idiopathic” scoliosis might have an underlying neurologic abnormality, with or without abnormalities on the history and physical examination. This is most commonly a Chiari I malformation and/or syringomyelia, which are most often diagnosed by magnetic resonance imaging (MRI).

Conclusions. Although the decision to obtain magnetic resonance imaging in a patient with scoliosis should be based on both clinical and radiographic criteria, we suggest that a heightened index of suspicion is warranted with certain curve patterns (left thoracic, double thoracic, triple, and a long right thoracic curve with end vertebra caudal to T12), and with a high or low apex and/or end vertebra, especially in males and patients with a normal to hyperkyphotic thoracic spine.
Predictors of Progression of Scoliosis After Decompression of an Arnold Chiari Malformation John M. Flynn  SPINE Volume 29, Number 3, pp286-292

There is an association between scoliosis and Arnold Chiari I malformations. Factors indicative of progressive scoliosis in children with Arnold Chiari I malformation are larger curve at presentation, later age at neurosurgical decompression, double scoliosis curve patterns, kyphosis, and rotation.
Nociceptive is the term applied to the reception of signals into the central nervous system evoked by activation of specialized sensory receptors that provide information about potential tissue damage. Neuropathic defines these disturbances in somatosensory processing independent of tissue damage that results in pain.

The dorsal nerve roots, DRG, spinal nerve, and greater occipital nerve could incur increased tensile forces during the flexion phase as well as possible impingement of the DRG by the posterior atlantoaxial ligament.

Occipital neuralgia is a diagnostic entity that has well-described clinical features with neuropathic pain aspects, and thus needs to be separated from other occipital pain syndromes. The character of the pain in occipital neuralgia shares many attributes of classic trigeminal neuralgia, with paraspinal lancinating pain in the territory of the greater occipital nerve. The attacks, often triggered by neck movement, usually are unilateral, with some element of underlying aching occipital pain.

The segmental compression of the posterior aspect of these facet joints (pinching action) has the potential for local tissue injury, which could serve as the basis for nociceptive pain. Facet joint capsules are rich in nociceptors that could undergo excitation by motions that exceed physiologic limits.

This study verifies the production of a nonphysiologic S-curve configuration in the C-spine, which results from the whiplash force applied to the intact human cadaver head-neck complex. Flexion at the upper segment may induce increased tensile forces that affect related neural structures, serving as the origin of a neuropathic pain process. Compression motion at the lower-segment facet joints demonstrates a focal component of increased compression in the posterior aspect of the facet joint (pinching), suggesting a risk of local injury, which is the basis of a nociceptive pain process.


Results. The spine initially assumed an S-curve, with the upper spinal levels in flexion and the lower spinal levels in extension. The upper C-spine flexion occurred early in the event (approximately 60ms) during the time the head maintained its static inertia. The lower cervical spine facet joints demonstrated statistically greater compressive motions in the dorsal aspect than in the ventral aspect, whereas the sliding anteroposterior motions were the same.
Conclusions. The nonphysiologic kinematic responses during a whiplash impact may induce stresses in certain upper cervical neural structures or lower facet joints, resulting in possible compromise sufficient to elicit either neuropathic or nociceptive pain.
The cervical spine may undergo a transient abnormal S-shaped motion during whiplash loading. Abnormal increased segmental motions with concomitant sliding and compression in the facet joints before the total physiologic range of flexion-extension is reached has been documented.

Results. In the whiplash-associated disorders group, the C3-C4 and C4-C5 segments showed significantly increased rotational motions. Significantly more women in the whiplash-associated disorders group (35.3%) had abnormal increased segmental motions compared to the insidious onset neck pain group (8.6%).

Conclusion. Hypermobility in the lower cervical spine segments in 12 our of 34 patients with chronic whiplash-associated disorders in this study point to injury caused by the accident.
Results. Patients with whiplash injury had significantly reduced flexion, extension, lateral flexion, and rotation of the neck immediately after injury, as compared with patients with ankle distortion injury.

Conclusions. Neck mobility is reduced immediately after, but not 3 months after, whiplash trauma. Headache and neck mobility are related inversely and neck pain and neck mobility are related inversely during the first 6 months after acute whiplash injury.
Anatomic Study of the Morphology of Human Cervical Facet Joint
Narayan Yoganandan  SPINE 2003 Volume 28, Number 20, pp2317-2323

One hypothesis advanced in the literature is that the lower neck extension induces facet joint impingement, which may lead to cartilage degradation and chronic neck pain.

Because the cartilage is devoid of nerve endings, its direct role is minimal in the ensuing pain process. However, the gap, or the lack of cartilage cover at the ends of the facet joint, as demonstrated in the present anatomic investigation, accentuates the role of this component on the subchondral bone mechanics in traumatic events. If the facet joint opposition is decreased leading to contract with the adjacent processes (because of trauma or physiologic process such as facet compromise caused by degeneration), lack of cartilage cover at the ends reduces the “cushions” normally provided by the cartilage to the subchondral bone.

The finding that the cartilage gap in the dorsal region is greater in females than in males. Epidemiological studies have determined that females are more vulnerable to whiplash-associated disorders such as chronic neck pain. The present finding that the cartilage cover is more extensive in males, less gap, predisposes the female subchondral facet bone to more direct whiplash forces, particularly at the lower cervical spinal levels. Kkaneoka et al. conducted rear impact studies using human volunteers and reported that facet joint impingement occurs secondary to externally applied posteroanterior acceleration. Cusick et al., which conducting rear impact simulations using the human cadaver as the experimental model, indicated that the facet joint undergoes pinching (dorsal compression associated with ventral distraction) and anteroposterior sliding. These authors associated the pinching and sliding kinematics to be a plausible mechanism of injury resulting in neck pain in whiplash. The studies refer to the compress (pinching or impingement) of the dorsal regions of the facet joint during the application of rear impact acceleration.

Posterior compression of the facet joint exposes the dorsal region of the apophyseal anatomy to additional compressive forces. Because the impingement occurs at the dorsal region during lower cervical extension in rear impact and because the cartilage gap in the dorsal region is larger in females, bone-bone contact is more likely in this population. The bony contact between the two adjacent facet surfaces may be a source of abnormality that leads to physiologic dysfunction in females more than in males. The facet joint width is significantly greater in the upper cervical spine (UCS) than in the lower cervical spine (LCS). The facet joint cartilage thickness is significantly greater in males than in females in both LCS and USC. The facet joint cartilage gap depends on the region of the spine (LCS vs UCS), gender (male vs. female), and location (dorsal vs. ventral).
Pain Immediately Upon sitting Down and relieved by Standing Up Is Often Associated With Radiologic Lumbar Instability or Marked Anterior Loss of Disc Space  Jean-Yves Maigne, SPINE Volume 28, number 12, pp1327-1334

Conclusion. Looking for pain immediately on sitting down and relieved by standing up will allow the physician to select a subpopulation of patients with low back pain in whom functional radiography could be usefully performed. The demonstration of instability could lead to improved management of the patients thus selected. A number of specific treatment methods for instability (lumbar muscle strengthening exercise, postural rehabilitation, stabilizing surgery) are available and could be used in these patient.

Patients with low back pain, which occurs immediately on sitting down and is relieved by standing, were studies with functional radiographs. A significant association was found between this symptom and Radiologic signs. Dynamic radiographs showed evidence of instability and/or severe anterior loss of disc space in flexion in 31% and 55% of cases, respectively (controls, 0% and 12.5% respectively). The disc involved were L1-L2 to L4-L5; L5-S1 was never involved. Females accounted for 86% of the patients.

Conclusion. Low back pain occurring immediately on sitting down and relieved on standing up was statistically associated with instability (specificity 100%, sensitivity 31%) or marked anterior loss of disc space in flexion (specificity 87%, sensitivity 55%)
Among available back pain-specific measure of functional status, the Roland-Morris disability questionnaire (RMDQ) is one. The RMDQ is a 24-item questionnaire with a yes/no response format that asks individuals about limitations due to back pain.

Conclusions. This short, simple, self-administered 12-item back-specifid functional status questionnaire performed extremely well in comparison with the original 23-item scale.
The average sagittal diameter of the cervical spinal cord ranges from 5mm to 11.5mm (mean 10mm) as seen on CT and myelography. The average sagittal diameter of the canal from C3 to C7 ranges from 15mm to 25mm (mean 17mm). If the diameter is <13mm, the canal is said to be stenotic, with absolute stenosis being < 10mm. This is based on the standard lateral film taken from a distance of 6 ft.

To avoid magnification variables, Pavlov et al used the ratio of the sagittal diameter of the spinal canal to the sagittal diameter of the vertebral body from a plain radiograph. A value > 1 is regarded as normal; a value <0.82 is said to indicate absolute stenosis.
Conclusion. Whiplash trauma can damage the transverse ligament. By use of high-resolution proton-weighted MR images such lesions can be detected and classified. The reliability of this classification still needs improvement.
The role of pro-inflammatory mediators and cytokines in the pathophysiology of symptomatic degenerative disc disease. Intervertebral disc tissue has been shown to produce a number of inflammatory mediators, including TNF-alpha, interleukin (IL)-1beta, IL-6, IL-8, MCP-1, granulocyte-macrophage colony-stimulating factor (GM-CSF), transforming growth factor-beta (TGF-beta1), basic fibroblast growth factor (bFGF), PLA2, leukotriene B4 (LTB4), and prostaglandin E$_2$ (PGE$_2$).

Sequestrated disc herniations, those from patients with discogenic back pain, and those with associated Modic 1 and 2 changes have been shown to secrete particularly high levels of pro-inflammatory mediators.
Safety of TNF-Alpha Inhibitors, Cush J, Safety of New Biologic Therapies in Rheumatoid Arthritis  Bulletin on the Rheumatic Diseases, 2003; 52(8) Arthritis Foundation

Tumor necrosis factor (TNF)-alpha inhibitors such as etanercept (Enbrel, Immunex Corp.) and infliximab (Remicade, Centocor, Inc.) have altered the therapeutic landscape for rheumatoid arthritis, Ankylosing spondylitis, and Crohn’s disease. They are under evaluation as a treatment for sciatica.
Infusion of the tumor necrosis factor (TNF)-alpha inhibitor infliximab (Remicade, Centocor, Inc.) resulted in a dramatic and nearly instantaneous decrease in leg pain.
Shoulder Impingement After Whiplash Injury, Gorski JM, Schwartz LH.,
Shoulder impingement presenting as neck pain. The Journal of Bone and
Joint Surgery 2003; 85-A(4):635-638
Chauhan SK, Peckham T, Turner R. Impingement syndrome associated
85-B(3): 408-410

Shoulder pain is common after rear-end collisions, with most studies
showing that about 20% of chronic whiplash patients report this symptom.
Shoulder impingement may not appear as should pain, but pain in the
upper back.

They obtained sagittal proton density-weighted MRI images of the craniovertebral junction from 92 whiplash patients and 27 uninjured control subjects. The radiologists graded the images on the tectorial membrane thickness and elongation or rupture of the posterior atlanto-occipital membrane/dura mater complex. In this study, the researchers found that a significant percentage of whiplash patients had objective evidence of torn ligaments when compared to a group of control subjects. For patients with chronic intractable whiplash pain, permanent ligament damage may be the culprit and an MRI of the upper cervical spine may be useful in diagnosing such injuries.

Injury to the ligaments of the cervical spine leads to pain, which is relayed to the spinal cord. Pain for sustained periods can lead to excitation of the sympathetic nervous system, which in turn causes activation of muscle fibers, causing tension, strain on the cervical spine and more pain.

Women report whiplash symptoms more often than do men; this has been documented in the scientific literature for many years. A study by van den Kroonenberg in 1998 found that women had a smaller neck circumference than did men, and that there was a direct correlation between peak head accelerations and neck size – a 20% reduction in circumference increased acceleration 2.5 times. Other researchers have speculated that women, in general, have less muscle mass in their necks than do men, which leaves them more vulnerable to injury in a rear-end collision.

1. The authors found the same s-shaped curve that occurs at about 75 milliseconds in the collision that has been reported in numerous previous studies. This anomalous motion of the spine is thought to be responsible for injury in these types of collisions. The chart above clearly demonstrates this abnormal motion, because while the lower spinal joints (C5/C6 and C6/C7) are extending at about 7 degrees, the upper cervical spine is either slightly extended or even in flexion (C2/C3).

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3. And most importantly, the current study found that the female cadavers experienced significantly greater degrees of motion than did the male specimens.

The accelerations used in this study were very small: the maximum impact was less than 6mph. Even with these very minor impacts, the study found individual spinal rotations of about 7 degrees. According to Grauer et al, normal physiological range of motion for C6/C7 is about 4.1 degree. Based on this study, we can see how even a very low speed impact can result in motions of the cervical spine that can cause ligament stretching and injury.
New data indicate that CRP is a stronger marker for risk than LDL, and both should be considered markers of risk.

Highly sensitive C-reactive protein (hsCRP), the acute-phase reactant that is a marker of infectious and noninfectious inflammation, has emerged as a potential risk factor for future cardiac events. Even moderate elevations in CRP typically present in apparently healthy individuals are also postulated to be strong predictors of the future cardiovascular events. The relationship between increased cardiovascular risk and CRP is based on the premise that inflammation correlates to the presence of atherosclerosis. Research has established that lowering inflammation markers helps to reduce heart-related conditions; however, the exact relationship between inflammation, atherosclerosis, and heart disease still needs further examination.

Vitamin D, which the body manufactures when exposed to sunlight, may help prevent multiple sclerosis and rheumatoid arthritis, two studies suggest, the findings may help explain why the two auto-immune diseases are more common in northern climes, where sunlight is often scarce. Neurology reports that women who take multivitamins containing vitamin D are 40% less likely to develop multiple sclerosis than women who do not. Arthritis & Rheumatism reports that women whose diets were highest in vitamin D had the lowest occurrence of rheumatoid arthritis, another autoimmune disease in which the joints are attached and destroyed.
Modic Type 1 change corresponds to vertebral body edema. Modic Type 2 signal changes reflect fatty degeneration of the bone marrow. Type 3 signal is observed in vertebral bodies with sclerotic changes. Percutaneous biopsies of Type 1 lesions obtained by Modic showed fractures and cracks in vertebral endplates, with replacement of the hematopoietic marrow by richly vascularized fibrous tissue.

Modic Type 1 degenerative lesions correspond to edema of vertebral endplates and subchondral bone that could correspond to microfractures of the cancellous bone and endplate cracks accompanied by increased vascular density, primarily on the ventral side, along with an increase in the number of nerve endings and in the levels of proinflammatory chemical mediators.

In 17 patients with Modic Type 1 change and chronic low back pain resistant to medical treatment administered more than 1 year, instrumented arthrodesis involving only the altered intervertebral segment was followed within 6 months by a change to Modic 0 in four patients and to Modic Type 1 lesions in 13 patients. A good clinical outcome 1 year after surgery was observed in all 17 patients.

The presence of Modic Type 1 signal appears to constitute a reasonable surgical indication if conservative treatment fails.
Cervical Range of Motion Discriminates Between Asymptomatic Persons and Those With Whiplash, Paul T. Dali’Alba, SPINE 2001, Volume 25, Number 19, pp2090-2094

Results. Range of motion was reduced in all primary movements in patients with persistent whiplash-associated disorder. Sagittal plane movements were proportionally the most affected. On the basis of primary and conjunct range of motion, age, and gender, 90.3% of study participants could be correctly categorized as asymptomatic or as having whiplash (sensitivity 86.2%, specificity 95.3%).

Conclusions. Range of motion was capable of discriminating between asymptomatic persons and those with persistent whiplash-associated disorders. (Key words: whiplash injuries, range of motion, articular, neck injuries).
Appropriate muscular control and movement sensation are of vital importance in preventing low back injury. Protection from injury requires an ability to anticipate events and to make suitable muscular responses. The appropriate proprioceptive information from trunk and lower limbs, as well as function motor control of the trunk and lower limbs, is essential in the maintenance of postural stability. Multifidus (MF) muscle denervation and atrophy have been previously reported in patients with lumbar disc herniation, and this may have an effect on muscle receptors and, subsequently, on trunk proprioception.

In conclusion, impaired postural control and lumbar movement perception were observed in sciatica patients. Lumbar proprioception and reflex control of paraspinal muscles seemed to improve after discectomy, indicating that the motor control failure is at least a partially reversible phenomenon. Impaired postural control did not recover after surgery. These results indicate that the full recovery of the impaired motor control of sciatica patients is not automatic after discectomy.

Study Design. A follow-up study evaluating postural control, lumbar movement perception, and paraspinal muscle reflexes in disc herniation-related chronic low back pain (LBP) before and after discectomy.
The Association of Backpack Use and Back Pain in Adolescents, Geraldine I. Sheir-Neiss, *SPINE* 2003, Volume 28, Number 9, pp 922-930

- The use of backpacks during school by adolescents was found to be associated with back pain.
- Adolescents with back pain were more likely to be female, to report poorer general health, and to have a larger body mass index than adolescents without pain.
- Adolescents with back pain were more likely to carry a heavier backpack and to use their backpack more during the school day than adolescents without back pain.
- Adolescents without back pain were more likely to attend schools that had banned the carrying of backpacks between classes.
The natural history of spondylolysis and spondylolisthesis has been studied and debated for years. The fetal incidence has been shown conclusively to be zero. The 6% incidence at adulthood has been verified in additional studies, with some ethnic variation.
Annular tears were associated with most of the LBP parameters studies. However, disc height was associated with all LBP parameters, including sciatica. Of all the potential confounders evaluated, controlling for past 12 months, physical loading increased the association mainly of annular tears and LBP today and 12 months LBP parameters. These changes in the associations could indicate that there exists an interaction between loading and LBP.

Study Design. Retrospective monozygotic twin cohort study.

Objectives. Our goal was to investigate the associations between different spinal MRI findings and current, past year, and lifetime low back pain after adjusting for occupational physical loading, smoking, genetics, and early family influences.

Results. After controlling for age, disc heights was associated with all back pain variables studied and annular tears with LBP frequency and intensity during the 12 months before imaging. Both were associated with life-time frequency of low back pain interfering with daily activities, disability, and intensity of the worst lifetime pain episode. Other MRI findings did not explain the various symptom histories.

This is anatomic evidence that the disc can be a source of pain (nociceptor) because of the innervation that exists (best established in the lumbar region) along the outer annulus from the ventral nerve roots that provide branches anteriorly (grey ramus communicans) and posteriorly (sinuvertebral nerve). There are many other structures in and around the spine that may be nociceptors, and it is often difficult for the clinician to differentiate these potential sources of pain (or when multiple, which is the primary inciting source), especially if there are numerous imaging “abnormalities,” The numerous pain sources have a variety of clinical expressions, which overlap with each other and with other disorders as well.

Degenerated disc are thought to cause pain in several ways, including mechanical instability (stretching of pain fibers), compressive impingement on adjacent nerves (radiculopathy), and biochemical irritation via the release of inflammation mediators.

Disc degeneration is usually heralded by loss of hydration and thus decreased T2 signal on MR imaging. However, focal T2 bright areas reflecting annular tears indicated fragmentation of the outer collagenous AF. Hyper-intense zone (HIZ) is the term that has been coined to denote this finding on T2-weighted MR images. The presence of an HIZ correlates with an annular tear and an approximately 85% chance that there will be concordant pain reproduction at discography.
Cervical Spine Injury and Restraint System Use in Motor Vehicle Collisions, Brian Claytor, MD, SPINE 2004, Volume 29, Number 4, pp 386-389

Key Points
- The combined use of airbag and seatbelt had the greatest protective effect relative to unrestrained occupants.
- Use of a seatbelt only had a protective effect.
- Use of an airbag only neither increased nor decreased the risk of cervical spine injuries.

Context. Cervical spine injury related to motor vehicle collision (MVC) is a severe and often permanently disabling injury. Although advances in automobile crash-worthiness have reduced both fatalities and some severe injuries, the impact of varying occupant restraint systems (seatbelts and airbags) on cervical spine injury is unknown.

Objective. To investigate the relationship between the occurrence of cervical spine injury and occupant restraint systems among front seat occupants involved in frontal MVC’s.

Conclusions. The results of this study suggest that there is an increase in overall protection against cervical spine injury by combining airbag and seatbelt restraint systems relative to seatbelt alone. (Key words: risk factors, cervical spine injury, motor vehicle collision, air bag, restraint systems)
Facet Joint Kinematics and Injury Mechanisms During Simulated Whiplash,
Adam M. Pearson, BA, SPINE, 2004, Volume 29, Number 4, pp390-397

Key Points
1. Peak facet joint compression and facet joint sliding exceeded the physiologic limits at 3.5 and 5 g, respectively.
2. Capsular ligament strains exceeded the physiologic strains at 6.5g and were largest in the lower cervical spine.
3. Peak facet joint compression occurred at maximum intervertebral extension, whereas peak capsular ligament strain occurred after the maximum intervertebral extension had been reached as the facet joint was returning to its neutral position.
4. Facet joint components are at risk for injury during whiplash due to facet joint compression and excessive capsular ligament strain.

Study Design. Facet joint kinematics and capsular ligament strains were evaluated during simulated whiplash of whole cervical spine specimens with muscle force replication.

Summary of Background Data. Clinical studies have implicated the facet joint as a source of chronic neck pain in whiplash patients. Prior *in vivo* and *in vitro* biomechanical studies have evaluated facet joint compression and excessive capsular ligament strain as potential injury mechanisms. No study has comprehensively evaluated facet joint compression, facet joint sliding, and capsular ligament strain at all cervical levels during multiple whiplash simulation accelerations.

Results. Peak facet joint compression was greatest at C4-C5, reaching a maximum of 2.6mm during the 5 g simulation. Increases over physiologic limits (P< 0.05) were initially observed during the 3.5 g simulation. In general, peak facet joint sliding and capsular ligament strains were largest in the lower cervical spine and increased with impact acceleration. Capsular ligament strain reached a maximum of 39.9% at C6-C7 during the 8 g simulation.

Conclusions. Facet joint components may be at risk for injury due to facet joint compression during rear-impact accelerations of 3.5 g and above. Capsular ligaments are at risk for injury at higher accelerations. (Key words: spine, biomechanics, facet joint, capsular ligament, whiplash, injury mechanism)
Patients commonly present with idiopathic musculoskeletal pain. Despite the high incidence and potential consequences of such pain, precise diagnosis and effective treatment are not always easily attained. Additionally, extremely low levels of vitamin D, known as hypovitaminosis D, may be a cause of nonspecific musculoskeletal pain that goes undetected, leading to more severe consequences, such as softening of the bones, which occurs in osteomalacia.

Rates of vitamin D deficiency were “unexpectedly high”, according to the authors, “particularly in this population of nonelderly, nonhousebound, primary care outpatients.” Overall, 28% of patients had severely deficient vitamin D levels; 55% of those individuals were younger than age 55. These deficiencies were similar for men and women, and season was not a significant variable in determining vitamin D levels.
Systematic review of randomized trials assessed whether manipulation and mobilization relieve pain or improve function/disability, patient satisfaction, and global perceived effect in adults with mechanical neck disorders.

Key Points:
- Mechanical neck disorders are common, costly, and can be disabling.
- This systematic review of 33 trials did not favor mobilizations and/or manipulations done alone or combined with other treatments like heat for relieving acute or persistent pain and improving function when compared to no treatment.
- Mobilization and/or manipulation when used with exercise are effective for alleviating persistent neck pain and improving function when compared to those who received no treatment. When compared to one another, neither mobilization nor manipulation was superior.
- There was insufficient evidence available to draw conclusions for mechanical neck disorder with radicular findings.


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Know the ABCs of CRP  Michelle Bridenbaker  Medscape Cardiology 6 (2), 2002. © 2002 Medscape

New data indicate that CRP is a stronger marker for risk than LDL, and both should be considered markers of risk. Highly sensitive C-reactive protein (hsCRP), the acute-phase reactant that is a marker of infectious and noninfectious inflammation, has emerged as a potential risk factor for future cardiac events. Even moderate elevations in CRP typically present in apparently healthy individuals are also postulated to be strong predictors of the future cardiovascular events. The relationship between increased cardiovascular risk and CRP is based on the premise that inflammation correlates to the presence of atherosclerosis. Research has established that lowering inflammation markers helps to reduce heart-related conditions; however, the exact relationship between inflammation, atherosclerosis, and heart disease still needs further examination.

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2


Injury to the ligaments of the cervical spine leads to pain, which is relayed to the spinal cord. Pain for sustained periods can lead to excitation of the sympathetic nervous system, which in turn causes activation of muscle fibers, causing tension, strain on the cervical spine and more pain.

They obtained sagittal proton density-weighted MRI images of the craniovertebral junction from 92 whiplash patients and 27 uninjured control subjects. The radiologists graded the images on the tectorial membrane thickness and elongation or rupture of the posterior atlanto-occipital membrane/dura mater complex. In this study, the researchers found that a significant percentage of whiplash patients had objective evidence of torn ligaments when compared to a group of control subjects. For patients with chronic intractable whiplash pain, permanent ligament damage may be the culprit and an MRI of the upper cervical spine may be useful in diagnosing such injuries.

Human Nucleus Pulposis Can Respond to a Pro-Inflammatory Stimulus
J.F. Burke  SPINE Volume 28, Number 24, pp2685-2693

The role of pro-inflammatory mediators and cytokines in the pathophysiology of symptomatic degenerative disc disease. Intervertebral disc tissue has been shown to produce a number of inflammatory mediators, including TNF-alpha, interleukin (IL)-1beta, IL-6, IL-8, MCP-1, granulocyte-macrophage colony-stimulating factor (GM-CSF), transforming growth factor-beta (TGF-beta1), basic fibroblast growth factor (bFGF), PLA2, leukotriene B4 (LTB4), and prostaglandin E2 (PGE2). Sequestrated disc herniations, those from patients with discogenic back pain, and those with associated Modic 1 and 2 changes have been shown to secrete particularly high levels of pro-inflammatory mediators.

Anatomic Study of the Morphology of Human Cervical Facet Joint
Narayan Yoganandan  SPINE 2003 Volume 28, Number 20, pp2317-2323

One hypothesis advanced in the literature is that the lower neck extension induces facet joint impingement, which may lead to cartilage degradation and chronic neck pain. Because the cartilage is devoid of nerve endings, its direct role is minimal in the ensuing pain process. However, the gap, or the lack of cartilage cover at the ends of the facet joint, as demonstrated in the present anatomic investigation, accentuates the role of this component on the subchondral bone mechanics in traumatic events. If the facet joint opposition is decreased leading to contact with the adjacent processes (because of trauma or physiologic process such as facet compromise caused by degeneration), lack of cartilage cover at the ends reduces the “cushions” normally provided by the cartilage to the subchondral bone.
The finding that the cartilage gap in the dorsal region is greater in females than in males. Epidemiological studies have determined that females are more vulnerable to whiplash-associated disorders such as chronic neck pain. The present finding that the cartilage cover is more extensive in males, less gap, predisposes the female subchondral facet bone to more direct whiplash forces, particularly at the lower cervical spinal levels. Kkaneoka et al. conducted rear impact studies using human volunteers and reported that facet joint impingement occurs secondary to externally applied posteroanterior acceleration. Cusick et al., which conducting rear impact simulations using the human cadaver as the experimental model, indicated that the facet joint undergoes pinching (dorsal compression associated with ventral distraction) and anteroposterior sliding. These authors associated the pinching and sliding kinematics to be a plausible mechanism of injury resulting in neck pain in whiplash. The studies refer to the compress (pinching or impingement) of the dorsal regions of the facet joint during the application of rear impact acceleration.

Posterior compression of the facet joint exposes the dorsal region of the apophyseal anatomy to additional compressive forces. Because the impingement occurs at the dorsal region during lower cervical extension in rear impact and because the cartilage gap in the dorsal region is larger in females, bone-bone contact is more likely in this population. The bony contact between the two adjacent facet surfaces may be a source of abnormality that leads to physiologic dysfunction in females more than in males. The facet joint width is significantly greater in the upper cervical spine (UCS) than in the lower cervical spine (LCS). The facet joint cartilage thickness is significantly greater in males than in females in both LCS and USC. The facet joint cartilage gap depends on the region of the spine (LCS vs UCS), gender (male vs. female), and location (dorsal vs. ventral).
Nociceptive is the term applied to the reception of signals into the central nervous system evoked by activation of specialized sensory receptors that provide information about potential tissue damage. Neuropathic defines these disturbances in somatosensory processing independent of tissue damage that results in pain.

The dorsal nerve roots, DRG, spinal nerve, and greater occipital nerve could incur increased tensile forces during the flexion phase as well as possible impingement of the DRG by the posterior atlantoaxial ligament. Occipital neuralgia is a diagnostic entity that has well-described clinical features with neuropathic pain aspects, and thus needs to be separated from other occipital pain syndromes. The character of the pain in occipital neuralgia shares many attributes of classic trigeminal neuralgia, with paraspinal lancinating pain in the territory of the greater occipital nerve. The attacks, often triggered by neck movement, usually are unilateral, with some element of underlying aching occipital pain.

The segmental compression of the posterior aspect of these facet joints (pinching action) has the potential for local tissue injury, which could serve as the basis for nociceptive pain. Facet joint capsules are rich in nociceptors that could undergo excitation by motions that exceed physiologic limits.

This study verifies the production of a nonphysiologic S-curve configuration in the C-spine, which results from the whiplash force applied to the intact human cadaver head-neck complex. Flexion at the upper segment may induce increased tensile forces that affect related neural structures, serving as the origin of a neuropathic pain process. Compression motion at the lower-segment facet joints demonstrates a focal component of increased compression in the posterior aspect of the facet joint (pinching), suggesting a risk of local injury, which is the basis of a nociceptive pain process.
**Whiplash Syndrome Kinematic Factors Influencing Pain Patterns**  
Joseph F. Cusick  
*SPINE* Volume 26, Number 11, pp1252-1258

Results. The spine initially assumed an S-curve, with the upper spinal levels in flexion and the lower spinal levels in extension. The upper C-spine flexion occurred early in the event (approximately 60ms) during the time the head maintained its static inertia. The lower cervical spine facet joints demonstrated statistically greater compressive motions in the dorsal aspect than in the ventral aspect, whereas the sliding anteroposterior motions were the same.

Conclusions. The nonphysiologic kinematic responses during a whiplash impact may induce stresses in certain upper cervical neural structures or lower facet joints, resulting in possible compromise sufficient to elicit either neuropathic or nociceptive pain.

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**Scoliotic Curve Patterns in Patients with Chiari I Malformation and/or Syringomyelia**  
David A. Spiegel  
*SPINE* Volume 28, Number 18, pp2139-2146

A subset of both juvenile and adolescent patients with presumed “idiopathic” scoliosis might have an underlying neurologic abnormality, with or without abnormalities on the history and physical examination. This is most commonly a Chiari I malformation and/or syringomyelia, which are most often diagnosed by magnetic resonance imaging (MRI).

Atypical curve patterns or curve features.

Conclusions. Although the decision to obtain magnetic resonance imaging in a patient with scoliosis should be based on both clinical and radiographic criteria, we suggest that a heightened index of suspicion is warranted with certain curve patterns (left thoracic, double thoracic, triple, and a long right thoracic curve with end vertebra caudal to T12), and with a high or low apex and/or end vertebra, especially in males and patients with a normal to hyperkyphotic thoracic spine.
Modic Type 1 change corresponds to vertebral body edema. Modic Type 2 signal changes reflect fatty degeneration of the bone marrow. Type 3 signal is observed in vertebral bodies with sclerotic changes. Percutaneous biopsies of Type 1 lesions obtained by Modic showed fractures and cracks in vertebral endplates, with replacement of the hematopoietic marrow by richly vascularized fibrous tissue. Modic Type 1 degenerative lesions correspond to edema of vertebral endplates and subchondral bone that could correspond to microfractures of the cancellous bone and endplate cracks accompanied by increased vascular density, primarily on the ventral side, along with an increase in the number of nerve endings and in the levels of proinflammatory chemical mediators.

In 17 patients with Modic Type 1 change and chronic low back pain resistant to medical treatment administered more than 1 year, instrumented arthrodesis involving only the altered intervertebral segment was followed within 6 months by a change to Modic 0 in four patients and to Modic Type 1 lesions in 13 patients. A good clinical outcome 1 year after surgery was observed in all 17 patients. The presence of Modic Type 1 signal appears to constitute a reasonable surgical indication if conservative treatment fails.
Ito S., Soft tissue injury threshold during simulated whiplash. A biomechanical investigation. Spine 2004;29(9), 979-87

Six fresh-frozen human cervical spine specimens were rear-impacted at horizontal maximum accelerations (3.5, 5.0, 6.5, and 8.0g). Acceleration of 5.0g caused soft-tissue injury with extension as the primary mode of injury, evidenced by a nearly 40% increase in the C5-C6 extension neutral zone. At higher accelerations, injuries spread throughout the lower cervical spine, from C4-C5 to C7-T1. A rear-end collision is most likely to injure the lower cervical spine by intervertebral hyperextension. The mode of injury suggests subfailure injuries of the anterior longitudinal ligament and anterior annulus fibers, along with impingement of the facet joints.

Chronic pain resulting from low-speed collisions may be explained by partial tears of the soft tissues, including anulus fibers, ligaments, and avascular cartilage. Because of poor blood supply, these tissues may not completely heal following injury, resulting in altered cervical spine kinematics that can lead to accelerated degenerative changes and clinical instability.

Mertz RD, Chiropractic Care: Is It A Substitution Care Or Add-On Care In Corporate Medical Plans? J of Occupational and Environmental Medicine 2004: 46 (8): 847-855

Chiropractic Is A Substitute, Not An Add On, To Medical Care

Ng LCL, Sell P: Outcomes Of A Prospective Cohort Study On Peri-Radiculard infiltration For Radicular Pain In Patients With Lumbar Disc Herniation And Spinal Stenosis. European Spine J 2004;13(4):325-29

Steroid Injection Relieves Pain in Disc Herniation Patients Better Than in Stenosis Patients


18 Daily VAX-D Treatment Yield 76% Remission; 9 Gave 43% Relief Vertebral axial decompression (VAS-D) is capable of reducing intradiscal pressure to the negative range.

Improvement, Not Cure, Must Be Accepted By Fusion Patients
Patient satisfaction was 71%; however, only 18.6% of patients followed achieved good or excellent low back outcome scores.
These findings support cautious use of posterior spinal fusion. Patients must appreciate improvement rather than normality as a realistic aim.


Balloon Kyphoplasty Reduces Pain and Increases Quality of Life
Minimally invasive balloon reduction via bilateral transpedicular or extrapedicular approaches followed by polymethyl methacrylate fixation was performed.
Balloon kyphoplasty safely improves vertebral body height and patient quality of life.


Chiropractic Adjustments Superior to Muscle Relaxants Or Placebo In Care Of Subacute Low Back Pain
Researchers compare the relative efficacy of chiropractic adjustments with muscle relaxants and placebo/sham for subacute low back pain.


Discs Adjacent To A spondylolisthesis Slip Degenerate.
This data supports the hypothesis that the disk adjacent to an isthmic slip is predisposed to symptomatic degeneration in the adult patient with axial pain.

The use of tumor necrosis factor (TNF)-alpha inhibitors infliximab (Remicade, Centocor,Inc.) or etanercept (Enbrel, Immunex Corp.) led to dramatic relief of sciatica symptoms in at least six open-label observational studies.
Many observers predicted a new era for sciatica treatment, where pharmacologic management would largely replace surgery and conventional conservative care for those with severe or intractable symptoms.
Some clinics around the world had such confidence in TNF-alpha inhibition that they began offering these treatments to patients with sciatica – before the results of randomized trials came in.
Preliminary analysis of the results of a randomized trial from Finland suggested that the TNF-alpha inhibitor infliximab did not appear to offer significant benefit for patients with moderate to severe sciatica.

Wood K et al., In vivo measurement of intradiscal pressure in healthy thoracic intervertebral discs, presented at the annual meeting of the North American Spine society, San Diego, 2003: as yet unpublished

In both the thoracic spine and the lumbar spine, intradiscal pressures vary significantly by position. The lowest pressures in healthy thoracic disc occurred with the subjects in prone and side-lying positions and the highest pressures with subjects sitting and holding 20-kg weights with the arms flexed.
The lowest intradiscal pressures occurred in the prone and side-lying positions. Significantly higher pressures occurred in sitting, sitting in extension, sitting in flexion and sitting while performing a Valsalva maneuver.
Intradiscal pressures increased dramatically when the researchers asked the subjects to hold 20-kg weights. There were sharp increases in intradiscal pressures when the subjects held the weights while sitting with the arms flexed, and when they stood upright while holding the weights with the arms flexed.