Management of Whiplash Associated Disorders

International Chiropractors Association of California
The participants in the guidelines development process undertaken by the ICAC are:

Charles G. Davis, DC – Editor
Joe Betz, DC
Art Croft, DC, MS, MPH, FACO
Ed Cremata, DC
Deed Harrison, DC
Hugh Lubkin, DC
John Maltby, DC
Dan Murphy, DC, DABCO
James Musick, DC
Bryan Gatterman, DC, DACBR
Shad Groves, DC, DACNB

Management of Whiplash Associated Disorders
Copyright © 2009 by International Chiropractors Association of California

All rights reserved. No part of this book may be reproduced or transmitted in any form or by any means without written permission from the author.

Printed in USA

ICA of California
9700 Business Park Drive #305
Sacramento, CA 95827
800-275-3515
Introduction

Injuries from whiplash may give rise to an array of symptoms and complaints. This document is a combination of research and clinical experience for the primary practitioner in a whiplash case.

This document provides a structure for the assessment and treatment of people with WAD during the first 12 weeks following injury and additional care in chronic cases. This document offers a summary of how to apply the recommendations.

As an individual patient can be considered a case study, all levels of evidence were considered, not just randomized control trials.

The Institute of Medicine defines clinical practice guidelines as “Systematically developed statements to assist practitioners’ and patient decisions about appropriate health care for specific clinical circumstances”. Guidelines are also known as “parameters, practice protocols, practice standards, review criteria and preferred practice patterns”


Medicare utilization review (UR) protocols, which were statutorily required to be based upon “Professionally developed norms of care, diagnosis, and treatment based upon typical patterns of practice.” (Public Law 92-603, Section 249f, 42 United States Code, Section 1301).

In this document the maxima guidelines are that considered in a complicated case.

Most injuries should not require the maxing out of these guidelines.

Guidelines are designed to support the decision-making processes in patient care. The content of a guideline is based on a systematic review of clinical evidence - the main source for evidence-based care.

Purposes of guidelines

- To describe appropriate care based on the best available scientific evidence and broad consensus;
- To reduce inappropriate variation in practice;
- To provide a more rational basis for referral;
- To provide a focus for continuing education;
- To promote efficient use of resources;
- To Act as focus for quality control, including audit.

It is a guide only and there will always be individual variations.
Management of Whiplash Associated Disorders

I. Introduction

Each patient is an N of 1 clinical trial. An N of 1 is a clinical trial in which a single patient is the entire trial, a single case study.

We found little evidence that estimates of treatment effects in observational studies reported after 1984 are either consistently larger than or qualitatively different from those obtained in randomized, controlled trials.


The results of well-designed observational studies (with either a cohort or a case-control design) do not systematically overestimate the magnitude of the effects of treatment as compared with those in randomized, controlled trials on the same topic.


The outcomes of the 12 large randomized, controlled trials that we studied were not predicted accurately 35 percent of the time by the meta-analyses published previously on the same topics.


As with many interventions intended to prevent ill health, the effectiveness of parachutes has not been subjected to rigorous evaluation by using randomized controlled trials. Advocates of evidence based medicine have criticized the adoption of interventions evaluated by using only observational data. We think that everyone might benefit if the most radical protagonists of evidence based medicine organized and participated in a double blind, randomized, placebo controlled, crossover trial of the parachute.

Individuals who insist that all interventions need to be validated by a randomized controlled trial need to come down to earth with a bump.


There are perhaps 30,000 biomedical journals in the world, and they have grown steadily by 7% a year since the seventeenth century. Yet only about 15% of medical interventions are supported by solid scientific evidence.

Whiplash Injury

Evidence supports an organic basis for acute and chronic whiplash injuries. A review the anatomical sites within the neck that are potentially injured during these collisions. Include — facet joints, spinal ligaments, intervertebral discs, vertebral arteries, dorsal root ganglia, and neck muscles.

Clinically, whiplash patients present with neck, shoulder, or back pain; headaches; dizziness; paresthesias; vertigo; or cognitive/psychological symptoms.

The cervical facet joints are the most common source of neck pain.

There are two facet joints between each pair of cervical vertebra from C2 to C7. The facet joint is a synovial joint enclosed by a thin, loose ligament known as the facet capsule. A synovial fold on the inner capsule extends between the margins of the articulating bony surfaces. Cervical facet joints are innervated by the medial branches of the dorsal primary ramus from the two levels surrounding each joint. Several histologic and anatomic studies have identified mechanoreceptors and unmyelinated nociceptors in the cervical facet joint. The facet capsule also contains Aδ- and C-fibers, both of which transmit nociceptive signals; i.e., pain.

Nociceptors reactive for substance P and calcitonin gene-related peptide have also been identified in the cervical facet capsules.

Magnetic resonance and autopsy studies of whiplash patients have documented injuries to the neck ligaments and intervertebral discs in addition to the facet joints.

Whiplash-related symptoms may be due, in part, to injuries of cervical ligaments and discs and their embedded mechanoreceptive and nociceptive nerve endings. Ligament injuries may cause acute neck pain and lead to chronic spinal instability, and injured echanoreceptors may corrupt normal sensory signals and could lead to abnormal muscle response patterns and decreased neck mobility and proprioception.

No significant correlation was found between delta-V and the QTF grade for any of the collision types. There was no delta-V threshold associated with acceptable sensitivity and specificity for the prognosis of a cervical spine injury.


Analysis of data revealed that the rear impact vector crash resulted in 2.8 times greater head linear acceleration than frontal crashes. Rear impact crashes resulted in biphasic, complex kinematics compared to the monophasic, less complex frontal crashes. Rear impact crashes were rated markedly less tolerable. Croft AC, Haneline MT, Freeman MD. Low speed frontal crashes and low speed rear crashes: is there a differential risk for injury? Annu Proc Assoc Adv Automot Med. 2002;46:79-91.

A substantial number of injuries are reported in crashes of little or no property damage. Property damage is an unreliable predictor of injury risk or outcome in low velocity crashes. Croft AC, Freeman MD. Correlating crash severity with injury risk, injury severity, and long-term symptoms in low velocity motor vehicle collisions. Med Sci Monit. 2005 Oct;11(10):RA316-21.

Healing

Phase I (acute inflammation) occurs during the first 72 hours. There is hematoma formation and acute inflammation manifested by swelling, redness, warmth, and pain.

Phase II (repair and regeneration) lasts from 48 to 72 hours after the injury until approximately six weeks after the injury. It is characterized by subsidence of inflammation and the beginning of healing.

Phase III (remodeling) requires 12 months or more to become maximal. The healing ligament becomes increasingly contracted, and demonstrates increasing tensile strength. The exact timing is unknown in humans but laboratory studies (including some in primates) indicate that maximum ligament scar maturation is not achieved before 12 months. Even then, the original tensile strength is not regained (50% to 70% is the probable range).

Range of Symptoms from Whiplash

**Generalized hypersensitivity**

Those with whiplash symptoms may have a generalized hypersensitivity, extending as far as the lower limbs, when compared with healthy volunteers.

It was suggested that WAD might lead to spinal cord hyperexcitability causing exaggerated pain on peripheral stimulation.

---

**Hypersensitivity**

Central hypersensitivity may explain exaggerated pain in the presence of minimal nociceptive input arising from minimally damaged tissues.


There is evidence for spinal cord hyperexcitability in patients with chronic pain after whiplash injury and in fibromyalgia patients. This can cause exaggerated pain following low intensity nociceptive or innocuous peripheral stimulation. Spinal hypersensitivity may explain, at least in part, pain in the absence of detectable tissue damage.


Findings demonstrate generalized hypoesthesia in acute whiplash associated disorders suggesting adaptive central nervous system processing mechanisms are involved, regardless of pain and disability.


Sensory hypoesthesia and hypersensitivity co-exist in the chronic whiplash condition. These findings may indicate peripheral afferent nerve fiber involvement but could be a further manifestation of disordered central pain processing.


Patients with chronic whiplash syndrome may have a generalized central hyperexcitability from a loss of tonic inhibitory input (disinhibition) and/or ongoing excitatory input contributing to dorsal horn hyperexcitability.


---

Range of Symptoms from Whiplash

**Neck pain**

Neck pain is the most commonly reported symptom of WAD. Furthermore, specific segmental zygapophyseal (facet) joint blocks have demonstrated that the neck and surrounding tissues are the most common source of chronic pain for people with WAD. People involved in a rear end motor vehicle accident found the most commonly reported symptom was neck pain, followed by headache, neck stiffness, low back pain, upper limb symptoms, dizziness, nausea and visual problems. Tinnitus, temporomandibular joint pain, paraesthesia and concentration or memory disturbance may also be experienced.

**Radiating pains to the head, shoulder, arms or interscapular area**

Radiating pains to the head, shoulder, arms or interscapular area are often reported at some time post injury. These patterns of somatic referral do not necessarily indicate which structure is the primary source of the pain but rather suggest a referred type of pain from the facets or discs in the cervical spine.

**Referred pain**

Literature on referred pain goes back to Henry Head in 1894. More recent studies have investigated referred pain from spinal structures including the facets and discs.


Range of Symptoms from Whiplash

Headache

Headache is the second most common symptom, often in the sub-occipital region with referral to the temporal area. These areas are innervated from the upper cervical levels and it was found that 50% of people complaining of headaches had pain arising from the C2/C3 segmental level.

Chronic daily headache (CDH) is defined by headache on 15 or more days per month.

Trauma to the cervical spine is probably the most important single factor in the causation of chronic headaches. Trauma produces a mechanical derangement of the structures of the cervical spine which may involve the cervical nerve roots, the cervico-cranial autonomic system, and/or the vertebral vessels. Chronic headache can be prevented by early recognition of the cervical lesion as the cause of the headache followed by adequate treatment directed towards the cervical spine.


Headache

Upper cervical pain and/or headaches originating from the C0 to C3 segments are pain-states that are commonly encountered in the clinic. The upper cervical spine anatomically and biomechanically differs from the lower cervical spine. Patients with upper cervical disorders fall into two clinical groups: (1) local cervical syndrome; and (2) cervicocephalic syndrome. Symptoms associated with various forms of both disorders often overlap, making diagnosis a great challenge. The recognition and categorization of specific provocation and limitation patterns lend to effective and accurate diagnosis of local cervical and cervicocephalic conditions.


This prospective study shows an association of low cervical prolapse with cervicogenic headache: headache and neck pain improves or disappears in 80% of patients after surgery for the cervical disc prolapse. These results indicate that pain afferents from the lower cervical roots can converge on the cervical trigeminal nucleus and the nucleus caudalis.


Anterior cervical discectomy and fusion appears to be quite effective for discogenic cervical headache, but should be reserved for patients who are extremely impaired and refractory to all other treatments.


Head or neck injury increases the risk of chronic daily headache.


The risk of developing post-traumatic chronic daily headache is greater for less severe head injury compared with moderate/severe head injury.

Couch JR. Headache 2001
Visual disturbances

Visual disturbances are mentioned in the literature. Whiplash was associated with defective accommodation in the present select group of whiplash subjects. Oculomotor function seems to be impaired in patients with chronic symptoms of whiplash injury of the cervical spine. The smooth pursuit neck torsion test to identify eye movement disturbances in patients with whiplash are likely to be due to disturbed cervical afferentation. Visual disturbances occur in 10 to 30% of whiplash patients with blurred vision the most common symptom.

Proprioceptive control of head and neck position

Proprioceptive control of head and neck position has been found to be reduced in people after whiplash injury. Individuals who have sustained a whiplash injury may have proprioceptive deficits that do not allow them accurately or reliably to calculate head position. This may be detrimental to their everyday function. The central nervous system (CNS) uses the information provided by the proprioceptors to build up an internal reference frame of our musculoskeletal system and to recalibrate it. Rehabilitation after whiplash injury should focus not only on range of motion and strength but on postural awareness.

Vertigo/Dizziness

Post-traumatic vertigo refers to dizziness that follows a neck or head injury. There are many potential causes of post-traumatic vertigo. Whiplash clinically is similar to post concussion syndrome, but with the addition of neck complaints. Dizziness occurs in 20-60%.

Impaired cognitive function

Cognitive function may be impaired in WAD with symptoms as a result of mild traumatic brain injury, chronic pain, chronic fatigue or depression. The cervicoencephalic syndrome is characterized by headache, fatigue, dizziness, poor concentration, disturbed accommodation (eye movements), and impaired adaptation to light sensitivity.


The proprioceptive deficit caused by a ligament injury rarely is due only to sensory and mechanical dysfunction of the ligament.

A ligament injury is often accompanied by damages to other joint structures, e.g. the joint capsule and menisci, implying that the disturbed sensory feedback from these structures are likely to contribute to the reported proprioceptive deficits.

Even in the cases of an isolated ligament injury, contributing effects from the surrounding tissue cannot be excluded since the sprained or ruptured ligaments induce alterations of the normal biomechanics of the joint.

Thereby the loads imposed on different joint structures and muscles will change, causing altered sensory feedback from mechanoreceptors within and around the joints.


The data support the notion of a causal connection between the disturbed posture control system and some cognitive malfunctions.

Thoracic outlet syndrome

There are various names for thoracic outlet syndrome (TOS) including: cervical rib, scalenus anticus, costoclavicular, hyperabduction, pectoralis minor, bachiocephalic, and fractured clavicle-rib syndromes, nocturnal parasthetic brachialgia, and effort vein thrombosis. Common whiplash TOS symptoms include: nausea, dizziness, numbness, aching pain, disorientation, neck stiffness, arm heaviness, incapacitating headache, easy fatigability of the arm, tingling and numbness in the ulnar aspect of the hand.

Complex Regional Pain Syndrome 1 (Reflex sympathetic dystrophy)

- Pain: 93%
- Hyperesthesia: 75%
- Hypesthesia: 69%
- Muscular incoordination: 54%
- Tremor: 49%


Double Crush Syndrome

Double crush syndrome means that nerves being irritated up in the neck or at some proximal location like the thoracic outlet (in the shoulder) are causing a peripheral nerve entrapment like carpal tunnel or ulnar entrapment at the elbow.

The hypothesis was that neural function could be impaired when single axons, having been compressed in one region, become especially susceptible to damage in another. They postulated that nonsymptomatic impairment of axoplasmic flow at more than one site along a nerve might summate to cause a symptomatic neuropathy. This was suggested by their clinical observation that the majority of their patients had a median or ulnar neuropathy associated with evidence of cervicothoracic root lesions.


Cervical spondylosis and disc prolapsed in patients with C5-C6 and C6-C7 were on the same side as the symptoms in the wrists in 50% of the cases.

The higher incidence of narrowed cervical foramens in the patient patients and the concordance with affected nerve roots on the same side of CTS, supports the hypothesis of a double crush phenomenon.

Structures Injured

Cervical Facets

The high yield of positive responders in this study probably reflects the propensity of patients with facet joint syndromes to gravitate to a pain clinic when this condition is not recognized in conventional clinical practice.


Both a symptomatic disc and a symptomatic zygapophysial joint were identified in the same segment in 41% of the patients.


Painful joints were identified in 54% of the patients (95% confidence interval, 40% to 68%). In this population, cervical zygapophysial joint pain was the most common source of chronic neck pain after whiplash.


Compared to a neutral head posture, the maximum principal strain in the facet capsule doubles on the side toward which the head is turned. Excessive capsular strains experienced by some individuals during some whiplash conditions may be responsible for painful capsular whiplash injury.


Facet joint components may be at risk for injury due to facet joint compression during rearimpact accelerations of 3.5 g and above. Capsular ligaments are at risk for injury at higher accelerations.


Cervical Facets

Diagnostic blocks are a valid technique in the identification of painful zygapophysial joints.


The evidence obtained from literature review suggests that controlled comparative local anesthetic blocks of facet joints (medial branch or dorsal ramus) are reproducible, reasonably accurate and safe. The sensitivity, specificity, false-positive rates, and predictive values of these diagnostic tests for neck and low back pain have been validated and reproduced in multiple studies.


Manual diagnosis by a trained manipulative therapist can be as accurate as can radiologically-controlled diagnostic blocks in the diagnosis of cervical zygapophysial syndromes.


Stretching the facet joint capsule beyond physiological range could result in altered axonal morphology that may be related to secondary or delayed axotomy changes similar to those seen in central nervous system injuries where axons are subjected to stretching and shearing. These may contribute to neuropathic pain and are potentially related to neck pain after whiplash events.

Clinical evidence suggests that disc injury and accelerated degeneration are common in whiplash patients.

Cervical Discs

Microdissection and histologic studies were undertaken to determine the innervation of the cervical intervertebral discs. The cervical sinuvertebral nerves were found to have an upward course in the vertebral canal, supplying the disc at their level of entry and the disc above. Branches of the vertebral nerve supplied the lateral aspects of the cervical discs. Histologic studies of discs obtained at operation showed the presence of nerve fibers as deeply as the outer third of the anulus fibrosus.


Nerve fibers appeared to enter the disc in the posterolateral direction and course both parallel and perpendicular to the bundles of the anulus fibrosus. Nerves were seen throughout the anulus but were most numerous in the middle third of the disc. Receptors resembling Pacinian corpuscles and Golgi tendon organs were seen in the posterolateral region of the upper third of the disc. These results provide further evidence that human cervical intervertebral discs are supplied with both nerve fibers and mechanoreceptors.


Cervical Discs

The results of recent experimental studies suggest that an injury to the anulus causes secondary cellular reaction in the nucleus pulposus, similar to the process observed in human disc degeneration.


A high incidence of discoligamentous injuries was found in whiplash-type distortions. Most patients with severe persisting radiating pain had large disc protrusions on MRI that were confirmed as herniations at surgery.


Excessive 150° fiber and disc shear strain occurred during simulated whiplash. These strains were greatest at the posterior region of the C5-6, and clinical data suggests that this is the most common location for disc herniation in whiplash patients. Disc injury may be the cause of acute pain and muscle spasm during the trauma, it could also lead to disc degeneration, facet osteoarthritis, and chronic neck pain.


The disc injuries occurred at lower impact accelerations during rear impact as compared with frontal impact. The subfailure injuries of the cervical intervertebral disc that occur during frontal impact may lead to the chronic symptoms reported by patients, such as head and neck pain.

Upper Cervical Structures

MRI shows structural changes in ligaments and membranes after whiplash injury, and such lesions can be assessed with reasonable reliability. Lesions to specific structures can be linked with specific trauma mechanisms. There is a correlation between clinical impairment and morphologic findings.

Whiplash trauma can damage soft tissue structures of the upper cervical spine, particularly the alar ligaments.


Whiplash patients who had been sitting with their head/neck turned to one side at the moment of collision more often had high-grade lesions of the alar and transverse ligaments. Severe injuries to the transverse ligament and the posterior atlanto-occipital membrane were more common in front than in rear end collisions. The patients who had the head rotated at the instant of collision had more often high-grade MRI changes of the alar ligaments than those with the head in a neutral position. A total of 61.7% of the patients with rotated neck position had alar ligament grade 3 lesions, as opposed to only 4.4% in the patient group with neutral neck position.


Reliable assessment of the anatomy and function of the alar ligament can be achieved with MR imaging, preferably in coronal planes. MR imaging with the aid of a functional study may be a valuable imaging modality in the evaluation of alar ligament failure.


High-signal changes of the alar and transverse ligaments are common in WAD1-2 and unlikely to represent age-dependent degeneration.


Whiplash trauma can damage the transverse ligament. By use of high-resolution proton-weighted MR images such lesions can be detected and classified.


The results for the membranes appeared somewhat better than for the ligaments. When there was disagreement, the classifications obtained by the clinical test were significantly lower than the MRI grading, but mainly within one grade difference. When combining grade 0-1 (normal) and 2-3 (abnormal), the agreement improved considerably (range 0.70-0.90). Although results from the clinical test seem to be slightly more conservative than the MRI assessment, we believe that a clinical test can serve as valuable clinical tool in the assessment of WAD patients.

Structures Injured

Shoulder Pain

52.6% of subjects with late whiplash syndrome had periarticular disorders of the shoulder joint and shoulder pain that was exaggerated by shoulder movement and tenderness in the tendons of the rotator cuff or the biceps tendon.


The shoulder is affected by irritation of a cervical nerve root or referred pain. The anteroposterior diameter of the spinal canal at C5 and C6 in the painful-shoulder group was significantly narrower than in the control group.


There is evidence that the acromioclavicular joint of the seat-belt shoulder may be injured during an road traffic accidents. The joint involved was significantly more likely to be on the side restrained by the seat-belt. The acromioclavicular joints should be checked for involvement following whiplash injuries, particularly in women.

_Saunders L. Acromioclavicular joint sprain and its prevalence with whiplash injuries. Physiotherapy 2001; 87(11);587-592._

Whiplash injuries can result in indirect acute shoulder trauma, possibly through an acceleration-deceleration mechanism, and may be a distinct entity.


This study showed an incidence of 22% of shoulder pain after whiplash injury and is comparable with other studies.


Symptoms from the temporomandibular joint

Symptoms from the temporomandibular joint have been reported in the literature related to WAD. Symptoms of TMJ induced by whiplash may include headache, dizziness, and deep ear pain, pressure behind the eyes, earaches and stiff neck. TMJ symptoms will appear as an inability to open the jaw fully, a clicking or snapping of the jaw and changes in alignment when the jaw is opened or closed.

Observations suggest an association between neck injury and disturbed jaw function and therefore impaired eating behavior.


The TMJ and surrounding musculature should be examined similarly to other joints, with no preconceived notion that TMD pathology after whiplash is unlikely.


_Symptoms from the temporomandibular joint_
**Structures Injured**

**Low back pain**

Low back pain occurs in approximately 50% of these cases. Compression with biphasic lumbar spinal motions (increased/decreased lordosis) may cause injuries in the lumbar spine.

**Lower back pain is associated with whiplash trauma**

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>% with Low Back Complaints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cassidy et al</td>
<td>2003</td>
<td>61</td>
</tr>
<tr>
<td>Berglund et al</td>
<td>2001</td>
<td>20</td>
</tr>
<tr>
<td>Squires</td>
<td>1996</td>
<td>48</td>
</tr>
<tr>
<td>Sturzenegger</td>
<td>1995</td>
<td>46</td>
</tr>
<tr>
<td>Radanov et al</td>
<td>1994</td>
<td>39</td>
</tr>
<tr>
<td>Magnusson</td>
<td>1994</td>
<td>47</td>
</tr>
<tr>
<td>Teasel</td>
<td>1993</td>
<td>40</td>
</tr>
<tr>
<td>Hildingson</td>
<td>1990</td>
<td>25</td>
</tr>
<tr>
<td>Hohl</td>
<td>1974</td>
<td>35</td>
</tr>
</tbody>
</table>

**Low Back Pain in Acceleration/Deceleration Collisions**

**Lumbar spine injury mechanisms**

Lumbar Spinal Strains Associated with Whiplash Injury, reported that up to half of the persons involved in these accidents (rear-end collisions) may develop low back pain but the mechanisms leading to and sustaining the low back pain still remain unclear as there is scant biomechanical data dealing with the low back after whiplash injuries.

Following a rear-end collision injury mechanisms include traction (tensile stretching) and compression together with shear forces affecting lumbar vertebrae, and that the forces could produce soft tissue injuries to muscles, ligaments, capsules.


---

From a standing to sitting position, the lumbar lordosis decreases by on average 38°

Evaluation - Initial

History & Physical Examination
Diagnostics & Imaging

Classify WAD grade
Assess Pain – Pain Scale (VAS/NPS) and Disability – Neck Disability Index (NDI) Pain Drawing

Define WAD grade
WAD I  WAD II  WAD III

Apply recommended treatments
• Mobilization/Manipulation
• Modalities/ Exercise/Nutrition
• Prescribed Functional Activities

7 Days

Improving
Continue recommended treatments

Not Improving
(VAS/NPS and NDI still high)
Consider more concerted treatment. Other treatments therapies may be considered

3 Weeks

Reassess
(Should include VAS/NPS and NDI, may include a psychological measure (for e.g., IES)

Improving
Continue recommended treatments

Not Improving
(e.g., VAS and NDI still high/unchanged)
Consider refer to Specialist: Specialist exam should include specialized physical examination

6 Weeks

Reassess
(Should include VAS/NPS and NDI, may include IES)

Resolving
Reduce treatment

Not Resolving
VAS/NPS and NDI still high/unchanged)
Refer to Specialist: Specialist exam should include specialized physical examination

Resolved – cease treatment

3 Months

Resolution expected (≈ 50%)
Discharge from care
or
Treatment as needed

Not Resolving (≈ 50%)
Follow recommendation from whiplash specialist and ensure coordinated care. Special studies (VF, MRI ect.)
**Initial Assessment**
Classify the injury Whiplash (WAD) injury. Although higher WAD grades indicate greater severity, poor prognosis is most likely associated with a high Visual Analogue Scale (VAS)/numeric pain score (NPS) >7/10 or high Neck Disability Index (NDI) score (>20/50). The SF-36 may be also be used. Orthopedic & neurological examination. Clinician determines imaging necessity. Apply recommended treatments.

**Seven Day Reassessment**
Reassess, including the VAS/NPS and NDI. If the VAS/NPS and NDI are high or unchanged, treatment type and intensity should be reviewed. Other treatments may be considered. The effectiveness of such treatments should be closely monitored and only continued if there is evidence of benefit (at least 10% change on VAS and NDI).

**Three Week Reassessment**
Reassess, including the VAS/NPS and NDI. If the VAS/NPS and NDI are unchanged, a more complex assessment may need to be considered and treatment type and intensity should again be reviewed. The Impact of Event Scale (IES) may be used as a baseline for psychological assessment. Other recommended scales can be used. If pain and disability are still high (VAS, NPS >5.5) and NDI (>20/50) or unchanged, consider referral to a specialist in Whiplash Associated Disorders (WAD).

A specialist is considered a practitioner with specialized expertise in the management of WAD. These may include chiropractors, medical physicians, pain medicine specialists and other physicians who specialize in WAD. Among other things, if the VAS/NPS and NDI are unchanged, the specialist should undertake a more complex physical and/or psychological examination. They should direct more appropriate care and liaise with the treating practitioner to ensure this is implemented.

**Six Week Reassessment**
Reassess again at this point. In at least 30% of cases resolution should be occurring, and the process of reducing treatment in these cases should commence or continue. If resolution is not occurring and the VAS/NPS and NDI have not changed by at least 10% from the last review, specialist care should still be followed, or a specialist should be referred to if this has not already been done. Prescribe home programs for functional improvement. Consultation with a whiplash specialist may be needed if pain or disability are still high (VAS, NPS > 5.5, NDI > 20/50) or unchanged.

**Three Month Reassessment**
Assessment should Include VAS/NPS and NDI. Resolution usually occurs in approximately 50% of cases. If the patient is still improving, continue treatment; independence should be promoted (e.g., focus on active exercise). In these resolving cases, the patient should be reviewed intermittently over the next six to 12 months until resolution. Prescribe home programs to maintain improvement. Consultation with a whiplash specialist is usually required. At this point, referral to a clinical psychologist may also be considered if the psychological assessment data is markedly below norms (for the IES this means a score of > 26 at six weeks after injury).

**Coordinated Care**
Patients whose VAS/ NPS and/or NDI scores are not improving at this point are likely to require coordinated care that is multidisciplinary. It is likely that a combination of physical, psychological and medical care is required. The primary practitioner should facilitate this process.
Range of Possible Symptoms in Whiplash Disorders

**Neck Pain**
Neck pain is the most commonly reported symptom of WAD. Furthermore, specific segmental zygapophyseal (facet) joint blocks have demonstrated that the neck and surrounding tissues are the most common source of chronic pain for people with WAD. People involved in a rear end motor vehicle accident found the most commonly reported symptom was neck pain, followed by headache, neck stiffness, low back pain, upper limb symptoms, dizziness, nausea and visual problems. Tinnitus, temporomandibular joint pain, paraesthesia and concentration or memory disturbance may also be experienced.

**Headache**
Headache is the second most common symptom, often in the sub-occipital region with referral to the temporal area. These areas are innervated from the upper cervical levels and it was found that 50% of people complaining of headaches had pain arising from the C2/C3 segmental level.

**Radiating Pains to the Head, Shoulder, Arms or Interscapular area**
Radiating pains to the head, shoulder, arms or interscapular area are often reported at some time post injury. These patterns of somatic referral do not necessarily indicate which structure is the primary source of the pain but rather suggest a referred type of pain from the facets or discs in the cervical spine.

**Generalized Hypersensitivity**
Those with whiplash symptoms may have a generalized hypersensitivity, extending as far as the lower limbs, when compared with healthy volunteers. It was suggested that WAD might lead to spinal cord hyperexcitability causing exaggerated pain on peripheral stimulation.

**Paresthesia and Muscle Weakness**
Paresthesia and muscle weakness may be caused by cervical radiculopathy, thoracic outlet syndrome and spinal cord compression.

**Symptoms from the Temporomandibular joint**
Symptoms from the temporomandibular joint have been reported in the literature related to WAD. Symptoms of TMJ induced by whiplash may include headache, dizziness, deep ear pain, pressure behind the eyes, earaches and stiff neck. TMJ symptoms will appear as an inability to open the jaw fully, a clicking or snapping of the jaw and changes in alignment when the jaw is opened or closed.

**Visual Disturbances**
Visual disturbances are mentioned in the literature. Whiplash was associated with defective accommodation in the present select group of whiplash subjects. Oculomotor function seems to be impaired in patients with chronic symptoms of whiplash injury of the cervical spine. The smooth pursuit neck torsion test to identify eye movement disturbances in patients with whiplash are likely to be due to disturbed cervical afferentation.
Proprioceptive Control of Head and Neck Position
Proprioceptive control of head and neck position has been found to be reduced in people after whiplash injury. Individuals who have sustained a whiplash injury may have proprioceptive deficits that do not allow them accurately or reliably to calculate head position. This may be detrimental to their everyday function. The central nervous system (CNS) uses the information provided by the proprioceptors to build up an internal reference frame of our musculoskeletal system and to recalibrate it. Rehabilitation after whiplash injury should focus not only on range of motion and strength but on postural awareness.

Vertigo/Dizziness
Post-traumatic vertigo refers to dizziness that follows a neck or head injury. There are many potential causes of post-traumatic vertigo. Peripheral vertigo may be either a lesion of the inner ear via the vestibular nerve or afferents from the cervical spine: major differential would be dizziness with turning the head but not with rotation of head and body together. Whiplash clinically is similar to post concussion syndrome, but with the addition of neck complaints. Dizziness occurs in 20-60%.

Impaired Cognitive Function
Cognitive function may be impaired in WAD with symptoms as a result of mild traumatic brain injury, chronic pain, chronic fatigue or depression. The cervicoenchehalic syndrome is characterized by headache, fatigue, dizziness, poor concentration, disturbed accommodation (eye movements), and impaired adaptation to light sensitivity.

Low Back Pain
Low back pain occurs in approximately 50% of these cases. Compression with biphasic lumbar spinal motions (increased/decreased lordosis) may cause injuries in the lumbar spine.

Carpal Tunnel Syndrome
The carpal tunnel is an opening through the wrist to the hand that is formed by the bones of the wrist on one side and the transverse carpal ligament on the other. This opening forms the carpal tunnel. The median nerve passes through the carpal tunnel into the hand. It gives sensation to the thumb, index finger, long finger, and half of the ring finger. It also sends a nerve branch to control the thenar muscles of the thumb. Any condition that causes abnormal pressure in the tunnel can produce symptoms of CTS.

Double Crush Syndrome
Double crush syndrome means that nerves being irritated up in the neck or at some proximal location like the thoracic outlet (in the shoulder) are causing a peripheral nerve entrapment like carpal tunnel or ulnar entrapment at the elbow.

Delay in Symptoms
Delay in symptoms is not uncommon. Symptoms may be delayed for hours, days, or longer.
Physical Examination

Taking Patient History
Taking a patient’s history is important during all visits for the treatment of patients with WAD of all grades. A patient’s history should include information about: date of birth, gender and education level; circumstances of injury such as relevant crash factors; symptoms, particularly including pain intensity (using the Visual Analogue Scale (VAS) or similar). Stiffness, numbness, weakness and associated extra cervical symptoms; localization, time of onset and profile of onset should also be recorded for all symptoms; disability level, preferably using the Neck Disability Index (NDI). Other scales such as the Functional Rating Index, Patient-Specific Functional Scale, Short Form Health Survey SF-36, or similar may also be used. Such an assessment should be conducted on a patient’s second visit at seven days, if not initially; and prior history of neck problems including previous whiplash injury.

Where appropriate, further assessment to determine psychological status may be undertaken at three or six week review. The preferred tool is the Impact of Event Scale (IES), which is a validated tool. Other scales may be useful. History details should be recorded. A standard form may be used.

Observation (particularly of head position / posture); palpation for tender points; assessment of range of movement (ROM) including flexion (chin to chest), extension, rotation and lateral flexion; neurological testing; assessment of associated injuries; and an assessment of general medical condition(s), including psychological state (as appropriate).

A further, more specialized, physical examination assessment might include: assessment of joint position error; assessment of neck muscle activity; and an assessment of widespread sensitivity (which may include cold sensitivity, pressure pain threshold and / or the brachial plexus provocation test, qualitative sensory perception).

Tools, such as a universal goniometer or inclinometer, can be used to measure neck ROM, and are more reliable than observation.

A standardized form may be used.

History and Physical Examination
Date of birth, gender, height weight, blood pressure, pulse rate, education level
Prior medical history, general medical condition, and pre-existing conditions
Symptoms including stiffness, numbness, onset of symptoms
Prior history of whiplash symptoms, neck injury or pain or chronic pain symptoms
Observation of head position and posture
Palpation for tenderness in the neck region
Cervical range of motion
Neurological testing of sensation, reflexes and muscle strength
Assess associated injuries and co-morbidities

Baseline Assessment
Disability level using self report instrument (NDI)
Pain intensity using a visual analogue scale (VAS) or numeric pain scale (NPS)

Look for lacerations, fractures, or other abnormalities requiring urgent intervention.
Note any deformities, swelling, asymmetry, atrophy or erythema.
Feel the areas of pain and surrounding structures. Examine for tenderness, deformity, crepitus and muscle spasm. Flaccidity, fasciculations and spasticity may indicate nervous system damage. Note particularly sensitive areas of palpation as this may help to determine etiology of pain (e.g., muscular versus facet).
Palpate the temporomandibular joints (TMJs) and adjacent musculature, including the masseter and temporalis muscles. Assess these joints by having the patient open, close and move the jaw from side to side. Note any pain, tenderness, clicking, popping or asymmetric jaw movement. Make note of jaw excursion and the location of pain that limits it. Have the patient move the region being tested. If the patient’s movement is restricted, passive movement should be attempted as the pain allows. It may not be possible to passively move the region farther due to pain, but this also allows the examiner to gauge the source of pain, limitation and degree of musculature tautness.

**Screening Neurological Motor Exam**
The integrity and mobility of the nervous system needs to be examined and tests should include:
• The integrity of the nervous system including testing myotomes, dermatomes and reflexes when indicated by the distribution of the symptoms
• Mobility tests may include passive neck flexion (PNF), upper limb tension tests (ULTT), passive knee bend, straight leg raise (SLR) and the slump test
• The plantar response should be examined to exclude an upper motor neuron lesion
• Tests for clonus, should be carried out to exclude an upper motor neuron lesion.

### Cervical Spine

<table>
<thead>
<tr>
<th>Arm Pain</th>
<th>C5 Lateral arm</th>
<th>C6 Lateral arm</th>
<th>C7 Posterior arm</th>
<th>C8 Medial arm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensory change in fingers</td>
<td>None</td>
<td>Thumb +/- index</td>
<td>Index/long +/- ring</td>
<td>Little +/- ring</td>
</tr>
<tr>
<td>Motor weakness</td>
<td>Deltoid +/- biceps</td>
<td>Biceps +/- biceps</td>
<td>Triceps</td>
<td>Finger Intrinsic</td>
</tr>
<tr>
<td>Diminished</td>
<td>Biceps</td>
<td>Brachioradialis</td>
<td>Triceps</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Myotome**
- C5: Shoulder abduction (deltoid, axillary nerve)
- Elbow flexion (biceps, musculocutaneous nerve)
- C6: Wrist extension (wrist extensors, radial/posterior interosseus nerve)
- C7: Elbow extension (triceps, radial nerve)
- C8: Grip strength (finger flexors, ulnar and median nerves)
- T1: Finger abduction (interossei, ulnar nerve)
- L2: Hip flexion (iliopsoas, femoral nerve)
- L3: Knee extension (quadriceps, femoral nerve)
- L4: Ankle dorsiflexion (tibialis anterior, peroneal nerve)
- L5: Great toe extension (extensor hallucis, peroneal nerve)
- S1: Ankle plantarflexion (gastrocnemius/soleus, tibial nerve)

**Sclerotome pain referrals:**
- C1 posterior neck, suboccipital, occipital, and behind eye,
- C2 posterior neck and suboccipital,
- C3 posterior neck to top of proximal shoulder,
- C4 posterior neck to top of distal shoulder,
- C5 across top of shoulder and upper mid scapular,
- C6 across top of shoulder, mid scapular, and posterior elbow,
- C7 across top of shoulder, mid and inferior scapular, anterior chest, and down the medial forearm,
- C8 across top and posterior shoulder, entire lateral shoulder, and down medial forearm into 4th and 5th fingers, T1 across the shoulder blade.
Subluxation Assessment
Vertebral Position Assessed Radiographically; Abnormal Segmental Motion Assessed Radiography

To demonstrate a subluxation based on physical examination, two of the four criteria mentioned below are required, one of which must be **asymmetry/misalignment** or **range of motion abnormality**.

- Pain/tenderness evaluated in terms of location, quality, and intensity; Pain, facet syndrome, trigger points, etc.
- Asymmetry/misalignment identified on a sectional or segmental level; Asymmetric or Hypertonic Muscle Contraction.
- Range of motion abnormality (changes in active, passive and accessory joint movements resulting in an increase or decrease of sectional or segmental mobility); Abnormal Segmental Motion/Lack of Joint End-play.
- Tissue, tone changes in the characteristics of contiguous, or associated soft tissues, including skin, fascia, muscle, and ligament; Soft Tissue Compliance and Tenderness.

Special Tests
- Thoracic outlet syndrome. Various tests for this complex syndrome include the Allen Test, Adson’s maneuver and provocative elevation tests.
- Upper cervical stability. Test for instability in the presence of certain signs (inability to support the head, dysphagia, tongue paraesthesia, a metallic taste in the mouth, facial or lip paraesthesia, bilateral limb paraesthesia, quadrilateral limb paraesthesia, nystagmus, gait disturbance).

Radiographic Imaging
Age ≥ 65 yr, dangerous mechanism, paresthesias in extremities, midline cervical spine tenderness, unable to rotate neck 45 degrees left and right, pain or limitation of motion, suspected spinal instability, x-rays are recommended. MRI may be indicated early in radiculopathy/myelopathy.

THE EXAMINATION

CPT code 99203 includes a detailed examination. A detailed, single-organ system examination should include at least 12 elements identified by a bullet within the system/body area(s) being examined according to the 1997 documentation guidelines on E/M services.

99203 – Usually the presenting problem(s) are of moderate severity and the physician typically spends 30 minutes face-to-face with the patient and/or family. E/M requires the following three key components:
- Detailed history.
- Detailed examination.
- Medical decision making of low complexity.
6 weeks to 3 months
With continued moderate/severe complaints:
 Dynamic sEMG
   MRI
   Videofluoroscopy
   Quantitative sensory testing

Specialized imaging techniques
   WAD Grade III
   Specialized imaging techniques might be used in selected patients;
   e.g., nerve root compression or suspected spinal cord injury, WAD Grade III,
   on the advice of a whiplash, medical or surgical specialist.

Specialized examinations
Examples of such examinations include
   electroencephalography (EEG), electromyographic (EMG)
   specialized neurological tests, depending on signs/symptoms.

Standard MRI may be used signs and symptoms of radicular disorders.
Evaluating soft tissues after trauma or surgery, STIR or T2-weighted fat-suppressed fast-spin-echo sequences are recommended. (ACR PRACTICE GUIDELINE MRI of the Adult Spine 2006)
Fast spin-echo (FSE) sequences can be used to decrease imaging times, to increase resolution, or to improve signal-to-noise ratios on T2-weighted images.
MRI proton-density weighted sequences of 2mm or less may show damage to the alar ligaments and ligamentous structures in the craniovertebral junction.
Motion MRI (kinetic MRI) has been shown to demonstrate significant differences in biomechanical function between normal patients and injured patients following rear, low-impact motor vehicle collisions.
kMRI delivers the ability to scan patients in neutral, flexion, and extension positions, which may allow for improved diagnosis. A significant increase in the degree of lumbar disc herniation was found by examining flexion and extension views when compared with neutral views alone. kMRI views provide valuable added information, especially in situations where symptomatic radiculopathy is present without any abnormalities demonstrated on conventional MRI.
SPECT/CT may be helpful in certain conditions.
Surface electromyography may be helpful in patients with cervical spine and low back disorders.
Patients with whiplash associated disorder Grade II can be distinguished from healthy control subjects according to the presence of cervical muscle dysfunction, as assessed by surface electromyography of the upper trapezius muscles.
Videofluoroscopy screening may be useful in for and evaluating for cervical instability injuries.
Quantitative sensory testing may be useful in identifying small or large fiber sensory abnormalities.
For addressing chiropractic use of x-rays see: www.pccrp.org.
Kinetic MRI

A significant increase in the degree of lumbar disc herniation was found by examining flexion and extension views when compared with neutral views alone.

kMRI views provide valuable added information, especially in situations where symptomatic radiculopathy is present without any abnormalities demonstrated on conventional MRI.


kMRI is effective for diagnosing, evaluating, and managing degenerative disease or injury within the spine.


The STIP scoring method is a practical, noninvasive method of determining the degree of clinical impairment, as a basis for distinguishing injury requiring medical treatment from injury requiring surgical treatment, in cases of subacute cervical spine trauma.


Functional magnetic resonance imaging is a radiological technique that can visualize injuries of the ligaments and the joint capsules, and accompanying pathological movement patterns.


This study showed that the presences of either Grade IV DD or grade 3 Facet joint osteoarthritis with ligament flavum hypertrophy at L4-L5 were good indicators for segmental instability. Using these parameters simultaneously in patients with segmental instability would be useful for determining candidacy for surgical treatment.


Assessment

Among the 200 patients investigated, 30 showed instability of the ligamentous dens complex. Of the same 200, 4% had a complete rupture and 11% an incomplete rupture of the alar ligament, with instability signs. In another 22.5% patients, fMRI-video showed evidence of instability, and all these patients had coexisting intraligamentous signal pattern variation, probably due to granulation tissue.

40% had signal indifference without demonstrable video instability signs, and 21.5% of patients (showed no evidence of instability and no signal variation in the alar ligaments. On the basis of recognition of instability and the malfunction of the ligaments, the fibrous capsula, and the tiny dens capsula, we now can distinguish between lesions caused by rotatory trauma to the craniocervical junction and those from classic whiplash injury.


MRI with lateral tilting and rotatory evaluation is a useful tool for investigating craniocervical instability. For patients who are recalcitrant to following a program of conservative therapy, surgical stabilization of the craniocervical junction appears to be justified.


Disk herniations were observed in 28% (28 of 100) patients. Biomechanical changes in the herniated disk were noted, with mildly increased spinal stenosis following flexion. The authors conclude that flexion and extension MR can be a valuable adjunct examination in the evaluation of patients in the clinical setting of subacute cervical spine trauma.

Examination - Videofluoroscopy

The following signs may be helpful in the selection of patients for musculoskeletal videofluoroscopy in those cases with persistent signs and symptoms following an appropriate conservative management:
- a. hypermobility
- b. hypomobility
- c. aberrant motion
- d. instability
- e. aberrant coupling
- f. paradoxical motion
- g. evaluation of spinal arthrodesis

Cervical Spine Examinations:

A. Minimum Examination. (Includes the following, but must be preceded and supported by clinical and radiographic findings.) A minimum of three repetitions should be performed and all fluoroscopic exposure must be recorded digitally or videotaped.
- 1. Lateral projection.
  a. nodding
  b. full range "forced" flexion and extension.
  c. relaxed flexion and extension.
- 2. Oblique right and left full range "forced" flexion and extension.

B. Additional Examinations (as indicated): Right and left lateral flexion (open mouth and lower cervical).

C. Optional Examination: Unsupported cross table lateral flexion/extension.

D. Check Ligament (ALAR) Examination
- 1. Lateral view, nodding.
- 2. Right and left lateral flexion open mouth.
- 3. Passive Stress views. Cases of incomplete tear can only be demonstrated by a passively forced lateral flexion maneuver.

Lumbar Spine Examinations:

1. Lateral projection in flexion and extension.
2. A-P right and left lateral bending.


VF Assessment

The alterations in the static alignment of the cervical curvature cause alterations in the dynamic kinematics of the cervical spine during cervical flexion–extension.


Changes in sagittal alignment of the cervical spine affect the kinematics. Consequently, it may cause changes in the segment subjected to maximum load for overall motion and accelerate its degeneration.


Cineradiography adds another diagnostic method of evaluating suspected soft-tissue injuries of the cervical spine by demonstrating its motion during active exercise. It is reasonable to anticipate that abnormal motion will accelerate degenerative change in the spine and will complicate the cineradiographic analysis. The cineradiographic study will have its greatest value if it can detect abnormal motion in patients who show normal spines on standard roentgenograms and before degenerative changes have occurred.

Imaging Examination

**SPECT/CT**

The CT-SPECT scanning modality combines the virtues of functional and anatomical imaging, aiding the clinician in making the diagnosis of painful facet arthropathy.


Higher spatial resolution SPECT images are better accepted by referring physicians who correlate them with CT or MR images. The high negative predictive value allows radionuclide bone imaging to be used to select appropriate patients to undergo the invasive facet injection procedure.


A “fire scan,” involves the digital fusion or overlay of a CT scan of the area of interest with a bone scan with SPECT imaging. The fire scan provides the anatomic resolution of the CT scan plus the sensitivity of the bone scan. The premise is that combining the results of these 2 complementary studies with the clinical assessment will enhance the diagnostic capabilities of identifying a distinct structure as a source of pain. The CT portion of the study also provides useful osseous information, for example, the extent of zygapophysial (facet) joint arthropathy when considering an intra-articular injection.


**Discography**

Significant cervical disc anular tears often escape magnetic resonance imaging detection, and magnetic resonance imaging cannot reliably identify the source(s) of cervical discogenic pain.


These results confirm the observations of prior investigators that cervical internal disc disruption can elicit axial and peripheral symptoms. The particular patterns of pain generation allow the discographer to preprocedurally anticipate disc levels to assess.


Eighty-seven of 100 of the high-intensity zone discs proved concordantly painful at discography. All 87 painful and concordant discs exhibited abnormal morphology with anular tears extending either well into or through the outer third of the anulus fibrosus. Sixty-five of 67 non-high-intensity zone control discs were nonconcordant and of lower sensation intensity than the high-intensity zone discs. Only one high-intensity zone was found in the control subjects. In patients with symptomatic low back pain, the high-intensity zone is a reliable marker of painful outer anular disruption.

Facet Blocks

Available literature pointed to strong evidence for controlled comparative local anesthetic facet joint medial branch blocks in the diagnosis of neck and low back pain. There was moderate evidence in the diagnosis of pain arising from thoracic facet joints. The evidence obtained from literature review suggests that controlled comparative local anesthetic blocks of facet joint nerves (medial branch or dorsal ramus) are reproducible, reasonably accurate, and safe. The sensitivity, specificity, false-positive rates, and predictive values of these diagnostic tests for neck and low back pain have been validated and reproduced in multiple studies.


Pain maps based on areas in which patients are relieved of pain by controlled blocks provide a more representative guide to the recognition of the segmental origin of cervical zygapophysial joint pain than do maps derived from normal volunteers.


Cervical zygapophysial joint pain is common among patients with chronic neck pain after whiplash. This nosologic entity has survived challenge with placebo-controlled, diagnostic investigations and has proven to be of major clinical importance.


Facet Blocks

Spine physicians diagnose zygapophysial joint pain based on analgesic response to anesthetic injections into the zygapophysial joints or at their nerve supply. Studies on treatment of isolated zygapophysial joint pain are limited.


The evidence obtained from literature review suggests that controlled comparative local anesthetic blocks of facet joints (medial branch or dorsal ramus) are reproducible, reasonably accurate and safe. The sensitivity, specificity, false-positive rates, and predictive values of these diagnostic tests for neck and low back pain have been validated and reproduced in multiple studies.


Standard treatment modalities for lumbar zygapophysial joint pain include intraarticular steroid injections and radiofrequency denervation of the medial branches innervating the joints, but the evidence supporting both of these is conflicting. In this article, the authors provide a comprehensive review of the anatomy, biomechanics, and function of the lumbar zygapophysial joints, along with a systematic analysis of the diagnosis and treatment of facet joint pain.


This study demonstrated that in an interventional pain management setting, facet joints are clinically important spinal pain generators in a significant proportion of patients with chronic spinal pain.

MRI

A high incidence of discoligamentous injuries was found in whiplash-type distortions. Most patients with severe persisting radiating pain had large disc protrusions on MRI that were confirmed on surgery.


Whiplash trauma can damage the tectorial and posterior atlanto-occipital membranes; this can be shown on high-resolution MRI.


Whiplash injuries can be visible by functional (kinematic) magnetic resonance imaging.


MRI - Cervical Muscles

There is significantly greater fatty infiltration in the neck extensor muscles, especially in the deeper muscles in the upper cervical spine, in subjects with persistent WAD when compared with healthy controls.


Fatty infiltrates in the cervical extensor musculature and widespread hyperalgesia were not features of the insidious-onset neck pain group in this study; whereas these features have been identified in patients with chronic WAD. This novel finding may enable a better understanding of the underlying pathophysiological processes in patients with chronic whiplash.


MRI High-intensity zone

The current study suggests that the high-intensity zone (HIZ) of the lumbar disc on MRI in the patient with low back pain could be considered as a reliable marker of painful outer anular disruption.


The lumbar disc HIZ observed on MRI in patients with low back pain is likely to represent painful internal disc disruption.


Perianular enhancement associated with anular tears revealed thick linear patterns (2.5–7 mm thickness) along margins of anular tears on contrast enhanced axial T1-weighted images with fat suppression. Locations of perianular enhancement adjacent to anular tears were at foraminal and extraforaminal portions. CT discography showed a leak of contrast from anular tear to the perianular regions. Pain reproduction at contrast leak level during discography showed concordant pain. There was an apparent correlation between perianular enhancement on MRI and clinical symptoms or provocative epidural nerve root injection in all cases. The perianular enhancement adjacent to anular tears on MRI may be relevant in the diagnosis of symptomatic chemical radiculitis.


Modic changes type 1 reflects earlier and acute stages of inflammation, whereas Modic changes type 2 are thought to be a result of previous inflammation and more progressive degeneration.

Muscle Dysfunction

Patients with whiplash associated disorder Grade II can be distinguished from healthy control subjects according to the presence of cervical muscle dysfunction, as assessed by surface electromyography of the upper trapezius muscles. Particularly the decreased ability to relax the trapezius muscles seems to be a promising feature to identify patients with whiplash associated disorder Grade II. Assessment of the muscle (dys)function by surface electromyography offers a refinement of the whiplash associated disorder classification and provides an indication to a suitable therapeutic approach.


These findings may indicate that peripheral nociceptive processes are activated in WAD with generalized hypersensitivity for pressure and they are not identical with those reported in chronic work-related trapezius myalgia, which could indicate different pain mechanisms.


Patients with whiplash showed a distinct pattern of trigger point distribution that differed significantly from other patient groups and healthy subjects. The semispinalis capitis muscle was more frequently affected by trigger points in patients with whiplash, whereas other neck and shoulder muscles and the masseter muscle did not differentiate between patients with whiplash and patients with nontraumatic chronic cervical syndrome or fibromyalgia.


Cervical Curve

Average normal values and ideal normal values do exist in the literature for spinal alignment on radiographs. In the cervical spine, average 34 degrees with an ideal value of 43 degrees.


A statistically significant association between cervical pain and lordosis < 20 degrees and a “clinically normal” range for cervical lordosis of 31 degrees to 40 degrees. Maintenance of a lordosis in the range of 31 degrees to 40 degrees could be a clinical goal for treatment.


The loss of cervical lordosis increases the risk of injury to the cervical spine following axial loading.


Localized kinking greater than 10 degrees and fanning greater than 12 mm are useful measurements by which to separate patients with true whiplash injuries from those with minor ligamentous tears. Flexion and extension views are essential to help define whiplash and other ligamentous injuries of the cervical spine.


The spinal canal was significantly smaller in the patients with persistent symptoms than in the asymptomatic group. A significant difference also was found between men and women.

Narrow diameter of the cervical spinal canal is unfavorable in patients with whiplash.

Defining Red Flags
Red flags are defined as indicators of serious pathology. Unlike the red flag guidelines for low back pain, there are no published guidelines on red flags for whiplash or cervical spine injury. However there is some consensus on the signs and symptoms that should alert the clinician to the presence of potential serious pathology. The list below includes the range of signs and symptoms that should be treated as potential red flags. They have been divided into two categories i.e. those requiring immediate investigation via the nearest accident and emergency department and those that should be considered precautions to treatment.

Symptoms needing urgent investigation if they develop after whiplash injury include:
- Bilateral paraesthesia in upper / lower limbs
- Gait disturbance - tripping or coordination difficulty
- Spastic paresis
- Positive Lhermittes sign i.e. shooting pain or paraesthesia into lower limbs or all four limbs with cervical flexion
- Hyperreflexia - Autonomic dysreflexia, also known as hyperreflexia, is a state that is unique to patients after spinal cord injury at a T-5 level and above.
- Nerve root signs at more than two adjacent levels
- Progressively worsening neurological signs - motor weakness, areflexia and sensory loss,
- Symptoms of upper cervical instability
- Non-mechanical pain which is unremitting and severe.

Symptoms and signs of infection (e.g. fever)  
Risk factors for infection (e.g. underlying disease process, immunosuppression, penetrating wound)
- Past history of malignancy
- Age > 50 years
- Failure to improve with treatment
- Unexplained weight loss
- Pain at multiple sites
- Pain at rest
- Low back pain - Absence of aggravating features

Red Flags - Spinal Conditions

Myelopathy
Cervical Myelopathy is a condition where the spinal cord gets compressed in the neck. Typically is no pain with a cervical myelopathy, only loss of function. There are different types of spinal cord injuries but the most common with trauma would be cord compression usually secondarily to swelling. We divide cord compression into 4 types:
1- lateral cord associated with the classic Brown-Séquard, characterized by features of a motor loss on the same side of the spinal injury and loss of sensation on the opposite side.
2- anterior cord (most common) associated with truncal weakness especially the pernium,
3- posterior cord (associated with spinal stenosis/kyphosis/ligament flavum hypertrophy associated with abnormal proprioception (positive Rhomberg's), head neck positioning, etc. and
4- central cord associated with an expanding syrinx associated with shawl like distribution of pain and temp loss (symetrical) and if large enough ventral horn cell disease as seen with a nerve root lesion.
Patients with cervical myelopathy will generally have these symptoms: neck stiffness; unilateral or bilateral deep, aching neck, arm and shoulder pain; and stiffness or clumsiness while walking.

**Cauda Equina Syndrome**

Cauda equina syndrome is a condition caused by compression of the spinal nerves in the lowest region of the spinal canal (lumbar spine). Patients who have cauda equina may require emergency surgical treatment in order to relieve pressure on the affected nerves.

**Medical screening for Red Flags**

| Category I: Factors that require immediate medical attention | • Blood in sputum  
• Loss of consciousness or altered mental status  
• Neurological deficit not explained by monoradiculopathy  
• Numbness or paresthesia in the perianal region  
• Pathological changes in bowel and bladder  
• Patterns of symptoms not compatible with mechanical pain (on physical examination)  
• Progressive neurological deficit  
• Pulsatile abdominal masses |
| --- | --- |
| Category II: Factors that require subjective questioning and precautionary examination and treatment procedures | • Age > 50  
• Clonus (could be related to past central nervous system disorder)  
• Fever  
• Elevated sedimentation rate  
• Gait deficits  
• History of a disorder with predilection for infection or hemorrhage  
• History of a metabolic bone disorder  
• History of cancer  
• Impairment precipitated by recent trauma  
• Long-term corticosteroid use  
• Long-term worker’s compensation  
• Nonhealing sores or wounds  
• Recent history of unexplained weight loss  
• Writhing pain |
| Category III: Factors that require further physical testing and differentiation analysis | • Abnormal reflexes  
• Bilateral or unilateral radiculopathy or paresthesia  
• Unexplained referred pain  
• Unexplained significant upper or lower limb weakness |

The rate of recovery following whiplash injury, symptoms within 7 days of accident: 86% symptomatic, 14% symptom free. Patients were more likely to improve between 3 months and 1 year and deteriorate between 1 and 2 years. Between 2 and 7.5 years, 12% described improved symptoms, 29% complained of continuing pain and 33% reported increased severity of symptoms since the accident. Symptoms largely stabilized within 3 months but there was significant fluctuation in symptom severity between 3 months and 2 years.

Symptoms
Poor outcomes following whiplash are associated with high initial: pain intensity (e.g., pain > 7/10 on VAS/NPS scale); and disability (e.g., NDI > 20/50). The presence of either of these two factors should alert the practitioner to the potential need for more intensive treatment or earlier referral.

Radiological Findings
There is evidence that cervical kyphosis, and motion segment integrity are associated with ongoing pain symptoms following whiplash.

Crash-Related Factors
The relevance of crash-related factors in predicting outcome in whiplash is inconclusive. Vehicle damage has not been related to whiplash disorders. Rear-end impacts, being unaware, having the head turned/rotated.

Physical Impairment
Factors related to poor outcome (ongoing disability) include: hypersensitivity to specific sensitivity testing; and decrease in cervical range of motion (ROM). AMA Impairments may include motion segment integrity, sleep disturbance and other factors.

Prior History/Previous Symptoms
Previous neck pain may be associated with poor outcome in terms of ongoing disability.

Factors Associated With Poor Prognosis
High initial pain intensity, High initial disability, Injury to the facet, disc or alar ligament. Degenerative changes are associated with a poor prognosis.

Early onset of symptoms, radiating pain and numbness and objective neurological signs Impaired neck movement, history of pretraumatic headache, history of head trauma, higher age, initial neck pain intensity, initial headache intensity, nervousness score, neuroticism score and test score on focused attention.

Features of accident mechanisms were associated with more severe symptoms: an unprepared occupant; rear-end collision, with or without subsequent frontal impact; and rotated or inclined head position at the moment of impact.

An association between development of arm pain, upper limb numbness or paraesthesia and bilateral trapezius pain and persistence of whiplash related symptoms has also been observed.

Poor Prognostic Indicators
- High initial disability
- Sensory sensitivity
- Rear-end impact
- High number of complaints
- High initial pain scores (VAS>7/10)
- Decrease of range of motion
- Prior history of neck pain or headache
- Head turned at impact
Head Turned at Impact

Compared to a neutral head posture, the maximum principal strain in the facet capsule doubles on the side toward which the head is turned. Excessive capsular strains experienced by some individuals during some whiplash conditions may be responsible for painful capsular whiplash injury.


Potential ganglion compression in patients with a non-stenotic foramen at C5-6 and C6-7; in patients with a stenotic foramen the injury risk greatly increases and spreads to include the C3-4 through C6-7 as well as C4-5 through C6-7 nerve roots.


Rotated or inclined head position at the moment of impact was associated with a higher frequency of multiple symptoms with more severe symptoms and signs of musculoligamental cervical strain and of neural, particularly radicular and damage.


The transverse and alar ligaments could be irreversibly overstretched or even ruptured when the head is rotated and, in addition, flexed by impact trauma, especially in unexpected rear-end collisions.


Elongation-induced vertebral artery injury is more likely to occur in those with rotated head posture at the time of rear impact, as compared to head-forward.

Utilizing outcomes questionnaires as a component in determining when a patient has reached maximum improvement and is ready to be discharged from therapeutic care.

A return to normal function, or a plateau in improvement, in these criteria may be used to indicate that a patient has reached maximum benefit from care.

Range of motion: A goniometer or inclinometer provides an accurate tool to assess this function.

Muscle testing: Assess muscle strength, endurance and flexor-extensor ratios utilizing manual or computerized testing devices.

Postural analysis: Assess anterior translation of the head, spinal curves and other postural landmarks with computerized devices, digital photos or plumb-line analysis.

Special functional goals for care: Evaluate other ADLs, essential functions and critical demands of employment necessary for the patient to return to pre-injury status.

Maximum Improvement is achieved when there is no improvement in clinical status for a period of 2 months as assessed with standard measurement outcomes (visual analog scale, Oswestry, Neck Disability Index, SF-36, etc.)

If treatment is withdrawn and the patient’s clinical status becomes worse, the patient has not achieved Maximum Medical Improvement.


Resolved

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>VAS, NPS</td>
<td>&lt; 3/10</td>
</tr>
<tr>
<td>NDI</td>
<td>&lt; 4/50</td>
</tr>
</tbody>
</table>

www.tracsa.org.au/resources-whiplashassociated_disorders_information_for_health_practitioners
Treatment Recommendations for Whiplash in the Acute Stage (zero to two weeks after injury)

Manual treatment – Adjustments/mobilization
- Adjustments/Manual mobilization should be considered for the reduction of neck pain
- Adjustments/Manual mobilization should be considered to increase neck range of movement
- Adjustments/Manual mobilization should be considered to improve function
- Soft tissue techniques should be considered for the reduction of pain

Exercise therapy
- Active exercise should be used to reduce pain
- Active exercise for pain reduction should be started within four days of injury
- An active exercise program devised for each individual following assessment should be considered for the reduction of pain

Modalities (including electrotherapy) may be used in support of active therapy and flare-ups
- TENS could be considered for reducing pain
- Traction
- Ultrasound treatment
- Laser treatment
- Massage
- Acupuncture
- PEMT

Education and advice
- Advice on self-management should be provided, to reduce patients’ symptoms
- Returning to normal activities as soon as possible should be encouraged
- Providing education about the origin of the pain should be considered for reducing pain
- Providing advice about coping strategies may be helpful for the reduction of pain
- Relaxation should be considered for reducing pain

Combining Manipulation/Adjustments and Exercise
- A combination of manipulation and exercise may be more effective than manipulation alone in:
  - Reducing pain
  - Improving function
  - Increasing patient satisfaction

Prescribed Function, Work Alteration
Prescribed function (i.e., return to usual activity as soon as possible) is recommended. Rehabilitation programs, which may include alteration to an individual’s work schedule, may assist recovery depending on symptoms (e.g., pain, ability to concentrate) and psychosocial factors.

Exercise
ROM and muscle re-education exercises to restore appropriate muscle control and support to the cervical region in patients with WAD should be implemented immediately, if necessary in combination with intermittent rest when pain is severe. Clinical judgment is crucial if symptoms are aggravated by exercise.
Exercise Therapy
• Combined advice about coping strategies and exercise may be more effective than exercise alone in assisting people’s return to normal activity
• Mobilizing exercises should be considered for the reduction of pain
• Group exercise should be considered to improve function
• Proprioceptive exercises should be considered to improve function
• Strengthening exercises may be more effective than passive treatment in improving function and in reducing pain
• Exercise based on individual assessment is likely to be better than general exercise in improving function
• Standard exercise (stretching, isometric, isotonic) to improving function
• Extension retraction exercises could be considered to improve neck function

Nutritional & Medications
• Omega 3 fatty acids, anti-oxidants and natural anti-inflammatories.
• Only simple analgesics should be prescribed for WAD Grade I.
• NSAIDs and non-opioid analgesics may be used for short term pain relief in WAD Grade II and III.

Medical Pharmacology
Medical pharmacology includes simple analgesics/non steroidal anti-inflammatory drugs (NSAIDs).
WAD Grade I – no medication other than simple analgesics should be prescribed.
WAD Grades II and III – non-opioid analgesics and NSAIDs can be used to alleviate pain in the short term. Their use should be limited to a few weeks and should be weighed up against known side effects, which appear to be dose related.
Opioid analgesics are not recommended for patients with WAD Grade I. They may be prescribed for pain relief in patients with acute WAD Grades II and III experiencing severe pain (VAS > 8) for a limited period of time.
Psychopharmacologic drugs are not recommended in patients with acute and subacute WAD of any grade. However, they can be used occasionally for symptoms such as insomnia or tension or as an adjunct to activating interventions in the acute phase.
Use of high dose intravenous methylprednisolone infusion for acute management of WAD Grades II and III is not recommended.
Opioid analgesics may be prescribed for short term pain relief of severe pain (VAS > 8) in acute WAD Grade II and III.

Postural Advice
Postural advice should be given in combination with manual and physical therapies and exercise.

Traction
A regime of traction should only be given to patients with WAD in combination with manual and physical therapies and exercise, with evidence of continuing measurable improvement.

Acupuncture
A regime of acupuncture should only be given to patients with WAD in combination with manual and physical therapies and exercise, with evidence of continuing measurable improvement.
**Modalities**
For acute whiplash and flare-ups, other professionally administered passive modalities/electrotherapies are optional adjuncts to manual and physical therapies and exercise, with emphasis on return to usual activity as soon as possible. Modalities/electrotherapies include heat, ice, massage, transcutaneous electrical nerve stimulation (TENS), pulsed electromagnetic treatment (PEMT), electrical stimulation, ultrasound, laser, and shortwave diathermy.

**Manipulation Under Anesthesia/Sedation**
During the treatment Manipulation under anesthesia/sedation may be beneficial in patients with chronic pain that affects work or activities of daily living. This procedure has been shown to be effective in selected cases. (Gerber, JAOA 1960;60:212-216; Davis, JNMS 1996;4:102-116; Herzog, JMPT 1999;22:166-170; West, JMPT 1999;22:299-308)

**Surgical Treatment**
Surgery is uncommon in patients with WAD. Surgery may be indicated in Grade III with persistent arm pain consistent with cervical radiculopathy (supported by appropriate investigations) that does not respond to conservative management, or with rapidly progressing neurological deficit. Other invasive measures may be needed depending upon the case.

**Regeneration Injection Therapy**
Invasive Intraarticular regeneration injection therapy can improve pain and function. RIT can last as long as or longer than patients with radiofrequency neuronatomy. When combined with spinal manipulation, exercise and other co-interventions, prolotherapy may improve chronic back pain and disability.

---

X-ray and MRI of the same person.
Treatment – Chiropractic

Treatment

Pain data from randomized controlled trials (RCTs) did not support claims of restricting Chiropractic care to 6-12 visits for headaches, neck pain, cervicobrachial pain, and/or upper back pain. In fact, assuming a constant linear dosage response, the data indicated a minimum of 24 visits on average would be needed to document, resolve, and stabilize these conditions.


Patients received an average of 30.6 treatment sessions over 11.1 weeks. Patients had significant debilitating pain and complications from neck injuries secondary to MVA. After application of SCALE methods, 84% of the patients experienced complete or near complete resolution of their pain and other neck related complications. All patients reported significant improvements in their conditions with 53% of the patients experiencing complete recovery. Range of motion (ROM) and other measurements of cervical spine function also improved. These findings showed durability for the duration of the measured post-treatment period.


Mean visits: WAD I: 19.9; WAD II: 34.7
Range: WAD I: 6 – 30; WAD II: 15 – 66
In this study Grade I patients almost completely recover with this type of treatment and Grade II patients improve substantially. Chiropractic therapy in acute whiplash patients Grade I & II appears to provide at least short-term benefits despite ongoing pending litigation.


Treatment

A retrospective study was undertaken to determine the effects of chiropractic in a group of 28 patients who had been referred with chronic ‘whiplash’ syndrome. 93 per cent of patients improved following chiropractic treatment. Techniques used included specific spinal manipulation, proprioceptive neuromuscular facilitation (PNF) and cryotherapy. Spinal manipulation is a high-velocity low-amplitude thrust to a specific vertebral segment aimed at increasing the range of movement in the individual facet joint, breaking down adhesions.


The results from this study provide further evidence that chiropractic is an effective treatment for chronic whiplash symptoms. Patients underwent a mean of 19.3 treatments (range 1 - 53), over a period of 4.1 months.


The results of this efficacy study suggest that spinal manipulation, if not contraindicated, may be superior to needle acupuncture or medication for the successful treatment of patients with chronic spinal pain syndrome, except for those with neck pain. The Neck Disability Index showed that for neck pain, acupuncture achieved a better result than manipulation.


Our best evidence synthesis suggests that therapies involving manual therapy and exercise are more effective than alternative strategies for patients with neck pain; this was also true of therapies which include educational interventions addressing self-efficacy.

Treatment – Electrical Stimulation

Electrical stimulation of peripheral nerves leads to inhibitory input to the pain pathways at the spinal cord level.

The same TENS protocol had different degrees of antinociceptive influence on chronic and acute pain in chronic low back pain patients.

After the six-week treatment, patients in the TENS and exercise group had a better and clinically relevant improvement in disability, isometric neck muscle strength, and pain. All the improvements in the intervention groups were maintained at the six-month follow-up.

The overall results showed a significant decrease in pain with electrical nerve stimulation (ENS) therapy using a random-effects model (p<0.0005). These results indicate that ENS is an effective treatment modality for chronic musculoskeletal pain and that previous, equivocal results may have been due to underpowered studies.

Transcutaneous electrical nerve stimulation (TENS) is a nonpharmacologic treatment for pain relief. TENS has been used to treat a variety of painful conditions. Clinical trials suggest that adequate dosing, particularly intensity, is critical to obtaining pain relief with TENS.

These results suggest that 2000 Hz stimulation excites selectively A-beta fibers and 5 Hz stimulation activates noxious transmission mediated mainly through C fibers. Although 250 Hz stimulation activates both A-delta and A-beta fibers, tactile sensation would not be perceived when painful sensation is produced at the same time. Therefore, 250 Hz was effective stimulus frequency for activation of A-delta fibers initiating noxious sensation. Thus, the transcutaneous sine-wave stimulation can be applied to evaluate functional changes of sensory transmission by comparing thresholds with the three stimulus frequencies.

For pain relief, electrical nerve stimulation (ENS) was significantly better than EMS; but for the improvement of ROM, electrical muscle stimulation (EMS) was significantly better than ENS. It is concluded that ENS is more effective for immediate relief of myofascial trigger point pain than EMS, and EMS has a better effect on immediate release of muscle tightness than ENS.
Treatment – Nutrition


Trials of glucosamine and chondroitin preparations for osteoarthritis symptoms demonstrate moderate to large effects, but quality issues and likely publication bias suggest that these effects are exaggerated. Nevertheless, some degree of efficacy appears probable for these preparations. McAlindon TE, LaValley MP, Gulin JP, Felson DT. Glucosamine and chondroitin for treatment of osteoarthritis: a systematic quality assessment and meta-analysis JAMA 2000 Mar 15;283(11):1469-75.

Oxidative damage to mitochondrial DNA may play a significant role in normal aging. Lin MT, Beal MF. The oxidative damage theory of aging. Clinical Neuroscience Research 2003;305–315.

The results support the hypothesis that antioxidants decrease genetic damage. The supplement consisted of vitamin C (100 mg/day), vitamin E (100 mg/day), β-carotene (6 mg/day) and selenium (50μg/day). Supplementation with antioxidants was associated with a decrease in the percentage of cells with chromosome aberrations in the group of rural controls (0.63% before compared with 0.27% after supplementation. The largest effect of supplementation was seen in smokers. Dusjinska M et al. Nutritional supplementation with antioxidants decreases chromosomal damage in humans. Mutagenesis 2003;18(4):371–376.

Pycnogenol (Maritime Pine Bark) Pycnogenol, like white willow bark, is a nutraceutical material that has been used since ancient times. Hippocrates mentions its use as an anti-inflammatory agent. It contains a potent blend of active polyphenols that includes catechin, taxifolin, procyanidins, and phenolic acids. It is one of the most potent antioxidant compounds currently known. Pycnogenol inhibits TNFα-induced NF-kB activation as well as adhesion molecule expression in the endothelium.

Curcumin is known to inhibit inflammation by suppressing NF-kB, 4 restricting various activators of NF-kB as well as stemming its expression it regulates the activity of several enzymes and cytokines by inhibiting both COX-1 and -2. Uncaria tomentosa (Cat’s Claw) has been shown to prevent the activation of the transcriptional factor NF-kB64,144,149 and it directly inhibits TNFα production by up to 65 to 85%.


Nutritional deficiencies can impede wound healing, and several nutritional factors required for wound repair may improve healing time and wound outcome. Vitamin A is required for epithelial and bone formation, cellular differentiation, and immune function. Vitamin C is necessary for collagen formation, proper immune function, and as a tissue antioxidant. Bromelain reduces edema, bruising, pain, and healing time following trauma and surgical procedures. Adequate dietary protein is absolutely essential for proper wound healing, and tissue levels of the amino acids arginine and glutamine may influence wound repair and immune function. MacKay D, Miller AL. Nutritional support for wound healing. Altern Med Rev. 2003 Nov;8(4):359-77.
Treatment – Laser therapy

Low-Level Laser Therapy (LLLT)

The patients were submitted to 12 sessions on alternate days to a total energy dose of 5 J each. Those in the placebo group submitted to the same number of sessions following an identical procedure, the only difference being that the laser apparatus was nonoperational. Pain was monitored using the Italian version of the McGill pain questionnaire and the Scott-Huskisson visual analogue scale. The results show a pain attenuation in the treated group and a statistically significant difference between the two groups of patients, both at the end of therapy and at the 3-month follow-up examination.


The mean VAS pain scores improved by 2.7 in the treated group and worsened by 0.3 in the control group (difference 3.0, 95% CI 3.8-2.1). Significant improvements were seen in the active group compared to placebo for SF-36-Physical Score (SF36 PCS), NPNQ, NPAD, MPQVAS and SAI. The results of the SF-36 - Mental Score (SF36 MCS) and other MPQ component scores (afferent and sensory) did not differ significantly between the two groups. Low-level laser therapy (LLLT), at the parameters used in this study, was efficacious in providing pain relief for patients with chronic neck pain over a period of 3 months.


In active laser group, statistically significant improvements were detected in all outcome measures compared with baseline while in the placebo laser group, significant improvements were detected in only pain score at rest at the 1 week later of the end of treatment. The score for self-assessed improvement of pain was significantly different between the active and placebo laser groups (63 vs. 19%). This study revealed that short-period application of LLLT is effective in pain relief and in the improvement of functional ability and QoL in patients with MPS.


Significant positive effects were reported in four of five trials in which infrared wavelengths (lambda = 780, 810-830, 904, 1,064 nm) were used. This review provides limited evidence from one RCT for the use of infrared laser for the treatment of acute neck pain (n = 71) and chronic neck pain from four RCTs (n = 202).


LLLT seemed to be beneficial for pain in MPS by using algometry and thermography.


Pain, paravertebral muscle spasm, lordosis angle, the range of neck motion and function were observed to improve significantly in the low-power laser (LPL) group, but no improvement was found in the placebo group. LPL seems to be successful in relieving pain and improving function in osteoarthritic diseases.

Treatment – Massage

The Fibromyalgia Impact Questionnaire and a physical examination scoring tender points (number, pain intensity). Evaluations were conducted at the screening visit, after 7 sessions, and after completion of 15 sessions. Most of the parameters (pain intensity, physical function, number of tender points) showed a significant improvement at visit 15 compared with screening. The findings suggest the possibility that the studied intervention might be associated with positive outcomes in women with fibromyalgia.


Massage therapy is effective in reducing pain, stress hormones and symptoms associated with chronic low back pain. Adults (Mean age=39.6 years) with low back pain with a duration of at least 6 months received two 30-min massage or relaxation therapy sessions per week for 5 weeks. Participants receiving massage therapy reported experiencing less pain, depression, anxiety and their sleep had improved. They also showed improved trunk and pain flexion performance, and their serotonin and dopamine levels were higher.


Sixty-four such patients were randomized to receive up to 10 massages over 10 weeks or a self-care book. At 10 weeks, more participants randomized to massage experienced clinically significant improvement on the Neck Disability Index [39% vs. 14% of book group; relative risk (RR)=2.7; 95% confidence interval (CI), 0.99-7.5] and on the symptom bothersomeness scale (55% vs. 25% of book group). After 26 weeks, massage group members tended to be more likely to report improved function. Massage is safe and may have clinical benefits for treating chronic neck pain at least in the short term.


21 female patients suffering from chronic tension headache received 10 sessions of upper body massage consisting of deep tissue techniques in addition to softer techniques in the beginning. When found, trigger points were carefully and forcefully massaged. The range of cervical movements, surface ENMG on mm. frontalis and trapezius, visual analogue scale (VAS) and Finnish Pain Questionnaire (FPQ), and the incidence of neck pain during a two week period before and after the treatment, and at 3 and 6 months during the follow-up period together with Beck depression inventory were taken for evaluation and follow-up. The range of movement in all directions increased, and FPQ, VAS and the number of days with neck pain decreased significantly. There was a significant change in ENMG on the frontalis muscle whereas changes in trapezius remained insignificant. Beck inventory showed an improvement after the treatment. This study confirmed clinical and physiological effects of massage.


Headache frequency decreased from 4.7+/-.7 episodes per week during baseline to 3.7+/-.9 during treatment period 2; reduction was also noted during the follow-up phase (3.2+/-.1). Secondary measures of headache also decreased across the study phases with headache intensity decreasing by 30% and headache duration from 4.0+/-.3 to 2.8+/-.05 hours. A corresponding improvement in Headache Disability Index was found with massage. This pilot study provides preliminary evidence for reduction in headache pain and disability with massage therapy that targets myofascial trigger points.

**Stages of Injury**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage I</td>
<td>Acute; Inflammatory phase; Up to 72 hours</td>
</tr>
<tr>
<td>Stage II</td>
<td>Subacute; Repair phase; 72 hours to 14 weeks</td>
</tr>
<tr>
<td>Stage III</td>
<td>Remodeling phase; 14 weeks to 12 months or more</td>
</tr>
<tr>
<td>Stage IV</td>
<td>Chronic; Permanent</td>
</tr>
</tbody>
</table>


**Stages of Care: The Mercy Document (Table II, Pg. 120, Mercy) (79)**

<table>
<thead>
<tr>
<th>Passive Care</th>
</tr>
</thead>
<tbody>
<tr>
<td>The doctor is doing most of the work</td>
</tr>
<tr>
<td><strong>Acute Intervention</strong></td>
</tr>
<tr>
<td>1. To promote anatomical rest</td>
</tr>
<tr>
<td>2. To diminish muscular spasm</td>
</tr>
<tr>
<td>3. To reduce inflammation</td>
</tr>
<tr>
<td>4. To alleviate pain</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Active Care</th>
</tr>
</thead>
<tbody>
<tr>
<td>The doctor and patient are doing the work together</td>
</tr>
<tr>
<td><strong>Remobilization</strong></td>
</tr>
<tr>
<td>1. To increase pain-free ROM</td>
</tr>
<tr>
<td>2. To minimize deconditioning</td>
</tr>
<tr>
<td><strong>Rehabilitation</strong></td>
</tr>
<tr>
<td>1. To restore strength and endurance</td>
</tr>
<tr>
<td>2. To increase physical work capacity</td>
</tr>
<tr>
<td><strong>Life Style Adaptations</strong></td>
</tr>
<tr>
<td>1. To modify social and recreational activity</td>
</tr>
<tr>
<td>2. To diminish work environment risk factors</td>
</tr>
<tr>
<td>3. To adapt psychological factors affecting or altered by the spinal disorder</td>
</tr>
</tbody>
</table>

### Grades of Severity of Injury

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I</strong></td>
<td>Minimal; No limitation of motion; No ligamentous injury; No neurological findings</td>
</tr>
<tr>
<td><strong>II</strong></td>
<td>Slight; Limitation of motion; no ligamentous injury; no neurological findings. Neck complaint and musculoskeletal signs.</td>
</tr>
<tr>
<td><strong>III</strong></td>
<td>Moderate; Limitation of motion; ligamentous instability; neurological symptoms. Common symptoms: Neck and arm pain; Cervical herniated disc; Neck pain with headache; Cervicoscapulalgia (pain referred to upper back)</td>
</tr>
<tr>
<td><strong>IV</strong></td>
<td>Moderate to Severe; Limitation of motion; some ligamentous injury; neurological symptoms; fracture or disc derangement.</td>
</tr>
<tr>
<td><strong>V</strong></td>
<td>Severe; Requires surgical management/stabilization</td>
</tr>
</tbody>
</table>

**Norris & Watt (1983)**

**Group 1** comprised patients complaining of symptoms related to their injuries but with no abnormality on physical examination.

**Group 2** comprised patients who in addition to symptoms had a reduced range of movement of the cervical spine but no abnormal neurological signs.

**Group 3** comprised patients with symptoms, a reduced range of cervical movement and evidence of objective neurological loss.


**Croft (1993)**

I Minimal: no limitation of motion; no ligamentous injury or neurological findings

II Slight: limitation of motion; no ligamentous injury or neurological findings

III Moderate: limitation of motion; some ligamentous injury; neurological findings may be present

IV Moderate to severe: limitation of motion; ligamentous instability; neurological findings present; fracture or disc derangement*

V Severe: requires surgical management/stabilization


**Quebec Task Force on Whiplash (1995)**

0 No complaints about the neck, no physical signs

1 Neck complaints of pain, stiffness, or tenderness only No physical signs

2 Neck complaint AND Musculoskeletal signs (decreased range of motion and point tenderness)

3 Neck complaint AND neurological signs (decreased or absent deep tendon reflexes, weakness, and sensory deficits)

4 Neck complaint AND fracture or dislocation

Symptoms and disorders that can be manifest in all grades include deafness, dizziness, tinnitus (ringing in the ears), headache, memory loss, dysphagia (difficulty swallowing), and temporomandibular joint pain.

Guidelines for Frequency and Duration of Care in Cervical Acceleration/Deceleration Trauma

<table>
<thead>
<tr>
<th>Frequency and Duration Guidelines</th>
<th>Daily</th>
<th>3x/wk</th>
<th>2x/wk</th>
<th>1x/wk</th>
<th>1x/mo</th>
<th>T_D</th>
<th>T_N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade I</td>
<td>1 wk</td>
<td>1-2 wk</td>
<td>2-3 wk</td>
<td>&lt;4 wk</td>
<td>....3</td>
<td>&lt;11 wk</td>
<td>&lt;21</td>
</tr>
<tr>
<td>Grade II</td>
<td>1 wk</td>
<td>&lt;4 wk</td>
<td>&lt;4 wk</td>
<td>&lt;4 wk</td>
<td>&lt;4 mo</td>
<td>&lt;29 wk</td>
<td>&lt;33</td>
</tr>
<tr>
<td>Grade III</td>
<td>1-2 wk</td>
<td>&lt;10 wk</td>
<td>&lt;10 wk</td>
<td>&lt;10 wk</td>
<td>&lt;6 mo</td>
<td>&lt;56 wk</td>
<td>&lt;76</td>
</tr>
<tr>
<td>Grade IV</td>
<td>2-3 wk</td>
<td>&lt;16 wk</td>
<td>&lt;12 wk</td>
<td>&lt;20 wk</td>
<td>....3</td>
<td>....3</td>
<td>....3</td>
</tr>
<tr>
<td>Grade V</td>
<td>Surgical stabilization necessary--chiropractic care is post-surgical</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


1 T_D indicates treatment duration; T_N treatment total number; 2 Possible follow-up at 1 month.
3 May require permanent monthly or p.r.n. treatment.

Do the guidelines include provisions for flare-ups of the condition? No, they do not. Those cases with several flare-ups, complicating factors, and/or risk factors are inherently almost impossible to assign meaningful treatment and duration parameters. In such cases, the treating doctor is in the best possible position to determine the medical necessity for treatment.


Mercy conference guidelines

Acute uncomplicated case (<6 wks symptoms): Up to 5 visits a week for the first 2 weeks, then 3 visits a weeks after that for a maximum of 6–8 weeks (maximum 28 visits) to return to preepisode status.

Subacute case (>6 but less than 16 weeks): average 2 visits a week for 6 to 16 weeks (max 16 visits) to return to preepisode status.

Chronic case: passive care not indicated unless there has been an acute exacerbation of the chronic condition.

Complicated case: exceeds the recommended duration of care but still fits within the guidelines.

Pain >8 days duration before presenting for care may take 1.5x longer to recover.

Severe pain may take 2x longer to recover.

4 to 7 previous episodes may take 2x longer.

Pre-existing conditions, underlying pathologies or anomalies may take 1.5 to 2 times longer.

Factors complicating recovery:
- biomechanical stress
- psychological stress
- poor compliance
- prolonged static stress
- re-injury exacerbation
- multilevel DJD
- spondylolisthesis

All may delay recovery and necessitate a need for additional care that may exceed the recommended guidelines for simple uncomplicated cases.


Recently published the Council on Chiropractic Guidelines and Practice Parameter (CCGPP) recommendations in support of manipulation for both acute and chronic low back pain closely mirrors that of the Mercy Conference and other reviews.

Frequency and duration for continuing courses of treatments

<table>
<thead>
<tr>
<th>Stage of condition</th>
<th>Frequency</th>
<th>Duration (wk)</th>
<th>Reevaluate after (no. of treatments)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute</td>
<td>2-3× weekly</td>
<td>2-4</td>
<td>4-12</td>
</tr>
<tr>
<td>Subacute</td>
<td>2-3× weekly</td>
<td>2-4</td>
<td>4-12</td>
</tr>
<tr>
<td>Chronic</td>
<td>1-3× weekly</td>
<td>2-4</td>
<td>2-12</td>
</tr>
<tr>
<td>Recurrence/flare-up</td>
<td>1-3× weekly</td>
<td>1-2</td>
<td>1-6</td>
</tr>
</tbody>
</table>


International Chiropractic Association Best Practice Guidelines
Equivalent treatment parameters

Grade I #1C
1C) 3 visits per week for 7 weeks + 1 visit per week for 4 weeks + 1 follow-up exam visit (which is 25 visits in 11 weeks)

Grade II #2C
2C) 3 visits per week for 7 weeks + 12 visits for 4 weeks + 1 visit per week for 4 weeks + 1 follow-up exam visit; (which is 37 visits in 15 weeks).

Grade III #6C
6C) 3 visits per week for 7 weeks + 60 visits for 20 weeks + 1 visit per week for 4 weeks + 1 follow-up exam visit; (which is 85 visits in 31 weeks)

ICACBPG Chapter 11 Frequency & Duration Recommendations.

www.icabestpractices.org
Common Factors Potentially Complicating Whiplash Trauma Management

1. Advanced age
2. Metabolic disorders
3. Congenital anomalies of the spine
4. Developmental anomalies of the spine
5. Degenerative disc disease
6. Disc protrusion (HNP)
7. Spondylosis
8. Facet arthrosis
9. Rheumatoid arthritis or other arthritides affecting the spine
10. Ankylosing spondylitis or other spondylarthropathy
11. Scoliosis
12. Prior cervical spinal surgery
13. Prior lumbar spinal surgery
14. Prior vertebral fracture
15. Osteoporosis
16. Paget's disease or other disease of bone
17. Spinal stenosis or foraminal stenosis
18. Paraplegia or quadriplegia
19. Prior spinal injury

Especially laminectomy and disectomy.


Imaging - Significant Signs of Cervical Spine Trauma

Significant signs of cervical spine trauma

I. Abnormal soft tissues
   A. Widened retropharyngeal space
   B. Widened retrotracheal space
   C. Displacement of prevertebral fat stripe
   D. Tracheal deviation and laryngeal dislocation

II. Abnormal vertebral alignment
   A. Loss of lordosis
   B. Acute kyphotic angulation
   C. Torticollis
   D. Widened interspinous space
   E. Rotation of vertebral bodies

III. Abnormal joints
   A. Widened middle atlanto-axial joint
   B. Abnormal intervertebral disc
   C. Widening of the apophyseal joints

<table>
<thead>
<tr>
<th>Modality</th>
<th>Stage I</th>
<th>Stage II</th>
<th>Stage III</th>
<th>Stage IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cervical pillow</td>
<td>All grades</td>
<td>All grades</td>
<td>All grades</td>
<td>All grades</td>
</tr>
<tr>
<td>Cervical collars</td>
<td>As needed, temporary use.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Rigid</td>
<td>Grades III-V</td>
<td>Grades III-V</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>- Soft</td>
<td>Grades II and III</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Home traction</td>
<td>--</td>
<td>Grades II-IV Unless contraindicated</td>
<td>Grades II-IV</td>
<td>Grades II-IV</td>
</tr>
<tr>
<td>Home exercise</td>
<td>--</td>
<td>Grades II-IV Unless contraindicated</td>
<td>Grades II-IV Unless contraindicated</td>
<td>--</td>
</tr>
<tr>
<td>Ice</td>
<td>All grades</td>
<td>All grades</td>
<td>As needed</td>
<td>--</td>
</tr>
<tr>
<td>Vit/min. suppl.</td>
<td>All grades</td>
<td>All grades</td>
<td>All grades</td>
<td>Recommended</td>
</tr>
<tr>
<td>DTM</td>
<td>Grades II-IV</td>
<td>Grades II-IV</td>
<td>As needed</td>
<td>--</td>
</tr>
</tbody>
</table>

Chronic Whiplash Pathway > 12 weeks

**12 + 6 weeks** post initial presentation in chronic phase
Reassess patient - should include pain scale (VAS, NRS) and NDI and reassessment of psychological status

- Improving: Continue recommended treatments.
- Resolving: Reduce frequency of treatment. Promote independence in program.
- Not Improving: Review treatment regime. Other treatments not initially recommended may be considered. Passive treatment in combination with active treatment.

**12 + 12 weeks** post initial presentation in chronic phase
Reassess patient - should include pain scale (VAS, NRS) and NDI and reassessment of psychological status

- Improving: Continue recommended treatments.
- Resolving: Reduce frequency of treatment. Promote independence in program.
- Not Improving: Refer to specialist or consider type and dose of current treatment.

**12 weeks + 6 months** post initial presentation in chronic phase. Resolution should have occurred in up to 65% of cases 12 months post accident. In these cases treatment should have ceased. At this point, even if resolution has not occurred and provided 6 months of appropriate treatment has been undertaken, treatment should be reduced. Patients at this stage should receive periodic review.
Practitioners should encourage patients to continue an active exercise program and should emphasize self-directed active management strategies. Alternatively, discharge from your treatment and refer back to primary practitioner. When there is no demonstrable evidence of benefit, consider appropriate referral to another relevant practitioner.

- Resolving: Continue treatment with periodic review (suggested monthly).
- Not resolving: Consider other therapy. Follow specialist recommendation.

Periodic review as required, encourage and emphasize continued active self-directed management.
Continue active exercise program.
Alternatively, discharge from your treatment and refer back specialist.
**Course of Recovery After Whiplash**

<table>
<thead>
<tr>
<th>Time after injury</th>
<th>% Recovered*</th>
<th>Pain Mean: scale 0-100† (95%CI)</th>
<th>Disability Mean: scale 0-100‡ (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 month</td>
<td>44%</td>
<td>38.0 (21.8-54.1)</td>
<td>28.6 (20.4-36.7)</td>
</tr>
<tr>
<td>12 months</td>
<td>65%</td>
<td>25.3 (11.7-39.0)</td>
<td>19.0 (13.0-25.0)</td>
</tr>
<tr>
<td>2 years</td>
<td>No data available</td>
<td></td>
<td>No data available</td>
</tr>
<tr>
<td>5 years</td>
<td>75%</td>
<td>No data available</td>
<td>No data available</td>
</tr>
</tbody>
</table>

*Recovery defined by individual studies (absence or minimal pain and/or disability)  
†Where 0 is no pain and 100 is worst pain imaginable  
‡Where 0 is no disability and 100 is total disability


**Emergency department cases**

At 1 year 36% Intermittent pain  58% symptomatic  6% Severe pain  

At 2 years 14% Minor discomfort  44% Major complaints  

At 10 years 28% Intrusive symptoms  12% Severe symptoms  

**Research clinic**

Symptomatic patients 44% at 3 months; 31% at 6 months; 24% at 12 months  

<table>
<thead>
<tr>
<th>Authors</th>
<th>Study</th>
<th>Year of Studied</th>
<th>No. Collisions</th>
<th>Type of Follow-up</th>
<th># Years</th>
<th>% Chronic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hohl</td>
<td>1974</td>
<td>146</td>
<td>Mixed</td>
<td>&gt;5</td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>Norris &amp; Watt</td>
<td>1983</td>
<td>61</td>
<td>Rear</td>
<td>2</td>
<td>44-90</td>
<td></td>
</tr>
<tr>
<td>Radanov et al.</td>
<td>1991</td>
<td>78</td>
<td>Mixed</td>
<td>1</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>Gargan &amp; Bannister</td>
<td>1994</td>
<td>50</td>
<td>Rear</td>
<td>1</td>
<td>62</td>
<td></td>
</tr>
<tr>
<td>Radanov et al.</td>
<td>1994</td>
<td>117</td>
<td>Mixed</td>
<td>2</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Borchgrevinck et al.</td>
<td>1996</td>
<td>345</td>
<td>Rear</td>
<td>&gt;2.5</td>
<td>58</td>
<td></td>
</tr>
<tr>
<td>Brison</td>
<td>2000</td>
<td>380</td>
<td>Rear</td>
<td>1</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>Berglund et al</td>
<td>2000</td>
<td>138</td>
<td>Mixed</td>
<td>7</td>
<td>39.6</td>
<td></td>
</tr>
<tr>
<td>Bunkertorp et al</td>
<td>2002</td>
<td>108</td>
<td>Mixed</td>
<td>17</td>
<td>55</td>
<td></td>
</tr>
</tbody>
</table>

Following a motor vehicle collision, 15% to 40% of patients with acute neck pain develop chronic neck pain.  
MILD TRAUMATIC BRAIN INJURY

Definition
A patient with mild traumatic brain injury is a person who has had a traumatically induced physiological disruption of brain function as manifested by at least one of the following:
- Any period of loss of consciousness
- Any loss of memory for events immediately before or after the accident
- Any alteration in mental state at the time of the accident
- Focal neurological deficits that may or may not be transient but where the severity of the injury does not exceed the following:
  - loss of consciousness of approximately 30 minutes or less
  - After 30 minutes, an initial Glasgow Coma Scale (GCS) of 13-15
  - Post traumatic amnesia (PTA) not greater than 24 hours.

Post-traumatic amnesia (PTA) not greater than 24 hours.


Symptoms
Physical: headache, dizziness, nausea, sleep difficulties, fatigue, blurred vision
Cognitive: decreased attention span, concentration, mental speed and short term memory, confusion
Behavioral: irritability, emotional lability (pathological expression of laughter, crying, or smiling), depression, anxiety

POST CONCUSSION SYMPTOMS

Definition
Post-Concussion Syndrome (PCS) is defined as:
1 – History of head trauma with loss of consciousness preceding symptom onset by maximum of 4 weeks
2 – Three or more symptom categories:
   a. Headache, dizziness, malaise, fatigue, noise intolerance
   b. Irritability, depression, anxiety, emotional lability
   c. Subjective concentration, memory, or intellectual difficulties without neuropsychological evidence of marked impairment
   d. Insomnia
   e. Reduced alcohol tolerance
   f. Preoccupation with above symptoms and fear of brain damage with hypochondriacal concern and adoption of sick role.

Diagnosis
The Rivermead Post-Concussion Symptoms Questionnaire (RPQ) is a useful tool for identifying patients with this syndrome. The RPQ has predictive validity in PCS patients compared to those without PCS. However, the validity and reliability of RPQ was found to be less predictive at 6 months compared with 3 months and 7-10 days.

Pain
The Visual Analogue Scale (VAS)
The Numeric Pain Scale (NPS)

Categories of Pain relation to 0-10 pain scales:
Mild 0-3
Moderate 4-6
Severe 7 and higher.


Function/ Quality of life
The Neck Disability Index
Core Whiplash Outcome Measure
Owensky Disability Index (low back)
Northwick Park Neck Pain Questionnaire
Pain Disability Questionnaire (PDQ)
The Short Form 36 Health Survey Questionnaire (SF-36)
Bournemouth Questionnaire

Anxiety and depression
Impact of Event Scale

Sleep Problems
Epworth Sleepiness Scale

Mild Traumatic Brain Injury/Concession
Rivermead Post-Concussion Symptoms Questionnaire (RPQ)

Pain, functional limitations, and work status are related, but are not equivalent and should not be regarded as interchangeable.

Outcomes Assessment

The Neck Disability Index (NDI)
The NDI is designed to measure neck-specific disability and is based on the Oswestry Disability Questionnaire. The questionnaire has 10 items concerning pain and activities of daily living including personal care, lifting, reading, headaches, concentration, work status, driving, sleeping and recreation. Each item is scored out of 5 (with the no disability response given a score of 0) giving a total score for the questionnaire out of 50. Higher scores represent greater disability. The result can be expressed as a percentage or as raw scores (out of 50). The NDI is translated into over 20 languages. In these guidelines use of the raw score is recommended.

Raw Score Level of Disability:
0 - 4 No Disability;
5 - 14 Mild Disability;
15 - 24 Moderate Disability;
25 - 34 Severe Disability;
35 - 50 Completely Disabled


Core Whiplash Outcome Measure
The Core Whiplash Outcome Measure (CWOM) is a five-item scale that is brief and user friendly for clinicians. It helps clinicians measure several constructs of health including pain symptoms, function and well-being. In addition, it enables the number of days taken off work to be measured, which is a useful measure for CTP insurers. The CWOM has high construct validity with the Functional Rating Index and the NDI, and equal responsiveness in the short-term and long-term as these lengthier measures.

Instructions
Score as follows:
Questions 1 and 2: Score from 1-5
Question 3: Score from 5-1
Questions 4 and 5: Score as follows
0-5 days = 1;
6-11 days = 2;
12-17 days = 3;
18-23 days = 4;
24 + days = 5.
The total score is created by summating the scores from each of the five items, where the minimum score for each item is 1 and the maximum score for each item is 5. Hence, the total score for the CWOM varies from 5-25.

Impact of Event Scale (IES)
The Impact of Event Scale (IES) was developed by Horowitz, Wilner, and Alvarez to measure current subjective distress related to a specific event. The IES is a self-report measure of post traumatic disturbance and is very widely used.

Scoring Method
Each item is scored:
Not at all = 0
Rarely = 1
Sometimes = 3
Often = 5
The item scores are summed. A total score of 26 or more, at 6 weeks after injury is in the “moderate” range. A score of > 43 is “severe”.
**Pain Disability Questionnaire (PDQ)**

The PDQ is made up of two factors: a Functional Status Component and Psychosocial Component. To differentiate these two you must separate the scores.

1. Functional total items 1,2,3,4,5,6,7,12 and 13. (Max score 90)
2. Psychosocial total items 8,9,10,11,14 and 15 (Max Score 60)

3. Total PDQ Score = Total Score of all items.
   Blank items are pro-rated. If one left an item blank you would determine which item it is from, Functional or Psychosocial. Take that category and sum the score divided by the total items for the category which is your mean (Average score per item in that category). You than add the mean to the black item and re-sum. Ex you have 9 items on the functional, the patient left one blank...you sum the 8 items and the total was 48...48 divided by 8 = 6 is the mean...you now assign a 6 to the blank item and resum the total...9 X 6 = 54.
   The higher the total the higher the disability. Also you can differentiate between functional disability and psychosocial.


**Administering the Pain Disability Questionnaire (AMA 6th Guidelines of Impairment)**

*The Pain Disability Questionnaire is used in Chapter 3, Pain-Related Impairment, on pages 43-44, and in Chapter 17, The Spine and Pelvis, on pages 599-600.*

Follow these instructions for administering and scoring the PDQ:

1. Ask the patient to complete all items on the questionnaire.
2. If necessary, the patient may complete the form with the assistance of a translator or reader. Be certain all 15 questions are answered. If the patient is unable to complete the PDQ, no functional assessment score will be given.
3. The evaluating doctor will score the PDQ by adding together the marked integer in each question.
4. If the patient fails to mark a question, the default score for that question is 0.

The PDQ scores can be divided into 5 distinct categories:

- score of 0 - no disability
- scores of 1 to 70 - mild
- scores of 71 to 100 - moderate
- scores of 101 to 130 - severe
- scores of 131 to 150 - extreme
Core Whiplash Outcome Measure

Instructions
Please answer questions 1 to 5
Name: _________________________________________________________ Date: __________________

1. During the past week, how bothersome have your whiplash symptoms been?
   _____ not at all bothersome
   _____ slightly bothersome
   _____ moderately bothersome
   _____ very bothersome
   _____ extremely bothersome

2. During the past week, how much did your whiplash injury interfere with your normal work (including both work outside the home and housework)?
   _____ not at all
   _____ a little bit
   _____ moderately
   _____ quite a bit
   _____ extremely

3. If you had to spend the rest of your life with the whiplash symptoms you have right now, how would you feel about it?
   _____ very dissatisfied
   _____ somewhat dissatisfied
   _____ neither satisfied nor dissatisfied
   _____ somewhat satisfied
   _____ very satisfied

4. During the past four weeks, about how many days did you cut down on the things you usually do for more than half the day because of your whiplash symptoms?
   ____________ number of days

5. During the past four weeks, how many days did your whiplash symptoms keep you from going to work or school?
   ____________ number of days
Impact of Event Scale

On ___________________________ you experienced a motor vehicle accident.

Below is a list of comments made by people after stressful life events. Using the following scale, please indicate with an ‘x’ how frequently each of these comments were true for you DURING THE PAST SEVEN DAYS. If they did not occur during that time please mark the ‘NOT AT ALL’ column.

<table>
<thead>
<tr>
<th></th>
<th>Not at all</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I thought about it when I didn’t mean to.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. I avoided letting myself get upset when I thought about it or was reminded of it.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. I tried to remove it from memory.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. I had trouble falling asleep or staying asleep because pictures or thoughts about it came into my mind.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. I had waves of strong feelings about it.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. I had dreams about it.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. I stayed away from reminders about it.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. I felt as if it hadn’t happened or it wasn’t real.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. I tried not to talk about it.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Pictures about it popped into my mind.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Other things kept making me think about it.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. I was aware that I still had a lot of feelings about it, but I didn’t deal with them.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. I tried not to think about it.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Any reminder brought back feelings about it.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. My feelings were kind of numb.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Pain Disability Questionnaire

Patient Name _________________________ Date __________________________

Instructions: These questions ask your views about how your pain now affects how you function in everyday activities. Please answer every question by making an “X” along the line to show how much your pain problem has affected you (from having no problems at all to having the most severe problems you can imagine).

1. Does your pain interfere with your normal work inside and outside the home?
   - Work normally
     - No problems
     - Unable to work at all
   - Take care of myself completely
     - Need help with all my personal care
     - Only travel to see doctors

2. Does your pain interfere with personal care (such as washing, dressing, etc.)?
   - Travel anywhere I like
     - Cannot sit /stand at all
   - Cannot do at all

3. Does your pain interfere with your traveling?
   - Cannot walk/run at all

4. Does your pain affect your ability to sit or stand?
   - Never see doctors
     - On pain medication throughout the day

5. Does your pain affect your ability to lift overhead, grasp objects, or reach for things?
   - See doctors weekly
     - Never see them

6. Does your pain affect your ability to lift objects off the floor, bend, stoop, or squat?
   - Never need help
     - Need help all the time

7. Does your pain affect your ability to walk or run?
   - Severe depression / tension
     - Severe problems

8. Has your income declined since your pain began?
   - Never need help
     - Total interference

9. Do you have to take pain medication every day to control your pain?
   - Never need help
     - Total interference

10. Does your pain force you to see doctors much more often than before your pain began?
    - Never need help
      - Total interference

11. Does your pain interfere with your ability to see the people who are important to you as much as you would like?
    - Never need help
      - Total interference

12. Does your pain interfere with recreational activities and hobbies that are important to you?
    - Never need help
      - Total interference

13. Do you need the help of your family and friends to complete everyday tasks (including both work outside the home and housework) because of your pain?
    - Never need help
      - Total interference

14. Do you now feel more depressed, tense, or anxious than before your pain began?
    - Never need help
      - Total interference

15. Are there emotional problems caused by your pain that interfere with your family, social and or work activities?
    - Never need help
      - Total interference
<table>
<thead>
<tr>
<th>Area of Spine</th>
<th>Names of Vertebrae</th>
<th>Number of Vertebrae</th>
<th>Short Form or Other Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck</td>
<td>Occiput</td>
<td>7</td>
<td>Occ, C0</td>
</tr>
<tr>
<td></td>
<td>Cervical</td>
<td></td>
<td>C1 thru C7</td>
</tr>
<tr>
<td></td>
<td>Atlas</td>
<td></td>
<td>C1</td>
</tr>
<tr>
<td></td>
<td>Axis</td>
<td></td>
<td>C2</td>
</tr>
<tr>
<td>Back</td>
<td>Dorsal or Thoracic</td>
<td>12</td>
<td>D1 thru D12</td>
</tr>
<tr>
<td></td>
<td>Dorsal or Costovertebral</td>
<td></td>
<td>T1 thru T12</td>
</tr>
<tr>
<td></td>
<td>Throcosto-transverse</td>
<td></td>
<td>R1 thru R12</td>
</tr>
<tr>
<td>Low Back</td>
<td>Lumbar</td>
<td>5</td>
<td>L1 thru L5</td>
</tr>
<tr>
<td>Pelvis</td>
<td>Ilias, R and L</td>
<td></td>
<td>I, Si</td>
</tr>
<tr>
<td>Sacral</td>
<td>Sacrum, Coccyx</td>
<td></td>
<td>S, SC</td>
</tr>
</tbody>
</table>

Diagram showing the distribution of symptoms related to different areas of the spine.