

Whiplash Syndrome

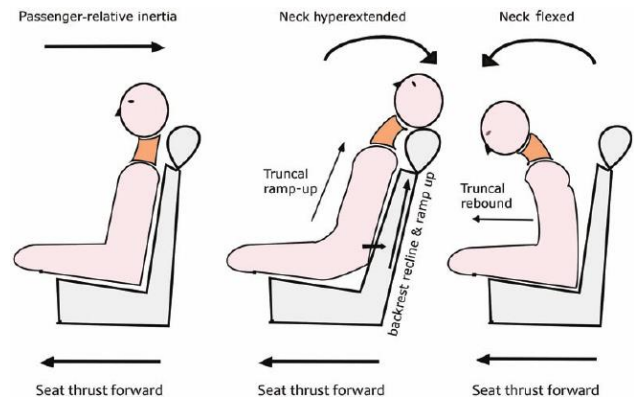
Pathology

Newton's First Law of Motion states that an object at rest will have a tendency to stay at rest unless acted upon by an outside force.

If you are waiting at a red traffic light and someone hits you from behind, your head will have a tendency to stay at rest when the force of the impact first throws the car (and your body) in a forward direction.

The lower cervicals and torso will thrust forward with the car seat causing a hyperflexion. But as the torso is being thrust forward, the upper cervicals / the head are being hyperextended, and then the cervicals are being hyper flexed to catch-up with the rapidly moving torso and lower cervicals (this is the whip like action). This is known as an acceleration injury.

- Let's look at a time line of what happens in the MVA - accelerated injury
- 0 Milliseconds (ms) ¹
 - Vehicle stationary and is Rear ended
 - Occupant remains stationary
 - No forces applied yet
- 100 ms
 - Seat accelerates and pushes torso forward
 - Torso loads the seat and is accelerated forward (seat will eventually deflect rearward)
 - Head remains stationary due to inertia
- 150 ms
 - Torso is accelerated by vehicle seat
 - Lower neck is pulled forward by the accelerated torso/seat
 - The head rotates and extends rapidly resulting in hyperextension of the neck
- 175 ms
 - Head is still moving backwards
 - Vehicle seat begins to spring forward
 - Torso continues to accelerate forward
 - Head rotation rearward is increased and is fully extended
- 300 ms
 - Head and torso are accelerated forward
 - Neck is "WHIPPED" forward and hyper-flexing the neck
 - The head accelerates forward trying to catch-up with the torso and lower cervicals.



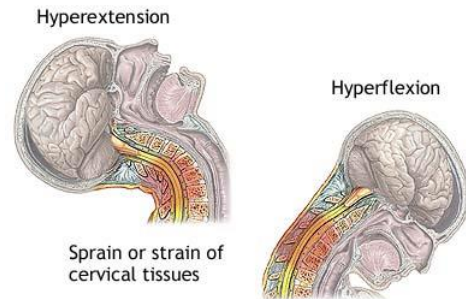
A similar situation happens in the deceleration injury. Newton's first law also states that an object in motion will have a tendency to stay in motion unless acted upon by an outside force.

If you are moving forward in a car and you hit something head-on, there is a sudden deceleration of both the car and your body.

But, your head is "floating" on top of your torso, so it is more moveable in relation to the torso. When your body suddenly stops as a result of hitting something straight in front of you (and you're strapped in by a

seatbelt), your head keeps going, but the body is strapped into the secure seat, the result will be a hyperflexion injury, but then the head gets whipped back in hyperextension, towards the body which has completely decelerated, but the head-rest typically stops the head from snapping into a full hyperextension. This will result in the anterior and posterior cervical soft tissue taking the brunt of the trauma. This is a deceleration whiplash injury.

At the moment of impact, the ranges of motion will increase and not in a good way. That is why we are calling these hyper-flexion and hyper-extension injuries. The average ROM of cervical flexion is 50-60° and extension is 60-70° but these may be increased by as much as 25-50% during these hyper-events.



Whiplash Associated Disorders (WAD) is a broad characterization of the severity and types of symptoms associated with whiplash and this was put together by the Québec Task Force on Whiplash Disorders. The severity read as follows:

ADAM.

Category	Description
• 0	No complaints or signs
• 1	Neck complaint with no musculoskeletal signs i.e. no rom loss
• 2	Neck complaint and musculoskeletal signs i.e. loss of rom
• 3	Neck complaint and neurological signs i.e. paresthesia into arm
• 4	Neck complaint and cervical fracture / dislocation

As seen in the above WAD, the injuries can involve many types of tissue - Muscle, tendon, ligament, intervertebral disc, bone, facet joint, nervous tissue, fascia, arteries and dural tube. So, as the above inflects, there is a lot of potential for injury. Also at times these injuries may not reel their ugly head for months. Example being fibromyalgia, this is being looked at as more of a nervous system disorder (I think more nervous and endocrine), and a severe whiplash falls into the parameters of a cause for the onset of fibromyalgia.

Assessments

When dealing with a whiplash injury, most injuries do not occur with driver and passengers looking straight ahead and the collision being perfectly centered to the rear-end or front-end of the vehicle, and the speed of the vehicles typically plays an important role with the extent of the soft tissue trauma. The therapist should keep all factors in mind when taking a subjective and evaluating your patients.

So let's start with a thorough subjective. The above information about the accident should be noted. Depending on the angle and direction of the accident will depend on your focus of the injured tissue. Also did the patient see the accident as it was happening? Typically this will indicate a guarded state before the accident which may indicate increased tissue trauma.

Other questions...

1. How long ago was the accident? Patients may come in 1 day or 10 years post whiplash injury. The longer out the MVA will mean the tissue trauma is more chronic in nature. I usually tell my patients for every year the chronic problem has been lingering = 2-4 weeks of excess treatment time. So an accident 3 years ago is going to be minimum 6 weeks max 12 weeks at 1 visit per week.

2. What are the symptoms? WAD Symptoms can range anywhere from ... (information gathered from Québec Task Force on Whiplash Disorders)

- Headache
- Pain neck / shoulder
- Numbness / paresthesia neck, shoulder, arm, hand
- Reduced ROM
- Nausea / Dizziness
- Ringing in the ears
- Fatigue / trouble concentrating / irritability

Secondary symptoms: Myofascial Pain syndrome (fibromyalgia), Low back pain

3. Where is/are the pain / symptoms / type of pain? Also, it is not uncommon for the symptoms to start 1-2 days post MVA. Is the pain sharp, dull, deep ache?
4. What is the intensity and frequency of the pain?
5. What makes the pain worse? Movements?
6. What makes the pain better?
7. How many hours are you sleeping? Our REM stage of sleep is our recovery stage of sleep, so if patients aren't in the REM stage, their body is never in full repair mode.
8. When is pain worse? AM / PM / All day? AM may be related to sleep positioning and problems with the mattress and or pillow height, and depression, anxiety, irritability. The former may also be related to the accident, so question the time line for the mental disturbances. LMTs are not there to treat those psyches, but we can make a recommended referral. PM may be related to the weakness within the cervical thoracic spine. The longer the day the more the muscles are firing which in turn will equal fatigue and subsequent pain.

ROM Test ³

ROM test should be performed to assess the possible limitations in movement. It is best to assess all ROMs actively first. ACTIVE means the patient is performing the ROM. Since the therapist is allowing the patient to actively contract the tissue without our assistance other than verbal guidance of movement, active ROMs (AROM) will assess the muscle and tendon trauma. AROMs are always done first, these acts as an assessment so the therapist knows what the range of motion of the joint is before the therapist uses PROM. Therapist should note the angle of movement and where any pain occurred during the ROM.

When assessing any joint with passive ROM (PROM), the therapist will distinguish injuries from contractile tissue to non-contractile tissue injury. If no pain is felt during PROM but is felt during AROM, than the injury is to contractile tissue, and if pain is felt during PROM and not AROM then the injury is most likely a non-contractile tissue like for instance a ligament, bone or bursa. When doing PROM the therapist should start by bringing the ROM to the end feel, which is where the patient's joint starts to give a bit a resistance during the PROM, but full stretch isn't ended.

Normal End Feel Physiological

Hard	Bone contacting bone <i>elbow extension</i>
Soft	Soft tissue approximation <i>elbow flexion</i>
Firm	Capsule stretch(<i>ext of MCP jt</i>) Ligament Stretch (<i>forearm supination</i>) Muscle Stretch (<i>hip flexion with knee extended</i>)

ABNORMAL END FEEL

End feel	Examples
Soft: Before complete ROM. Feels boggy.	Soft tissue edema. Synovitis.
Firm: Before complete ROM	Hypertone, soft tissue shortening.
Hard: Bony grating/bony block	#, OA, MO, loose bodies.
Empty: No end feel, pain prevents full ROM	#, Inflammation.

(#) = Pain in the above chart

As seen from the above charts, if there are any indications of hyper joint mobility, passive movements may be utilized to assess for any possible ligament or osseous pathology injury.

***The ligament hyper-mobility should be done with caution, and if not fully trained for assessing cervical ligament injury, refer to an acceptable healthcare practitioner. In this assessment section, there are no hypermobility ligament tests included. Again they should be done by a trained professional.*

Cervical ROM chart

Cervical		measurement	normal	% of Normal
	Flexion	<input type="text"/>	50	
	Extension	<input type="text"/>	60	
	Left Lat Flex	<input type="text"/>	45	
	Right Lat Flex	<input type="text"/>	45	
	Left Rotation	<input type="text"/>	80	
	Right Rotation	<input type="text"/>	80	

Other Orthopedic Assessments

1. Cervical Distraction Test ^{2,3}

Purpose: To assess the contribution of cervical radiculopathy of the patient's symptoms.

Test Position: Supine.

Performing the Test: Either place each hand around the patient's mastoid processes, while standing at their head, or place one hand on their forehead and the other on the occiput and slightly flex the patient's neck and pull the head towards your torso, applying a distraction force. A **positive** test is when the patient's radicular symptoms are reduced with the traction.

Importance of the Test: As disc height decreases and bone spurs accumulate, the space for nerves to enter and exit the vertebral canal gets smaller. The decreased space can result in greater pressure on the nerve roots or other innervated structures, causing pain and weakness. With distraction, the joint space is increased to relieve the pressure on the nerve roots, thus decreasing the symptoms.

2. Deep Neck Flexor Endurance Test ^{2,3}

Purpose: To assess the endurance of the deep neck flexors (Rectus Capitus Anterior, Rectus Capitus Lateralis, Longus Capitus, Longus Colli - "Muscle specificity in tests of cervical flexor muscle performance").

Test Position: Supine

Performing the Test: Tuck patients chin in and lift off table 1 inch. The examiner looks for substitution of the

platysma or SCM muscle and patient holds.

Normal Values: Men: 38.9 seconds, Women: 29.4 seconds (“The Deep Neck Flexor Endurance Test: normative data scores in healthy adults”).

Importance of the Test: Those with neck pain were found to have significantly decreased deep neck flexor endurance, average of 21.4 seconds (“Reliability of a measurement of neck flexor muscle endurance”). They tend to over-utilize other muscles (platysma, hyoid muscles, and especially the sternocleidomastoid) for postural maintenance, which leads to the commonly seen position of forward head postures—a position we commonly see in those who use computers frequently or engage in sedentary activity on a regular basis. This may lead you to think of some impairment that is contributing to the patient’s pain. Be sure to assess a patient’s posture and segmental mobility in the cervical spine.

*** If there is any doubt due to severe acute pain, excessive pain or neurological symptoms into extremity, refer out. Therapist May need to rule out Bone, Ligament or Nervous tissue injury through MRI, X-ray and CT scan which is prescribed by MD or possible physical therapist.*

Treatment

Per the norm, the general 48-72 post injury applies here. Within the first 72 therapists can utilize energy work and effleuraging / lymphatic work can be applied to the area, but no stretching or vigorous massage within the first 48-72 hrs.

In the past, immobilization was a standard form of treatment, but over the years the healthcare profession has gotten away from mobilization (cervical collars) for muscle and tendon injury. It is better to keep firing those muscles for posture, so they don’t atrophy. I want my patients to use their muscles and keep their ROMs going. I tell them to push it to a pain-free – uncomfortable range of motion.

Considering the whiplash effects on the cervical intervertebral discs and ligaments, a cervical traction device is something we use here in the office. If the symptoms aren’t severe enough to warrant a referral out, or if a patient has been cleared by their MD and a cervical distraction test came back positive, utilizing cervical neck traction can be helpful to decompress the nerve involved. If necessary, it can be recommended that a patient invest in a unit for home use as well. They can range anywhere from \$50-\$350.

Patients may feel the need to take NSAID’s, which I have no problem with. If it makes them feel better so they can move more freely, there is no harm in allowing them to increase their ROM. But, I leave this to their discretion, as LMTs are not in the prescription business.

Hands-on treatment

If after 72hours the patient is still a bit too sore for deep work on the area of concern, I will utilize more PNF and RI types of approaches.

Reciprocal Inhibition - Supine

- Lateral flexors of the neck – side stretch to the left until end feel (so right side is being stretched), contract muscle on the opposite side (left) for 7-10 secs, relax, then stretch until the next end feel barrier and then re-stretch to new end feel, repeat above 3-5 x’s.
- Anterior flexors of the neck –while therapist supports the head with both hands, Have client scoot up so there head and neck are hanging off of the table. Therapist slowly lower the client’s head of the table until you begin to feel a little resistance from the anterior flexors (always supporting the head), at that point start to contract muscle on the opposite side (the extensors get pushed in to therapists hands) for 7-10 secs, relax, then lower the head to the next end feel and repeat above 3-5 xs.

PNF - Supine

- Lateral Flexion of the Neck – side stretch (right) to end feel, contract muscle being stretched (right) for 7-10 secs, relax, then move to the next end feel barrier and repeat 3-5 xs.
- Anterior flexion of the neck – Lift head and stretch to end feel, contract muscle being stretched for 7-10 secs, relax, then move to the next end feel barrier and repeat 3-5 xs.(Neck extensors are being stretched)

Next is a highlight list of techniques that can be utilized to help with the normalization of the soft tissue.

- Myofascial mobilization (MM) to the anterior and posterior thoracic's
- MM to the posterior, lateral and anterior cervicals
- Neuromuscular therapy (NMT) to the suboccipitals, scalenes, scm, levator scapula, longus colli and capitis
- Possible strengthening exercises to anterior, posterior and lateral cervicals and upper thoracics (depending on your state and scope of practice may not be indicated for just an exclusive LMT)
- Patient HW – stretching and possible strengthening.

I hope you enjoyed this article, and I would appreciate any feedback.

I look forward to seeing you in an upcoming class.

In good Health,

Jeff Mahadeen LMT, Structural Integrator, Personal Trainer, Educator

“He who loves practice without theory is like the sailor who boards ship without a rudder and compass and never knows where he may cast.” **Leonardo Da Vinci**

1. Dr Christopher Jenner, Imperial Healthcare NHS Trust and London Pain Clinic, lecture power point, May 10th 2012
2. <https://www.thestudentphysicaltherapist.com/deep-neck-flexor-endurance-test.html>
3. MWI Ortho testing Manual, Jeff Mahadeen and Kelly Toler
4. Othopedic Massage, Whitney Lowe, 2009 2nd ed
5. file:///C:/Users/jeff/Documents/cont.%20ed/strengthening%20therapeutic/1%20intro%20&%20shoulder/LWW%20Assessment%20needs%20to%20be%20added%204_15_17.pdf