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Introduction

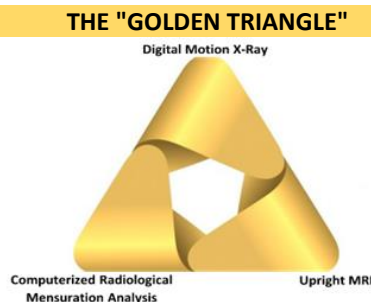
Douglas E. Schmidt, a personal injury lawyer with over 50 years' experience in handling neck and back injuries resulting from CAD (Cervical Acceleration/Deceleration) or "whiplash trauma" says this:

A large percentage of personal injuries involve injuries to the human spine, the neck and back. Many of those injuries involve damage to the ligaments of the spine which cannot be objectively determined with normal X-rays, MRIs or CT scans. They can be proven by Digital Motion X-ray.

Digital Motion X-ray (DMX) is an "X-ray movie" showing X-ray images of the movement of the human body in motion. DMX, when used to assess for ligament damage in the cervical spine, is one of the greatest medical developments in my 40-year career as a personal injury lawyer.

Computerized Radiological Mensuration Analysis (CRMA) can then be used to precisely measure the amount of ligamentous laxity and, thus, ligamentous injury and damage.

DMX, combined with CRMA analysis and multi-positional upright MRIs, comprises the "Golden Triangle" that provides solid objective proof of ligamentous and disc injuries - which couldn't have been objectively proven in the past.



Acceleration/Deceleration Injuries (CAD or "Whiplash") are estimated to produce 3 million injuries per year. For many years, ligamentous injury has been at the core of most Cervical Acceleration/ Deceleration injuries (CAD).

However, until recently there was no objective proof of the ligamentous injuries. DMX now provides that proof.

This science is firmly recognized in respected medical literature, i.e., that whiplash injury to cervical ligaments causes spinal instability, which is recognized as Alteration of Motion Segment Integrity (AOMSI). This concept is well- respected in medical research and literature, but poorly recognized in the everyday practice of the general medical community.

For the first part of my legal career as a personal injury Attorney, we didn't have MRIs – and, in turn, no objective proof of disc injuries. Without that objective proof, many victims of personal injury were dismissed by the medical community as "complainers." They were told to just "grin and bear it." They received minimal compensation for their injuries.

Later, when I started seeing MRI scans proving the existence of disc injuries, I became sad for all of those past clients who didn't get justice because they couldn't prove their disc injury.

Digital Motion X-rays now can objectively prove injury to the ligaments that are so important in maintaining structural integrity to the human spine. I am now seeing case after case where my clients' ligamentous injuries are now being objectively proven. I can't help but reflect on all the victims of whiplash injuries that haven't received the justice they deserved because there was no objective proof of ligamentous injuries.

Now, the good news!!! This combination of technology has come together as one of the biggest single medical advancements of my 40+ year legal career!!!

The 'Golden Triangle' now provides objective proof of ligamentous injury and the devastating consequences of the accelerated degeneration that follows:

- 1. Digital Motion X-ray (DMX);***
- 2. Computerized Radiographic Mensuration Analysis (CRMA); and***
- 3. Multi-positional MRI.***

Nearly 100% of the DMX's that have been performed on my clients have revealed objective proof of ligamentous laxity. (Note: These cases have been carefully selected, i.e., the majority being clients with significant symptoms that are resistant to conventional treatment modalities and that last more than 1 year after the motor vehicle collision.)

Another remarkable development has ensued. It has been well established in the medical literature for many years that flexion-extension trauma results in accelerated degeneration of the spine, including the intervertebral discs. Until recently, that has only been a theoretical concept based on clinical observations. Recently, we have 'circled back' and sent a number of our clients with objectively documented Alteration of Motion Segment Integrity back for repeat MRIs. The results have been astounding, showing clear proof of shockingly accelerated degeneration of the intervertebral discs in a matter of just a few years. [See Appendices A and B for case examples.]

The evidence that DMX videos provide in the court room setting is also amazing. In the very first case in which DMX was introduced as evidence in a court trial, the jury was obviously fascinated. They 'scooped' forward in their seats, craned their necks forward, and stared 'buggy-eyed' at the screen as the DMX film played out. The result was a jury verdict of \$743,188.95, in a case where the last formal offer before trial was only \$10,000.00. [See Appendix C for a copy of the jury verdict in that case.]

DMX is an amazing technological development. It is well recognized and respected in the medical literature – but the vast majority of the medical community has virtually no knowledge of it. It has been accepted as reliable evidence in court in a number of cases. The courts and arbitrators have accepted DMX/CRMA in over one hundred cases where the Schmidt Salita Law Team has represented the victim without a single case where the evidence has been rejected.

The purpose of this Handbook is to provide basic information about the value of DMX in medical, chiropractic and legal practice.

Respectfully submitted,

***Douglas E. Schmidt
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1. The normal and healthy function of the cervical spine is critical and vital.

The importance of the cervical spine should not be minimized. The cervical spine supports the head and brain. It protects the spinal cord and the supply of neurological function to the remainder of the body. It protects the blood supply flowing through the subclavian and carotid arteries to the head and brain. It provides for movement of the head in relation to the body proper, allowing for functions such as proprioception, balance and vision.

Ligaments play a passive/protective role, becoming taut only during the extreme ranges of motion, controlling the 'end play' to prevent pathological movement. In other words, they are intended to prevent excessive movement of the joints of the body – but they can fail when stretched too far.

The ligaments of the cervical spine play an especially important role. 50% of all rotational movement of the cervical spine occurs in the joint between the atlas and the axis (C1-2). Because there is no intervertebral disc at that the C1-2 joint, the burden falls on the ligaments to provide the large majority of the structural support.

The remainder of the cervical spine consists of a combination of ligaments, including the anterior and posterior longitudinal ligaments (ALL & PLL), the ligamentous flavum (LF), the interspinous ligaments, the capsular ligaments of the facet joints, and the nuchal ligaments. These ligaments play an important role in maintaining the structural integrity of the cervical spine. Without their support, the cervical spine loses its stability which results in significant negative consequences.

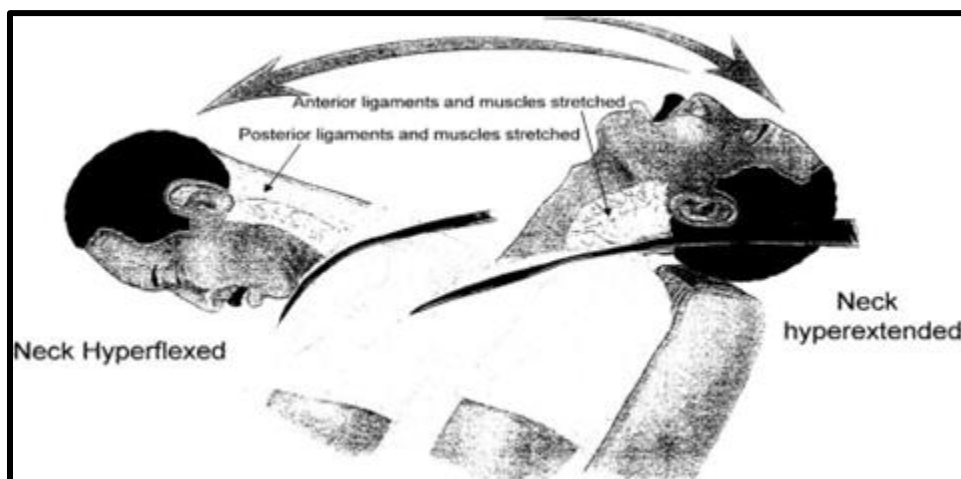
2. Ligamentous injury is at the core of all whiplash, CAD (Cervical Acceleration/Deceleration) injuries.

It is well known that ligament damage is at the core of all Cervical Acceleration/Deceleration Injuries (CAD, also known as flexion/extension injuries or "whiplash" injuries).

The collection of ligaments of the vertebral column, working in conjunction with the muscles, intervertebral discs, and tendons, provide the structural integrity of the spinal column. Ligaments provide a natural brace, aid in joint stability (especially in movement) and, when healthy, work to protect against abnormal movements in hyperextension and/or hyperflexion¹.

As noted in Foreman and Croft:

"Ligaments and related structures such as the fascia and the discs are also damaged or disrupted in CAD trauma. Both the ALL (Anterior Longitudinal Ligament) and the posterior ligamentous complex (intervertebral disc, zygapophyseal joint capsules, posterior longitudinal ligament, ligamentous flavum, interspinous ligament, and the ligamentum nuchae) have been shown experimentally...to rupture, either partially or completely. Ligaments of the upper cervical spine, such as the cruciform ligament, the suspensory and apical ligaments of the dens, and the alar ligaments also have been found to be ruptured or disrupted."



In rear-end collisions, the force of the impacting vehicle drives the car forward violently with the seatback pushing the torso of the occupants forward. The head is not restrained and is forced backwards².

Injury to the ligaments of the cervical spine is a “well established feature” of whiplash trauma resulting in joint laxity and spinal instability. This condition is typically not detectable with static X-rays, MRIs or CT scans. Videofluoroscopy (digital motion X-ray) allows for examination in movement which can reveal the abnormalities of intervertebral motion associated with ligamentous instability³.

One of the most common injuries in motor vehicle crashes is that of soft tissue injuries of the cervical spine. Even low speed collisions can cause deformations due to abnormal stretching of the cervical ligaments beyond their natural physiological range of motion⁴.

This paper “Diagnostic Accuracy of Videofluoroscopy for Symptomatic Cervical Spine Injury Following Whiplash Trauma” was published in 2020 in a well-ranked peer-reviewed journal, describing a 10 year research project that has basically validated ligament injury as the pathology in patients with chronic pain after crash-related trauma, The diagnostic technique used to ascertain the diagnosis is DMX or Digital Motion X-ray⁵.

3. CAD trauma causes damage to cervical ligaments by stretching them beyond their anatomical limit.

CAD forces in rear-end collisions have been found to reach 9 G’s of force, or 9 times the force of gravity, resulting in the human head, which normally weighs 10 pounds, to effectively weighing the equivalent of 90 pounds. The forces created during a rear end collision push the human torso forward while the head is forcefully tossed backwards, resulting in the forceful hyperextension and hyperflexion of the cervical spine and injury to the associated ligaments.

Hyperextension has been proven to cause damage to the anterior longitudinal ligament (ALL) and the facet capsular ligaments.

Cadaver studies have revealed that “failure elongation,” or stretching of the interspinous and supraspinous ligaments was significantly greater than that of the anterior longitudinal ligament (ALL) and the ligamentous flavum, both of which are naturally the most flexible. Cadaver studies have confirmed “failure elongation” of the interspinous and supraspinous ligaments as much as 4.9 mm⁶.

Sixty percent or more of the victims of chronic pain lasting more than one year post-accident have facet joint injury, specifically in the facet joint capsule, as the primary source of their pain⁷.

Research in the Journal of Biomechanics reported that injury to the apical and alar ligaments is common as a result of CAD trauma, with damage to the alar ligaments occurring in 66% of whiplash victims⁸.

Hyperflexion has been proven to cause damage to the ligamentum flavum and the interspinous ligaments.

4. Over-stretching of ligaments causes “plastic” (versus “elastic”) deformity with spinal instability.

Over-stretching, or excessive distension (hyper-elongation), of the cervical ligaments results in “plastic” deformity instead of “elastic” deformity¹.

“Elastic” deformity is that which returns to its original shape, like a rubber band.

“Plastic” deformity is that which does not return to its original state and, thus, results in the ligament remaining “stretched.” In other words, once stretched, always stretched.

Six Pack Analogy: A frequently used analogy is that of the plastic holder for a six-pack of soda pop. When a person pulls a can out of the plastic holder, it stretches its shape and does not return to its original shape. The plastic holder will no longer hold the can if one attempts to put it back. That is exactly what happens with an over-stretched ligamentous injury.

Ligaments suffer a “sub-failure injury where they are stretched beyond their elastic limit with resulting abnormal flexibility constituting functional injury to the spine¹.”

The end result is that this plastic deformity leaves the ligament with laxity, meaning that it is too loose to hold the joint in proper anatomical alignment, resulting in “joint hypermobility” of AOMSI. The result is that the entire complex of nerves, muscles, tendons, and intervertebral discs becomes dysfunctional, a condition called spinal instability.

Note: The ICD10 Code for ligamentous injury of the cervical spine is S13.4, which applies to a “sprain of the joint/ligament of the cervical spine” including the anterior longitudinal ligament, the atlas-axial joint, and the cervical spine generally⁹.

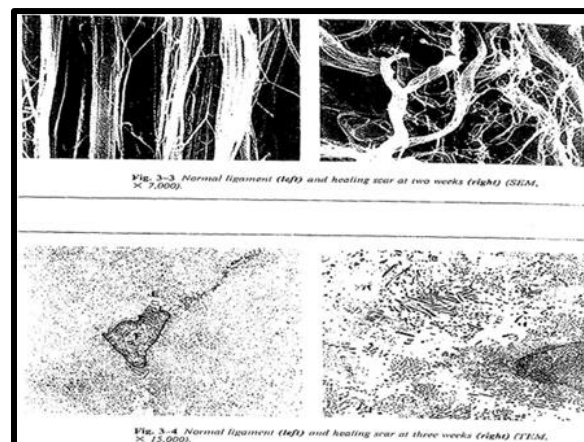
5. Plastic deformity of the cervical spine ligaments is a permanent condition with progressive degeneration.

Injury to both the muscles (“strain”) and the ligaments (“sprain”) of the cervical spine may be the cause of immediate acute symptoms of neck pain and muscle spasm. The resulting healing process is often much different. Muscles are highly vascularized with abundant blood supply which allows for prompt healing. Ligaments, on the other hand, have poor blood supply and heal slowly with the potential for the formation of scar tissue¹⁰.

Plastic deformation is, by definition, permanent. Overstretched ligaments heal with scar tissue. The following photographs show the abnormal scar tissue formation in ligaments that have been injured due to abnormal stretching in a flexion-extension injury.

Foreman/Croft states, “The healing of ligamentous structure is generally incomplete” (p. 183) and further, “Plastic deformation or ligamentous ‘sub-failure’ still present after 4 months is likely to be permanent.” (p. 185)¹¹

The AMA Guides to the Evaluation of Permanent Impairment acknowledge the permanency of AOMSI. When the translational laxity (anterolisthesis or retrolisthesis) is 3.5 mm or greater, the condition is the basis of a 25% to 28% impairment rating. An angular abnormality of 11 degrees is also deemed the basis of a 25% to 28% impairment.



6. “Sub-failure,” stretch only-no tear, ligament injuries are as serious as complete ligament tears!

Ligamentous injuries are classified in the medical literature in two categories:

1. Complete failure injuries involving a total tear or rupture; and
2. Sub-failure injuries involving a “stretching” without tear or rupture.

Studies have proven that “sub-failure” ligamentous injuries can be as serious and often more serious than “complete failure” ligamentous injuries. An article published in the Journal of Biomechanics reported on studies done at the Orthopedic Bioengineering Research Laboratory of Colorado State University. They took anterior longitudinal ligaments (ALL) and ligamentum flavum (LF) ligaments from cadavers and subjected them to whiplash-type trauma. The results were:

1. Stretch (distension) damage resulted in abnormal laxity equal to having “no ligamentous support” at all!!
2. Partial injury to these ligaments resulted in laxity equivalent to “completely compromised” ligaments¹².

7. Alteration of Motion Segment Integrity (AOMSI) is the medical term for instability of the spine caused by ligament damage.

Instability of both the cervical and lumbar spine from trauma or the resulting degeneration is recognized as a significant contributor to neck and lower back pain and disability¹³.

The American Academy of Orthopedic Surgeons defines instability as “segmental instability [which] is an abnormal response to applied loads, characterized by motion in motion segments beyond normal constraint¹⁴.”

The results of AOMSI are chronic pain, headache, dizziness, vertigo and paresthesia in the upper extremities which have been confirmed by autopsy studies to be the result of ligamentous injury. Ligamentous instability results in increased stress and strain on the paravertebral muscles with resulting myofascial pain. Biomechanic researchers Paul Ivanic and Manohar Panjabi have performed studies establishing that laxity of capsular ligaments in the facet joint is a significant cause of facet pain, muscle spasms, altered muscle response patterns, repositioning errors, and altered neck range of motion¹⁵.

8. Ligament injuries produce two types of “motion segment” impairment – translational and angular.

The primary function of ligaments is to hold the vertebrae in place.

Ligamentous “stretch” injuries produce laxity. Ligamentous laxity, in turn, causes abnormal movement of the vertebrae that can be seen on X-ray. The ligaments do not show up on the DMX. However, the abnormal positioning and motion of the vertebrae in the cervical spine does show up on a motion X-ray. It is a simple fact that the function of ligaments is to keep the vertebrae in their normal anatomical position. Abnormal positioning of the vertebrae results from ligamentous laxity. Therefore, the abnormal motion of the vertebrae revealed by motion X-ray proves the damage of the ligaments, i.e., ligamentous laxity.

Medical literature has established two types of motion segment impairment resulting from ligamentous laxity:

1. Translational irregularity,
and
2. Angular irregularity.

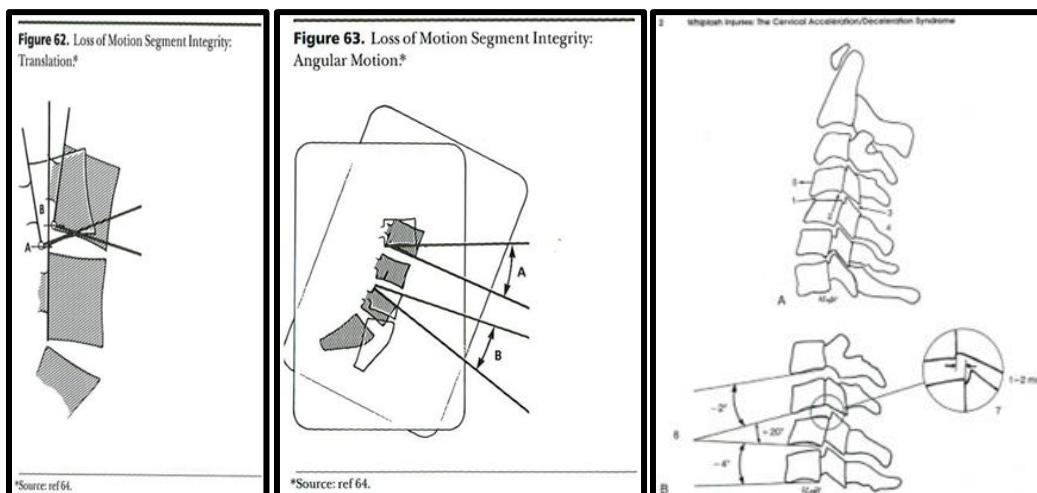
Since 1993, the AMA Guides to the Evaluation of Permanent Impairment have recognized the concept of “**Alteration of Motion Segment Impairment**” (AOMSI).

A “motion segment” of the spine consists of two adjacent vertebrae, an intervertebral disk, and the corresponding facet joint. Loss of motion segment structural integrity can be either “translational” or “angular”.

“**Translational AOMSI**” is defined as abnormal horizontal, or back-and-forth, motion. Forward slippage is anterolisthesis. Rearward slippage is retrolisthesis. Translational AOMSI in the cervical spine of more than 1 mm. is considered abnormal, and more than 3.5 mm. is considered a 25% impairment according to the AMA Guides.

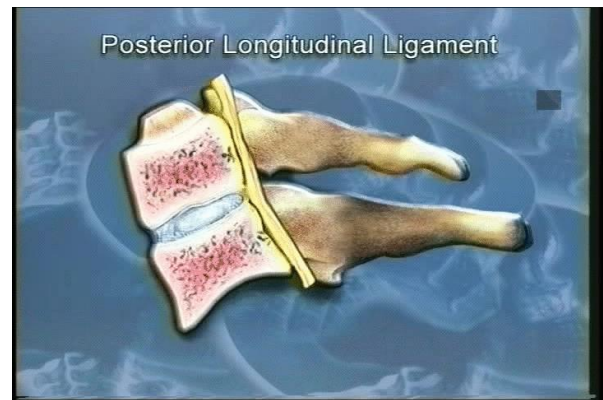
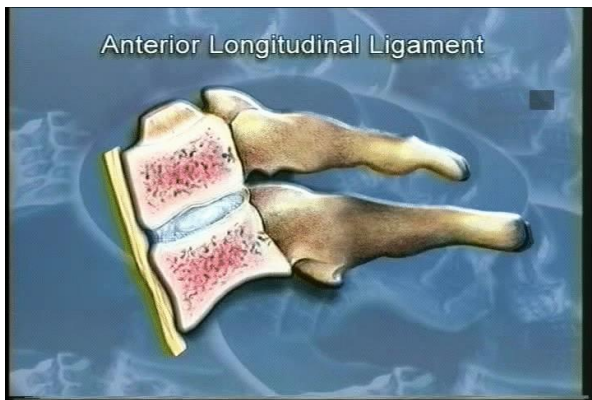
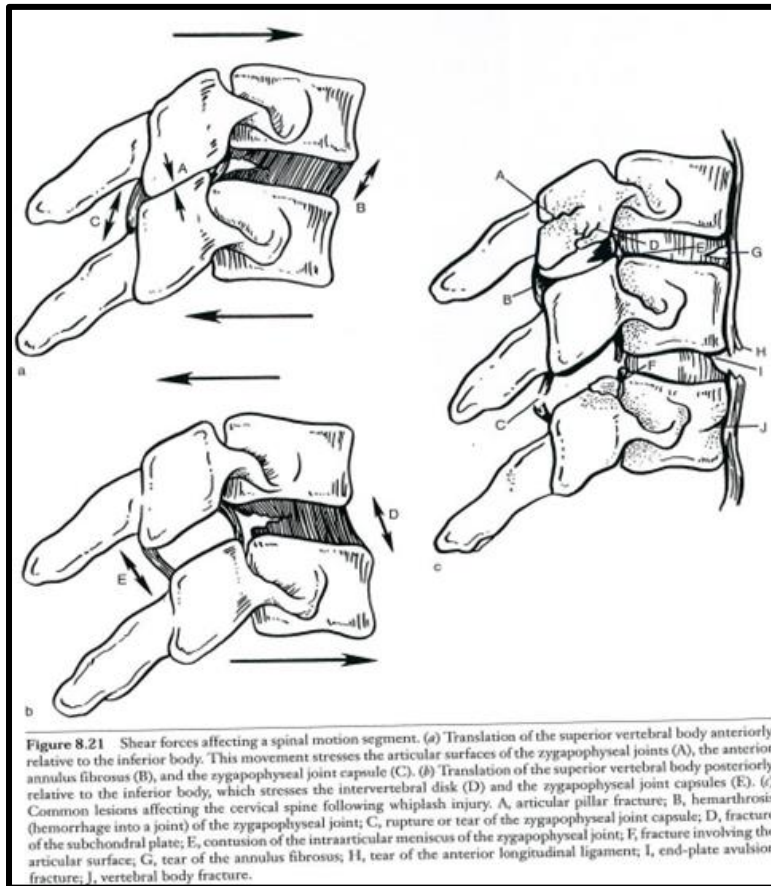
“**Angular AOMSI**” is defined as excessive angular bending of one vertebra in relation to the one above or below. In a normal spine, there is a smooth curvature of the cervical spine called the “George’s line” (also known as the posterior vertebral alignment line) which is a measure of the integrity of the posterior longitudinal ligament and vertebral body alignment. Interruption of the smooth curvature of the George’s line is evidence of ligament instability due to ligamentous sub-failure injury. Excessive stretching of the cervical ligaments can result in excessive binding at one or more spinal joints which can only be properly evaluated with maximum flexion and extension. Angular AOMSI of more than 7 degrees is considered abnormal, and over 11 degrees is considered as a 25% impairment by the AMA Guides.

The *AMA Guides to the Evaluation of Permanent Impairment*, 4th Ed (1993) illustrate the concepts of Loss of Motion Segment Integrity, both in terms of “translation” motion and angular motion as follows:



Foreman/Croft used a similar illustration of the same concept in 1995:

Loss of translational motion segment integrity can result in both **retrolisthesis** (the backward displacement of one vertebra in relation to the vertebral body immediately below it) or **anterolisthesis** (forward displacement). Trauma is a well-recognized cause of this phenomenon. See the illustration below which shows both anterolisthesis (top left) and retrolisthesis (bottom left) due to rupture of the capsular ligament:



Research has proven that overstretching of these ligaments without tear or complete rupture can result in almost the same amount of laxity as with a tear or complete rupture.

9. It's all about motion!!!

Most patients complain that their worst pain is with movement, especially repetitive movements. This aggravates their symptoms, producing muscle spasms, myofascial pain, and disability. Since it is motion that causes the symptoms, it is logical to conclude that imaging during motion is more likely to reveal the injury.

In simple language, when people are hurt in motion, diagnostic tests must be done in motion to properly detect the full extent of the problem. DMX does that!!!

“The proof is in the pudding.” DMX has the ability to identify ligamentous laxity during certain movements and not others.

It's like the wind. You can't see it, but you can see what it does, it makes a flag wave North, South, East or West. You can't see the ligaments themselves, but you can see the abnormal motion that results.

The reason that digital motion x-ray is so instructive is simple. It's like the wind. You can't see wind but you can see what it does, how it waves the flag and even knocks down trees. The structural integrity of the ligaments can only be assessed by observing the movement of the vertebrae in relation to other vertebrae. Only by using digital motion x-rays taken during movement can the accurate and complete assessment of ligamentous integrity be determined. Abnormal movement of the vertebrae reveals ligamentous laxity caused by the excessive stretching of the spinal ligaments. Conversely, when the cervical spine is not moving, it is impossible to fully assess the relative motion of the vertebrae in relation to each other and the resulting ligamentous injury.

For 30 years, the AMA Guides have recognized “Alteration of Motion Segment Integrity” (AOMSI) as the basis of permanent impairment of the spine and have recognized that it cannot be determined by physical examination alone. Instead, flexion-extension X-rays are required:

"Motion of the individual spine segments cannot be determined by physical examination but is evaluated with flexion and extension roentgenograms¹⁶."

Taking that statement to its logical conclusion, how can static X-rays fully reveal an abnormality that occurs in motion? It is simply nonsense to suggest that that could happen. Instead, digital motion x-rays are needed to show motion abnormalities!!!

It is important to remember that during the acute phase of the whiplash injury, muscle spasm creates hypomobility of the cervical spine which hides the ligamentous laxity. Accordingly, the abnormal excessive motion resulting from ligament damage cannot be expected to be revealed on digital motion X-ray during the acute stage until the muscle spasm has subsided.

10. Spinal instability due to ligamentous injury is recognized by the World Health Organization as a significant medical condition.

In 2005, the World Health Organization assembled a team of international experts to study the safety and efficacy of chiropractic treatment. The final result was the publication of the WHO Guidelines on Basic Training and Safety in Chiropractic, World Health Organization, Geneva 2005. The Guidelines recognized that chiropractic treatment “offers a potential for cost-effective management of neuromusculoskeletal disorders.”



The WHO Guidelines also recognized ligamentous laxity with signs of ligamentous rupture or instability to represent a serious condition so that they “represent an absolute contraindication to joint manipulation applied at the anatomical site or region.” The Guidelines further declared that atlantoaxial instability, in particular, represents an absolute contraindication to joint manipulation at that area of pathology.

The Guidelines declared that “patients who have suffered traumatic events require careful examination for areas of excessive motion, which may range from mild heightened mobility to segmental instability.”

11. DMX is an X-ray movie.

The concept is quite simple. DMX is simply a “moving picture” using a series of X-rays to create an “X-ray movie”. X-rays were discovered in 1895, by Professor Roentgen in Germany. Thomas Alva Edison obtained the first patent for a moving picture or “movie” in 1908. (A movie or motion picture is simply a series of still photographs shown on the screen moving from one image to another with such speed that the human brain perceives it as a moving image.)

So why did it take so long to put 2 + 2 together, adding the X-ray and the moving picture together? The problem was that of excess radiation, which previously resulted from taking all of the X-rays that are necessary to create an X-ray “movie.” This problem has been solved.

Digital Motion X-ray utilizes X-ray technology, and couples it with new digital and optic technology in the image intensifier to create high-resolution images of the spine and skeletal system in real-time motion. **DMX can produce 2700 still X-rays with the same radiation dose as the seven (7) view Cervical Davis Series.**

DMX testing is performed while the patient is in a weight bearing standing position and moving the body through different arcs of motion. Each arc of motion is specific to test an individual motion segment in a specific group of ligaments. Each arc of motion is a complete independent study that focuses on the anatomical structures found in that arc of motion.

The intended use for Digital Motion X-ray is to visualize suspected intersegmental joint dysfunction by evaluating all 22 major cervical ligaments with 2700 X-ray images. DMX is performed in a weight bearing position. (This is much more than a "chiropractic X-ray" designed to look for "subluxations.")

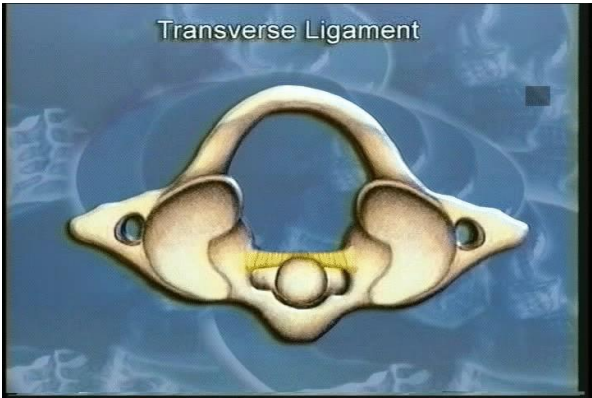
There are two types of Ligament Injuries:

1. **Sub-failure:** When a ligament stretches or partially tears, and
2. **Complete failure:** When a ligament is completely severed.

Digital Motion X-ray is the only test that will detect sub-failure ligament injuries. MRI does not have the resolution to detect the stretching or an elongation of a ligament. MRI can detect a complete failure, which is commonly seen in the knee and shoulder. Sub-failure ligament injuries are most commonly seen in the cervical spine, the temporomandibular joint (TMJ), and the wrist.

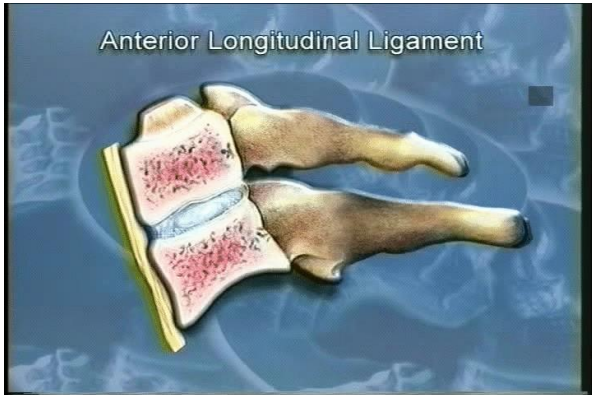
DMX can provide valuable information about the stability of all 22 major ligamentous structures in the cervical spine (**anterior and posterior longitudinal, facet/capsular, alar, transverse, and accessory ligaments**). The upper 30% of the cervical spine gets its stability from ligaments only. There are no intervertebral discs in the upper 30% of the cervical spine between Occipital C1 and C2. Digital Motion X-ray is used in demonstrating instability in the neck that may be responsible for posterior neck pain, headaches, and referred pain.

DMX provides objective proof of injury which provides substantiation to insurance companies for continued treatment.



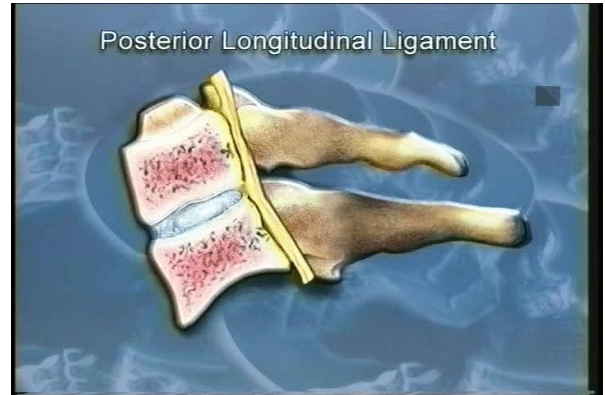
Transverse Ligament

Transverse Ligament



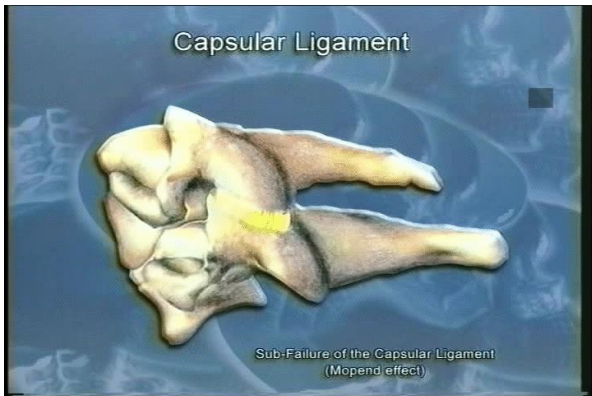
Anterior Longitudinal Ligament

Anterior Longitudinal Ligament



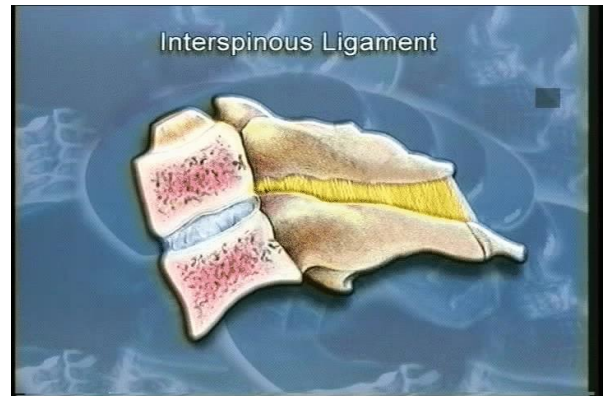
Posterior Longitudinal Ligament

Posterior Longitudinal Ligament



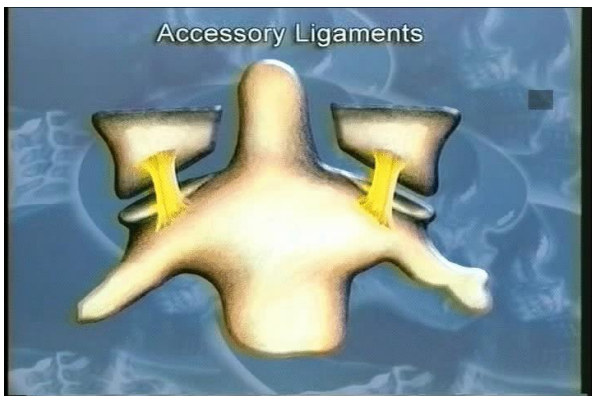
Capsular Ligament

Capsular Ligament



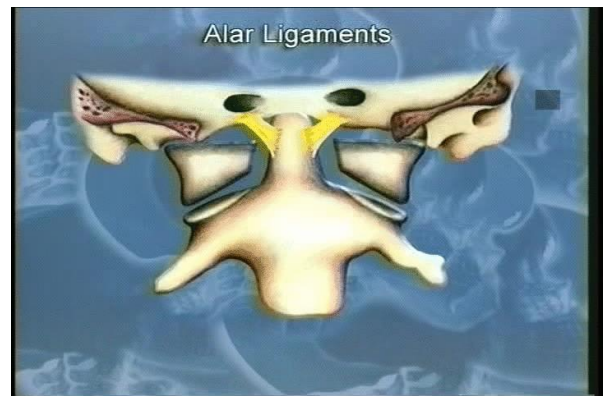
Interspinous Ligament

Interspinous Ligament



Accessory Ligaments

Accessory Ligament



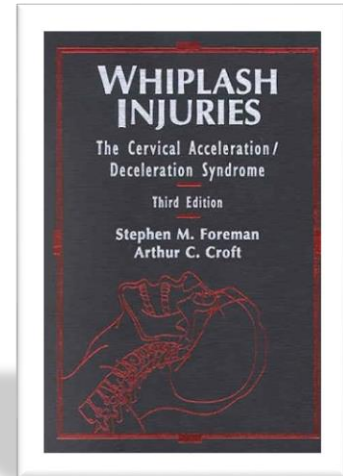
Alar Ligaments

Alar Ligament

12. DMX can detect ligamentous laxity that static X-rays cannot see.

Because DMX can X-ray the vertebrae in motion, it is able to detect ligamentous laxity that static X-rays cannot see. As noted by Foreman/Croft, static X-rays don't reveal major ligamentous injuries:

Most of these [static X-ray] studies...fail to define movement in a dynamic sense...deviation from the normal biokinetics may occur somewhere between these arcs of motion, which would not be visualized by static radiographic techniques.



A study by Buonocore found that 68% of the whiplash injuries studied by DMX were interpreted as abnormal. Another study by Woesner and Mitts reported that DMX detected abnormalities in 35% of the plain film studies that were interpreted as normal.

The author's series has shown that objectively determined ligamentous laxity has been revealed by DMX in nearly 90% of the cases of patients with chronic pain resistant to treatment and lasting more than one year post-surgery. Nearly 30% of these were revealed to have ligamentous laxity sufficient to warrant a 25% impairment rating using the standards of the AMA Guides, 5th Ed.

90% of subjects with chronic neck pain resistant to conventional treatment had abnormal ligamentous laxity on DMX. 30% had enough laxity to justify a 25-28% AMA impairment.



13. DMX is well respected by the chiropractic experts.

DMX has been utilized by chiropractic experts for many years. In 1995, Foreman/Croft stated that:

Videofluoroscopy is important in the evaluation of ligamentous instability...Several studies have indicated that value of Videofluoroscopy in the evaluation of certain types of soft tissue lesions of the neck...clinicians trained in the interpretation of these studies are able to interpret them reliably. (p. 53).

They continue to state that:

Videofluoroscopy has an important role in the diagnosis of instability of the cervical spine and, to some extent, in determining the prognosis regarding future disability. For example, making them has shown that the healing of a ligamentous structure is generally incomplete; this instability may result in early and accelerated degenerative changes (Citing studies done by Panjabi and others).

The Council on Chiropractic Practice (CCP) has stated, as it relates to DMX, that:

Videofluoroscopy may be employed to provide motion views of the spine when abnormal patterns are clinically suspected. Videofluoroscopy may be valuable in detecting and characterizing spinal kinesiotherapy associated with chiropractic vertebral subluxation.



In its 4th edition, it flatly stated that "Observational and case studies support the use of videofluoroscopy to evaluate vertebral motion when this information cannot be obtained by other means¹⁷."

14. DMX is recognized by the U.S. Government.

The Agency for Healthcare Research & Quality (AHQR) of the U.S. Department of Health & Human Services recommends DMX in two separate practice guidelines. The Guideline, Vertebral Subluxation in Chiropractic Practice states:

Videofluoroscopy may be employed to provide motion views of the spine when abnormal motion patterns are clinically suspected. Videofluoroscopy may be valuable in detecting and characterizing spinal kinesiotherapy associated with vertebral subluxation¹⁸.



The Guideline, Management of Whiplash Associated Disorders , states:

Videofluoroscopy screening may be useful in and for evaluating for cervical instability injuries. Motion MRI (kinetic MRI) has been shown to demonstrate significant differences in biomechanical function between normal patients and injured patients following rear-end, low-impact motor vehicle collisions.



DMX is cleared by the FDA. The FDA has classified the dynamic motion X-ray system with a device classification name of "image-intensified fluoroscopic X-ray system", a regulation number of "892.1650", assigned a 510(k) number of "k943272". The machine has been classified as a "class II" device, Section 892.1650, Image-intensified fluoroscopic X-ray system, and is a device intended to visualize anatomical structures by converting a pattern of x-radiation into a visible image through electronic amplification. This generic type of device may include signal analysis and display equipment, patient and equipment supports, component parts and accessories.



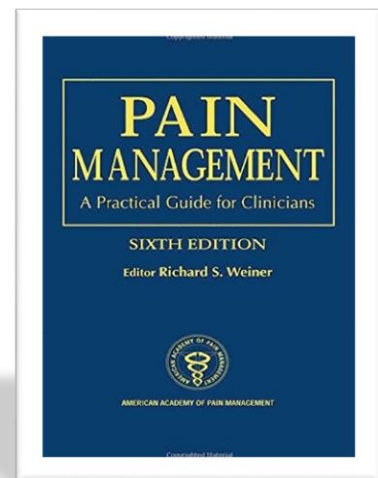
The Centers for Medicare and Medicaid Services further support the appropriateness of fluoroscopy as an examination technique utilized to determine biomechanical abnormalities (subluxation).

15. DMX is respected by the medical experts – but generally unknown to general medical practitioners.

Digital motion X-ray is well accepted and acknowledged in the medical community as well by the experts in the field – but typically ignored in practice in the general medical community.

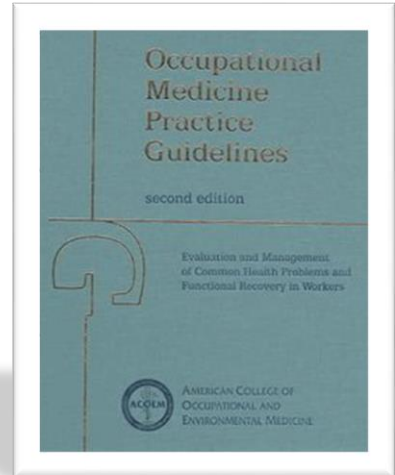
The American Academy of Pain Management's Practical Guide to Clinicians, 6th Edition states:

"...digital motion radiography is currently a valuable diagnostic method in evaluating painful hyper-mobility and instability of capsular and axial ligaments in the cervical spine¹⁹."



The American College of Occupational Medicine's Practice Guidelines, 2d Ed. 2004 (American College of Occupational and Environmental Medicine), states:

If [there is evidence of] probable ligamentous injury with persistent pain, consider fluoroscopically directed flexion study²⁰.

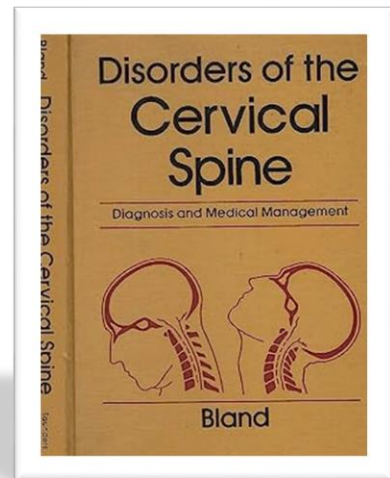


Medical doctors (MDs) have publicly proclaimed DMX to be a valuable diagnostic tool. As early as 1966, Professor Edward Buonocore of the University of Tennessee Medical School declared in the Journal of the American Medical Association, that cineradiography (an early version of DMX) represents "the single most important diagnostic test for patients with soft-tissue injuries who have not been helped by conservative treatment²¹.

John H. Bland, M.D., Professor of Medicine, University of Vermont, in his book entitled Disorders of the Cervical Spine (1987), said:

Video fluoroscopy is the most valuable technique in analyzing cervical spine motion. The stability of the cervical spine depends on bony structures only to a minor degree; stability depends to a major degree on the ligamentous structures²².

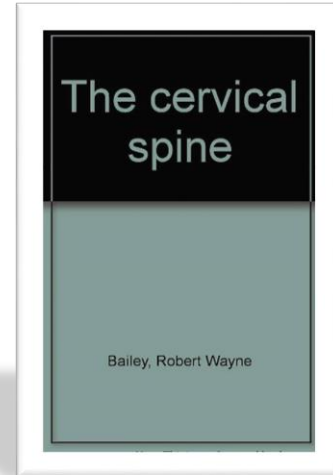
Such injury is not always detected on static plain film X-rays (standard roentgenograms). The next best medically reasonable diagnostic tool for determining ligamentous injury (a biomechanical source of pain) is the fluoroscopic exam.



(Dr. Bland's text was reviewed by Dr. Howard Polley of the Mayo Medical School and declared that Dr. Bland "has no equal" in understanding the complexities of the physiology of muscles, bones, and joints.)

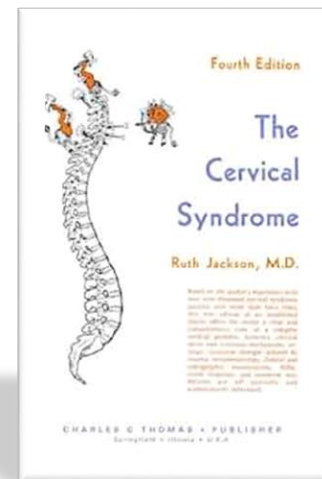
Robert Baily, Professor of Orthopedic Surgery, University of Michigan in The Cervical Spine (1974), chapter 3, Dynamic Anatomy and Cineradiography of The Cervical Spine said this:

Video fluoroscopy shows abnormal secondary to soft tissue (ligamentous) damage. Stability is dependent on ligaments²³.

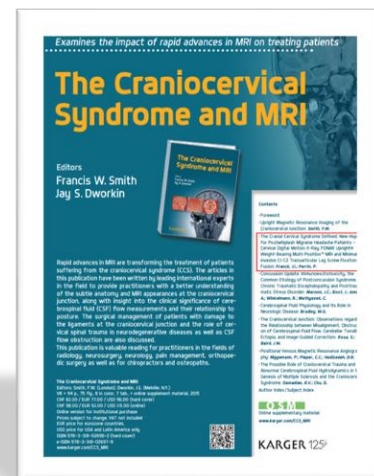


Ruth Jackson, M.D., Instructor of Orthopedic Surgery at Baylor University, in her book entitled The Cervical Syndrome (1977) said:

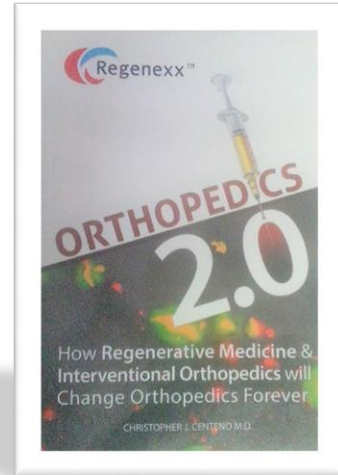
Video fluoroscopy shows areas of limited or unstable motion resulting from ligamentous and capsular injuries²⁴.



Neurosurgeon Joel Ira Franck, M.D., reported on the value of digital motion X-ray in the evaluation and treatment of patients with lateral ligamentous instability at C1-C2²⁵. The author has experienced cases where the lateral shifting of the atlas has been revealed on side binding with DMX where this condition was not revealed on prior MRIs or X-rays.



Regenerative Medicine and Interventional Orthopedics, Christopher Centeno, MD., A newer form of this test is called Digital Motion X-ray (DMX). This test looks at a moving x-ray view of the spine as the patient is put through various ranges of motion. It can also be used in various peripheral joints such as knee, shoulder, elbow, etc...²⁶



16. DMX has been accepted as reliable evidence by the courts.

It seems foolish to even suggest that there might be any question as to whether the courts would accept a DMX as reliable evidence. It has now been 118 years since Dr. Roetgen discovered X-rays as a technology that could be useful in the detection and diagnosis of various physical conditions. In 1908, Thomas Alva Edison obtained the first patent for a “moving picture” which simply moves a series of still photographs past the human eye with such speed that it appears to be “moving.” DMX simply combines technology that has been respected for more than 100 years.

The courts have acknowledged DMX as reliable evidence. In *Graftenreed v. Seabaugh*, 268 S.W .3d 905 (Ark. Ct. App. 2007) the Arkansas Court of Appeals made these statements:

Generally, a chiropractor is qualified to testify in a personal injury action concerning matters within the scope of the profession or practice, and may testify as to the permanency of an injury, as well as its probable cause. DMX evidence is reliable, and is accepted by the chiropractic and medical communities. Appellant argues that DMX technology does not meet the Daubert standard because it has not been proven to aid in diagnosing or treating any injury and that DMX gives no more information than standard X-rays.

Appellant also asserts that the scientific community has not generally accepted the use of DMX is for diagnosing or treating any injury or ailment. We disagree. Here, there is no question that this evidence was prejudicial to Appellant’s position, however, we cannot say that it was unfairly prejudicial. Appellant next argues that the trial court erred in admitting the DMX evidence because there was no proof as to which accident caused the ligament damage referred to in the radiologist report. According to Appellant, even if the DMX has indicated injury, there was no proof that it was caused by the January 2001 accident....there is more than sufficient evidence to let the jury decide whether Ms. Woods’ injuries were caused by the 2001 accident.

Appellees presented testimony that her symptoms began immediately after the wreck; that they continued over several years; that the 2003 accident did not exacerbate them; and that the pain and problems she was experiencing at the time of trial were the same as those that began immediately following the 2001 motor vehicle collision.

Other cases that support the admissibility of fluoroscopy²⁷. [See Hughes v. Denny’s Restaurant, 328 so.2d 830 \(Fla. Supreme Court 1976\); Destin v. Sears, Roebuck & Co., 803 s.w.2d 113 \(Mo. Dist. Ct. App. 1990\); Cognata, et.al. v. Weishaupt, et.al., bc243305 \(Ca. Los Angeles County Superior Court 2002\).](#)

17. CRMA can quantitatively analyze the extent of the ligamentous laxity.

CRMA is Computerized Radiographic Mensuration Analysis, or CRMA. It is also called “digitized X-ray.” The term “mensuration” simply means “the measurement of geometric quantities.” Medical and chiropractic doctors have, for nearly 100 years, been measuring the translational and angular malpositioning of vertebrae. CRMA is used to measure radiographics (X-ray) using a computer. CRMA provides for accurate, computerized measurement of the malpositioning of vertebrae due to ligamentous laxity.

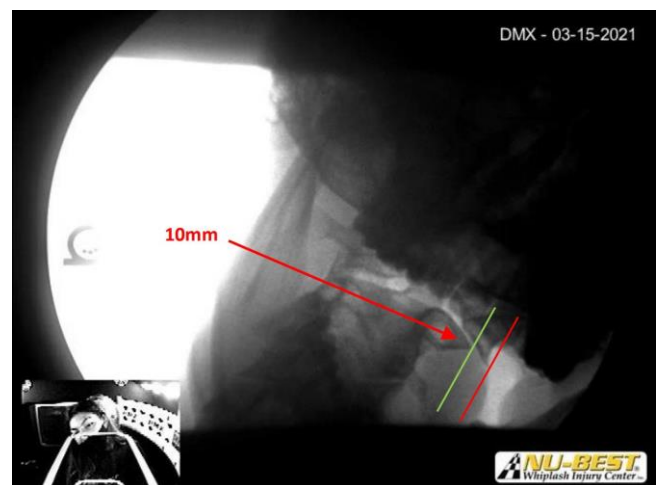
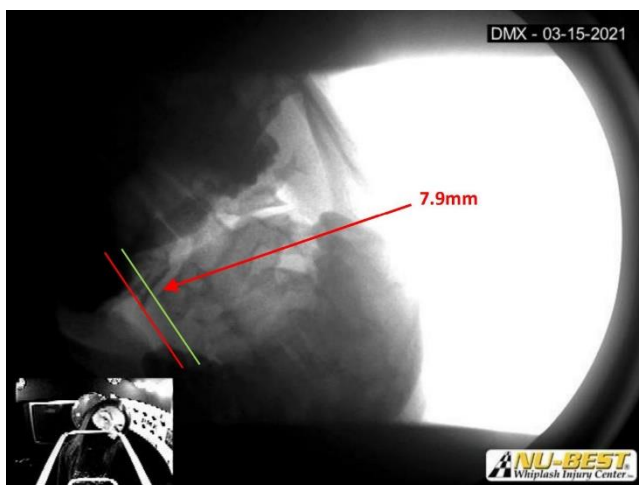
CRMA is a valuable tool to all health care practitioners, in that it provides quantifiably definite measurement. It assists in arriving establishing a differential diagnosis and the development of an appropriate treatment plan.

The measurements of translation in the cervical spine in excess of 1 mm is considered to be abnormal movement of the cervical spine. Measurement in excess of 7 degrees of angular variation is considered to be abnormal.

Abnormal shifting of the Atlas on the Axis of more than 1.7 mm is considered abnormal²⁸.

It provides substantiation for pain that might otherwise be labeled as “secondary gain,” “somatoform disorder,” or “faking,” “malingering.”

For attorneys, it is a “blockbuster” development. It provides objective evidence of ligamentous injury that has been the major cause of chronic pain and disability in CAD injuries.



Antero-Posterior Open Mouth Projection

DIGITAL MOTION X-RAY REVEALS SEVERE SPINAL INSTABILITY OF C1 LATERAL MASS SLIDING OF THE EDGE OF C2 AND THE INCREASE/DECREASE OF THE PARAODONTOID SPACES. THIS DEMONSTRATES THAT THERE WAS TEARING OF THE RIGHT AND LEFT ALAR AND ACCESSORY LIGAMENTS.

18. Medical Necessity for DMX/CRMA is defined by Foreman/Croft.

Foreman and Croft have defined the medical necessity for a digital motion X-ray as follows:

1. History compatible with events known to result in ligamentous instability (trauma or disease).
2. Neck pain that is unresponsive to conservative management.
3. Evaluation of spinal fusion.
4. In cases of trauma in which initial studies reveal significant instability (i.e., more than 2.5 mm subluxation).
5. In cases of clinical instability in which follow-up plain films are unremarkable.
6. In cases in which radiographic and clinical instability are present, and the patient remains refractory to treatment beyond 4 months.

In almost all cases where a static MRI had revealed AOMSI of any degree, a DMX will usually reveal AOMSI of a much greater degree.

What about safety??? A strong case can be made for the use of DMX studies in almost all significant trauma cases in order to protect the patient from the results of inappropriate manipulation therapy administered to the victims of traumatically induced AOMSI. The World Health Organization Guidelines for Safety in chiropractic practice list "Ligamentous laxity with anatomical subluxation or dislocation represents an absolute contraindication to joint manipulation in anatomical regions of involvement"²⁹.

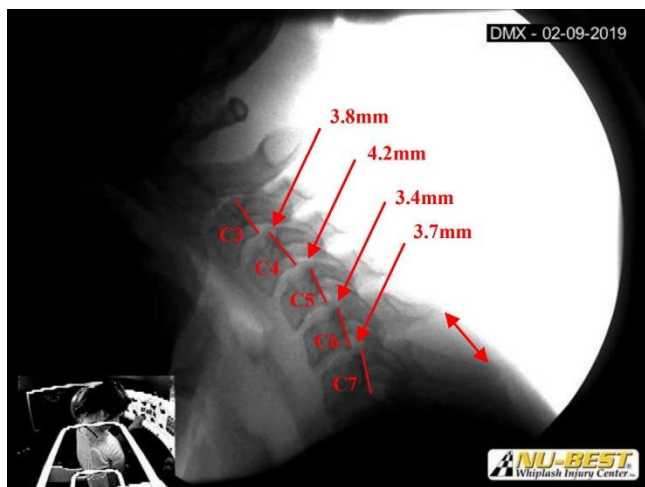
19. CRMA can be used to establish a percentage impairment rating using the AMA Guides rating system.

For 20 years, the AMA Guides have recognized "Alteration of Motion

Segment Integrity" (AOMSI) as the basis of permanent impairment of the spine and have recognized that impairment cannot be determined by physical examination. Instead, flexion-extension X-rays are required:

Motion of the individual spine segments cannot be determined by physical examination but is evaluated with flexion and extension roentgenograms.

But how can static X-rays show abnormality occurring in motion? It is simply nonsense to suggest that that could happen. Instead, digital motion X-rays are needed to show motion abnormalities!!!



Lateral Flexion - Extension Projection

DIGITAL MOTION X-RAY REVEALS DAMAGE TO THE POSTERIOR LONGITUDINAL LIGAMENT INDICATED BY AN ANTEROLISTHESIS AT C3 ON C4, C4 ON C5, C5 ON C6 AND C6 ON C7. DAMAGE TO THE INTERSPINOUS LIGAMENT IS INDICATED BY A SEPARATION BETWEEN C6-C7 SPINOUS PROCESS.

20. DMX scans can be used to provide an AMA-based impairment rating.

The AMA Guides to the Evaluation of Permanent Impairment, 5th Ed. (2000), p. 392, states that Alteration of Motion Segment Integrity (AOMSI) results in a 25-28% impairment rating in each of the following cases:

Alteration of Motion Segment Integrity or bilateral or multilevel radiculopathy; alteration of motion segment integrity is defined from flexion and extension radiographs as at least 3.5 mm of translation or one vertebrae on another, or angular motion of more than 11 degrees greater than at each adjacent level.

This is an objective finding based on scientific, mathematical modeling!

But what about translation at lesser levels? What about angular irregularity less than 11 degrees? Assessments of impairment levels less than that specified in the AMA Guides are appropriate. As stated in Foreman/Croft:

To adopt 3.5 mm of translation as the minimal criterion for anterior subluxation is to leave the majority of mild to moderate instability unclassified.

Translations greater than 2.0 mm have been determined to indicate ligamentous disruption³⁰.

In another study, measurement of 1 mm translation and/or 7 degrees of angular variation has been considered to be clinically significant and indicative of abnormal flexibility of the cervical spine.

Therefore, it is logical that translations less than 3.5 mm should result in impairment ratings as follows:

3.5mm	=	25%
3.0mm	=	20%
2.5mm	=	15%
2.0mm	=	10%
1.5mm	=	5%

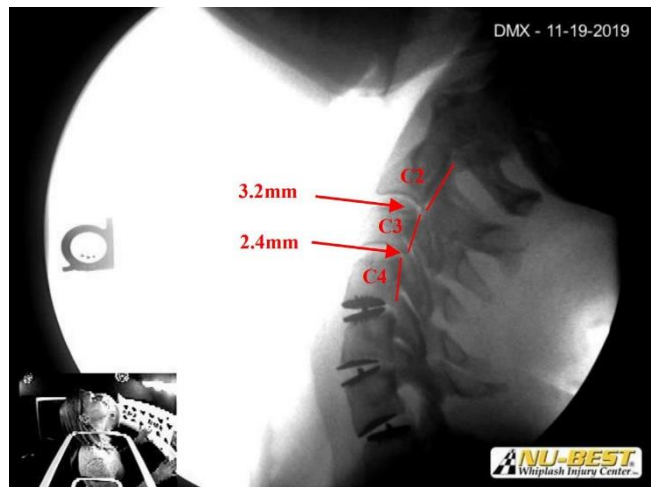
And also logical that angular irregularity should result in impairment ratings as follows:

11 degrees	=	25%
10 degrees	=	20%
9 degrees	=	15%
8 degrees	=	10%
7 degrees	=	5%

It is true that the AMA Guides does not recognize these numbers, affirmatively or negatively. However, the above numbers are a logical conclusion.

The AMA Guides to the Evaluation of Permanent Impairment, 6th Ed., have recognized and addressed this oversight. The 6th Edition recognizes 3.5 mm as loss of structural integrity (translational) and 11 degrees for loss of angular integrity. The 6th Edition recognizes disc herniation and/or AOMSI at a single level with radiculopathy to warrant a 9-14% impairment.

It recognizes intervertebral disc herniations at multiple levels with or without radiculopathy to warrant a 15-24% impairment.



Lateral Flexion - Extension Projection

DIGITAL MOTION X-RAY REVEALS DAMAGE TO THE ANTERIOR LONGITUDINAL LIGAMENT INDICATED BY AN RETROLISTHESIS AT C2 ON C3 AND C3 ON C4. DAMAGE TO THE INTERSPINOUS LIGAMENT IS INDICATED BY A SEPARATION BETWEEN C6-C7 SPINOUS PROCESS.

21. Proof of causation of ligamentous laxity from CAD trauma.

The causal connection between the trauma and the ligamentous laxity is probable for each of the following reasons:

1. If the patient was asymptomatic prior to and immediately acutely symptomatic after the trauma, the causal connection should be clear.

Delayed onset of symptoms of ligamentous injury is well recognized. Delayed neck pain of up to 24 hours is a classic feature of CAD trauma. Foreman and Croft recognize that the delay can be as much as weeks or months. However, more immediate symptoms are consistent with more severe lesions of the anterior longitudinal ligament (ALL).

2. Motion segment alteration is extremely rare in the absence of trauma. The AMA Guides states:
When routine X-rays are normal and severe trauma is absent, motion segment alteration is rare; thus, flexion and extension X-rays are indicated only when the physician suspects motion segment alteration from history or findings on routine X-rays.
3. If the DMX shows ligamentous laxity that is present at specific levels and not generally throughout the spine, it is highly probable that the laxity is traumatic rather than the result of natural progressive degeneration. As stated in Lin, *“characteristics of sagittal vertebral alignment in flexion determined by dynamic radiographs of the cervical spine.” The aging changes of the cervical spine should be similar at each level, if no trauma affects a specific level.*
4. If the ligamentous laxity occurs in whole or in part in the upper cervical spine, that is an additional indicator that the laxity is trauma-induced because laxity due to non-traumatic degeneration typically occurs at the lower cervical levels, rather than the upper levels³¹.
5. If the ligamentous laxity is centered at the C4-5 joint, it is likely due to trauma. It is well recognized that the C4-5 joint is the single most vulnerable of the cervical spine joints and the location at which ligamentous laxity is most likely to occur. Accordingly, if the ligamentous laxity includes that joint, it is an additional indicator that the laxity was caused by traumatic forces.

22. The Atlas-Axis joint and the capsular ligaments of the facet joints are the most susceptible to injury.

The cervical spine is composed of many ligaments, most all of which are susceptible to ligamentous damage due to overstretching in CAD trauma. The three most susceptible ligaments are:

- (1) the ligaments of the **atlas-axis joint** (at C1-C2);
- (2) the **capsular ligaments of the facet joints** at all levels of the cervical spine. (The C4-C5 joint is considered most vulnerable to trauma.); and
- (3) the ligamentum flavum.

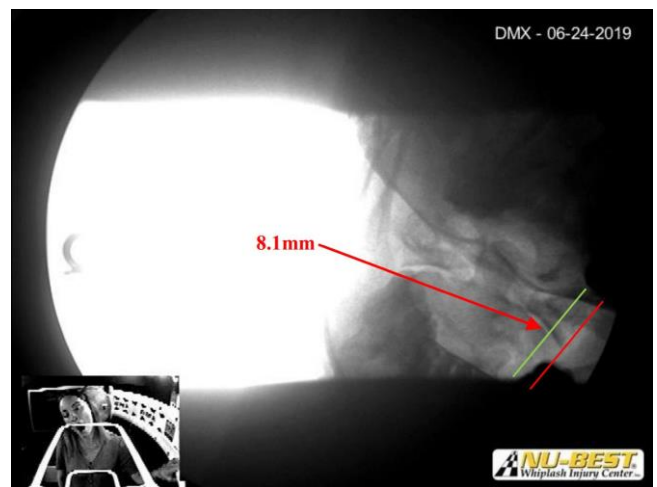
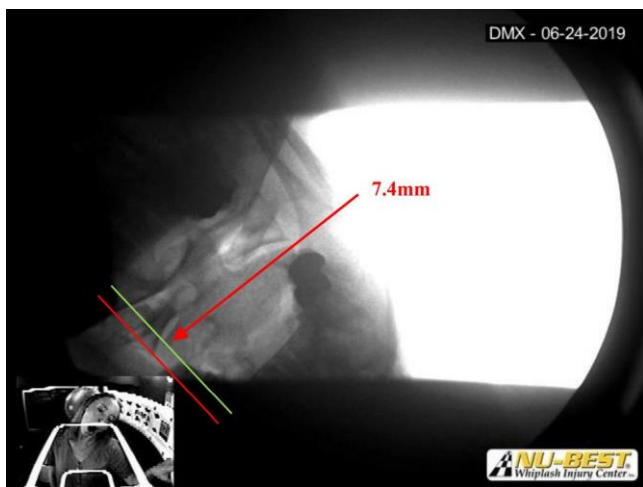
The “atlanto-axial joint” (at C1-C2) is considered the most mobile segment of the vertebral column and has the least inherent stability of any of the vertebral articulations³². Studies have shown that 50% of the axial rotation of the spine occurs at C1-C2. Symptoms of vertigo, nausea, tinnitus, and visual disturbances may occur from occlusion of the vertebral artery associated with axial rotation of the atlas.

The atlas-axis joint is secured by the craniocervical ligaments, especially the transverse ligament of the axis, which is vulnerable to excessive trauma. The **atlantodental interval (ADI)** is defined as the distance between the anterior border of the odontoid process and the posterior inferior border of the anterior arch of the atlas on lateral imaging views. The normal values for ADI have been established by research showing some minimal variation according to age and sex³³.

Measurement of the abnormal “overhang” of the C1-C2 joint with DMX has revealed overhangs of more than 11 mm. Normal is between .76 mm and 2.4 mm, depending on age and gender variations.

2. More than 60% of the cases of chronic pain following CAD trauma involve an injury to the capsular ligament of the facet joint. The gold standard of diagnosis of a facet joint injury is that of a medial branch block injections which is diagnostic of facet joint damage if the injection results in pain relief. The specific injury is typically to the capsular ligament which provides the structural support to the facet joint³⁴. DMX studies can provide preliminary evidence of joint laxity resulting from the over stretching of the capsular ligament.

3. The ligamentous flavum (LF), also called the “yellow ligament”, is a short but thick ligament that connects the laminae of one vertebra with the next, running along the backside of the vertebrae. During CAD trauma, the function of the LF is to prevent excessive flexion. During full normal flexion, it increases in length by 35%, which is the total of physiological range. With excessive extension during trauma, an additional lengthening of 20% results in failure.



Antero-Posterior Open Mouth Projection

DIGITAL MOTION X-RAY REVEALS SEVERE SPINAL INSTABILITY OF C1 LATERAL MASS SLIDING OF THE EDGE OF C2 AND THE INCREASE/DECREASE OF THE PARAODONTOID SPACES. THIS DEMONSTRATES THAT THERE WAS TEARING OF THE RIGHT AND LEFT ALAR AND ACCESSORY LIGAMENTS.

23. Prolonged ligamentous laxity causes accelerated degeneration of the intervertebral discs.

When ligamentous laxity causes instability of the spine, an increased load falls on the other components of the spine, the intervertebral discs, and the muscles. Biomechanical studies have established the following principles:

- Ligaments are the primary source of stability in the human spine.
- Ligaments and intervertebral discs work together, in tandem, to provide stability to the spine.
- Loss of ligamentous support (ligamentous laxity) places increased stress on the intervertebral discs, resulting in accelerated degeneration of the intervertebral disc.

Foreman/Croft reported that injuries to the anterior longitudinal ligament and intervertebral discs typically produce immediate symptoms. Delayed instability is not uncommon in injury to the spinal ligaments of the cervical spine. They report that “ligaments heal with scar tissue, which is less elastic, less resilient, less pliable, and less resistant to shear and tensile forces than the original tissue,” adversely affecting mobility and extensibility and causing altered biomechanics of the spine. They note that “the lack of motion at one level will be compensated for by hypermobility at adjacent levels, which in turn usually will result in degenerative disc disease^{35, 36} and osteoarthritis sometime in the future.” A further sequela is that of chronic myofascial pain syndrome.

Foreman and Croft cite a study by Dr. Ruth Jackson and Ehni which explains the biomedical aspects of the process of accelerated degeneration as follows:

Acute injury (sprain) of the joint produces synovial effusion, histamine release, capsular ligament is stretched or tore, bleeding, and associated clinical disabilities. Some of this is visible and palpable in joints in the extremities, such as the ankle and knee, but not in those of the spine. With repetition of the traumatic process and with chronic stress and the joint from shearing and other forces, as the disc fans and the superior facet moves cephalad under the inferior facet of the vertebra above, a chronic synovial reaction becomes established, which extends to the underlying articular cartilage. The cartilage undergoes fibrillar change, softens and becomes rough and eroded. Stresses in the capsule and periosteum result in marginal osteophytosis, which may encroach on the underlying nerve root. A loose body may develop in the joint cavity, or an austere olefinic process may fracture of life rear loosely attached in or near the foramina. The facet bone may thicken or hypertrophy, and the laminae may do so as well, but not to the same degree as seen in the lumbar spine. Degenerative enlargement of facets with irritative compression of one or more cervical roots may occur...

The zygapophyseal joint is particularly susceptible to this accelerated degeneration process.

Whiplash injury causes changes that predispose the victim to “premature degenerative disc disease.”

Biomedical studies have established the following principles:

- 1) ligaments are the primary source of stability in the human spine.
- 2) ligaments and intervertebral discs work together, in tandem, to provide stability to the spine.
- 3) loss of ligamentous support, ligamentous laxity, places increased stress on the intervertebral discs, resulting in accelerated degeneration of the discs.

Delayed instability of the spine due to ligamentous laxity is recognized in the medical literature. DMX is a valuable tool in detecting delayed instability of the ligaments³⁷.

24. Repeat MRIs can objectively prove accelerated degeneration.

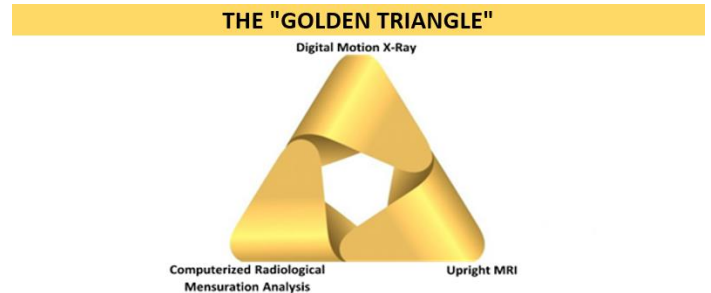
We have known for many years that CAD injury predisposes the victims to accelerated degeneration. Previously, that concept has only been a hypothetical one as it relates to any given patient/client. Recently, however, the lawyers at the Schmidt Salita Law Firm have discovered that, in some cases, there is objective, irrefutable proof of highly accelerated degeneration in some of the clients who have been found on DMX to have significant ligamentous laxity. One of those cases is presented below. In "Gina's Case," a 14-year-old, previously healthy girl was found to have the equivalent of 30 years of accelerated degeneration that had occurred in only 2 years!!!

25. The 'Golden Triangle' prove major impairment.

DMX provides objective proof of the existence of both translational laxity and angular laxity in ligaments. CRMA provides a scientifically reliable method of accurately measuring or quantifying the exact amount of laxity in each segment.

Motion MRI provides a method of proving the existence of accelerated degeneration.

Together, they form the "Golden Triangle" of Objective Proof of ligamentous injury.



26. CRMA can be used with still X-rays.

It should be remembered that CRMA can be used to measure ligament damage from still X-rays. Using still X-rays has the advantage that the clarity of the film is much better. Digital motion X-rays, on the other hand, have the advantage of revealing AOMSI irregularities that would not be captured on still X-rays. For example, translational irregularities of the Atlas-Axis are best depicted in motion X-rays.

Foreman/Croft note that still Xrays can miss abnormalities:

"a given joint may flex and extend the usual range of intersegmental motion as measured by flexion/extension radiographs...(but) deviation from the normal biokinetics may occur somewhere between these arcs of motion, which would not be visualized by static radiographic techniques."

They note that Digital Motion X-rays allow for the evaluation of motion throughout the entire arc of motion dynamically.

27. Motion MRIs provide a method of detecting herniations that are not observable in conventional MRIs.

New technology that may be as revolutionary as Digital Motion X-rays, namely "Motion MRIs." This procedure involves taking MRIs in a number of positions, or stations, throughout the flexion- extension cycle. It has been shown that some herniations will be revealed at one station but not others. Some will be revealed at one station, then disappear at other stations, and reappear at yet others.

The bottom line is that Motion MRIs can reveal herniations that may be missed by other forms of MRIs.

28. DMX provides proof of the cause of facet joint injuries.

Recently, authoritative and reliable medical research has established that the primary cause of chronic pain in the victims of CAD trauma is injury to the facet joint. Reliable biomedical research has established that facet joint pain is primarily due to injury to the capsular ligament and to some extent of the anterior longitudinal ligament. Research is also established that injury to the synovial fold may be a secondary cause³⁸.

Laxity of the capsular ligament of the facet joint produces “mechanical pain that is associated with mechanical instability. Mechanical pain is pain that is deep and agonizing in nature, worsened by spinal loading, and relieved by spinal unloading. A characteristic pain pattern deep and agonizing pain that is usually worsened by activity (loading) and relieved by an activity (unloading) suggests the diagnosis of mechanical back pain which is often associated with dysfunctional motion segment³⁹.”

Facet joint injury can provoke pain in the medial branch nerve. Radiofrequency neurotomy (RFN) provides relief of pain in the medial branch nerve by coagulating the nerve so that it no longer transmits the pain message to the brain. However, RFN procedures do absolutely nothing to cure the underlying injury in the facet joint.

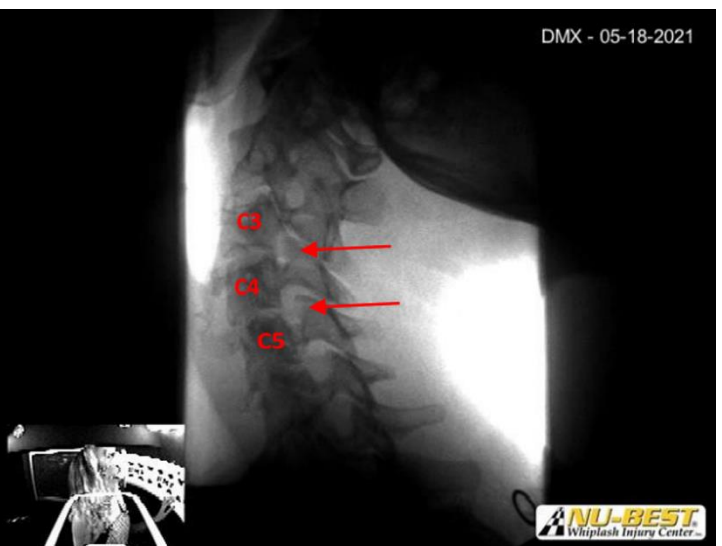
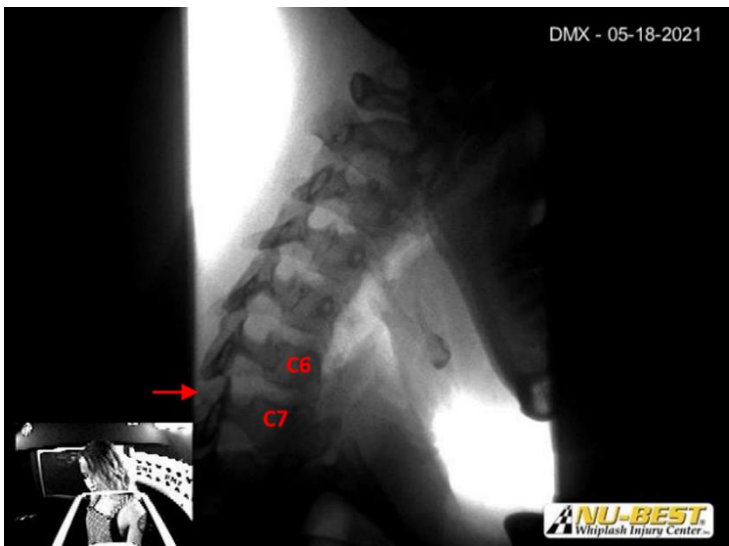
As Paul Harvey would say, “Now, the other side of the story”: DMX now provides a method of proving damage to the capsular ligament and the anterior longitudinal ligament!!!



Left Oblique Flexion-Extension Projection



Right Oblique Flexion-Extension Projection



DIGITAL MOTION X-RAY REVEALS SEVERE SPINAL INSTABILITY OF THE RIGHT AND LEFT FACET JOINTS BY SHOWING INTERVERTEBRAL FORAMINAL ENCROACHMENT OF C3-C4 ON THE RIGHT AND C4-C5 BILATERALLY. FACET GAPPING IS ALSO NOTED ON FLEXION AT C5-C6 ON THE RIGHT AND C6-C7 BILATERALLY. THIS DEMONSTRATES TEARING OF THE CAPSULAR LIGAMENTS.

29. Ligamentous laxity is the primary cause of Myofascial Pain Syndrome.

When the ligaments fail to perform their task of providing structural integrity to the spine, extra stress is placed on the muscles and intervertebral discs. The chronic overload of the muscles then produces symptoms of myofascial pain syndrome with trigger points which are the result of the muscle overload resulting from the muscles working excessively to compensate for ligamentous laxity.

Foreman/Croft states that muscles heal within “a few weeks” leaving “myofascial pain disorders” in which the muscles serve as the “end organs” of the “long term manifestations...of late whiplash” (p. 15, 384). Benzel concurs, stating that “The pain pattern implicates an exaggerated reflex muscle response that is enlisted to improve stability, implying that adequate intrinsic stability is not provided by this by a proper; dysfunctional segmental motion.”



DIGITAL MOTION X-RAY REVEALS SEVERE SPINAL INSTABILITY OF C1 SLIDING ANTERIOR ON C2 SHOWING AN INCREASE IN THE ATLANTO-DENS INTERSPACE DEMONSTRATING TEARING OF THE TRANSVERSE LIGAMENT.

30. Case studies demonstrate objective proof of accelerated degeneration of intervertebral discs.

It has been recognized for decades that whiplash trauma and injury causes long term accelerated degeneration of the spine. However, that concept has been largely theoretical—until now. In several cases, the Schmidt Law Firm has “doubled back” and sent clients for repeat MRIs of the cervical spine. The results have been amazing! Two such cases are presented here.

Gina’s Case

Gina was injured in a car crash as a 14-year-old. Her MRI, done shortly after that collision, was totally normal. Two years later, and \$32,000 of chiropractic and medical treatment, as well as physical therapy and massage therapy, and she was still symptomatic. However, DMX showed significant ligamentous laxity.

CRMA showed translational instability of 3.5 mm, sufficient to establish an AMA rating of 25%. It also showed angular instability of 12.5%, also sufficient to establish another AMA rating of 25%.

Repeat MRIs then showed significant desiccation and bulging of her intervertebral discs—proof of accelerated degeneration.

This evidence formed the basis of a claim that Gina’s cervical spine, in a 14-year-old that was healthy before her car accident, had “aged” the equivalent of 30 years in the course of only 2 years!!! Her medical doctor then reported the following:

It should be noted that MRIs of Gina’s cervical spine which were performed on September 17, 2011, were unremarkable with the exception of the 25 degree cervical lordosis that was noted. The finding of cervical lordosis indicates that the ligamentous laxity which is noted on the recent DMX studies was present at that time. That ligamentous damage would not be expected to show on static MRIs. However, it is apparent that Gina has, in the intervening 2 years experienced significant degeneration of her cervical spine which is an expected result of the ligamentous damage.

It is established in the medical literature that the ligaments of the spine and the intervertebral discs work in tandem to provide stability to the spine. When the ligaments are stretched and damaged creating ligamentous instability, excessive stresses are imposed on the intervertebral discs causing accelerated degeneration of the intervertebral discs. These studies provide objective evidence that Gina’s ligamentous instability has resulted in significantly accelerated degeneration.

It should also be noted that these studies provide objective evidence to support the diagnosis of myofascial pain syndrome. Myofascial pain syndrome is the result of overload imposed on the skeletal muscles in the neck and back as a result of the ligamentous laxity. Myofascial trigger points result from the fact that the muscles are working overtime to compensate for the ligamentous laxity.

The result was objective proof of disc desiccation and bulging discs which occurred over a 2-year period. Gina’s ligamentous injury had produced laxity which imposed abnormal stresses on the intervertebral discs, causing accelerated degeneration. In the course of only 2 years following her whiplash injury, Gina’s neck had “aged” or “degenerated” the equivalent of 30-40 years! For more detail regarding Gina’s case, see Exhibit A.

Bruce's Case

Bruce was injured in a car accident when he was 45 years old. His MRI showed some generalized degeneration, mostly mild desiccation and some facet arthrosis which would be typical and expected for a 45-year-old with a history of doing physical labor while working as a carpenter. Four years later, a DMX showed major ligamentous laxity – much more than would occur naturally, especially when considering that he stopped doing any significant physical work after his accident.

Again, repeat MRIs showed dramatic accelerated degeneration with 3 large herniations and impingement on the nerve roots at all 3 levels:

MRI of the Cervical Spine dated 12/17/13 with the following elements:

- (1) *Left paracentral posterior disc herniation (4mm) at C3/4;*
- (2) *Broad-based posterior disc herniation at C5/6(6mm) and C6/7 (4mm);*
- (3) *Annular bulge at C2/3 and C4/5;*
- (4) *Dehydration of the discs as noted above;*
- (5) *Mild loss of disc height;*
- (6) *Straightening of the normal lordosis;*
- (7) *Moderate stenosis of the bilateral intervertebral neural foramina at C5/6 and C6/7 with impingement of the bilateral C6 and C7 nerve roots;*
- (8) *Moderate stenosis of the left intervertebral neural foramen at C3/4 with impingement of the left C4 nerve roots; and*
- (9) *Mild central canal stenosis at C3/4, C5/6 and C6/7.*

Based on this new MRI, his medical doctor concluded that he had experienced the equivalent of 30 years of degeneration since his motor vehicle collision:

It is well established in the medical and biomedical literature that injuries of the type that Bruce experienced in the November 18, 2008, motor vehicle collision produced ligamentous deformation (which is plastic in nature so that it does not return to its prior condition) thus producing instability of the cervical spine as now documented on Bruce's DMX studies. The ligamentous instability then resulted in placing stresses on the intervertebral discs, thus producing advanced degenerative changes that are significant and have occurred in just 3 years. In this case, **Bruce's degeneration cannot be explained by the normal aging process. This degeneration is the equivalent of 30 years of degeneration due to normal aging.**

31. Ligamentous injury is the primary cause of facet joint injury and chronic pain.

Facet joint injuries have come to be widely recognized as an important aspect of spinal injuries. Medical research has established that facet joint injury is the primary cause of 60% of the cases of chronic pain lasting more than one year post injury.

Radiofrequency Neurotomy (RFN) has become increasingly recognized as a form of treatment that can provide major pain relief to the victims of facet joint pain. It is currently being taught to residents at every one of the top medical schools in the country and recognized by such respected medical institutions as Mayo Clinic and the Cleveland Clinic.

The medial branch nerve transmits the pain signals from the facet joint to the brain. RFN, also known as radiofrequency ablation or rhizotomy, involves coagulating the medial branch nerve which, in turn, interrupts the pain transmission from the facet joint and provides relief from the facet joint pain.

RFNs have been determined to be successful in 90% of the cases where the patients are properly worked up with medial branch block testing. The beneficial effects of RFN last somewhere between 8-15 months, until the pain progressively returns.

The RFN does nothing to heal, cure or improve the injury to the facet joint; it only degenerates the pain transmission to the brain.

The RFN procedure can then be repeated indefinitely. Studies show that the repeat procedure will be successful more than 90% of the time in cases where the first RFN was successful.

Personal injury cases involving RFN treatment have been successful in producing some rather large jury verdicts for several reasons:

- (1) RFN procedures, including the test injections, cost approximately \$10,000-\$12,000. If they need to be repeated, the projected cost of future medical expenses will be well in the six figure range, thus significantly increasing the potential size of the jury verdict. (Note: If a 35 year old will require RFNs for life, and has a life expectancy of 44.6 years, then the future projected medical expenses would be \$490,600.00).
- (2) The fact of successful treatment with RFN provides strong evidence of the existence of the facet joint injury. (If the pain goes away with treatment of the facet joint, that proves that the facet joint was the cause of the pain.)

In most cases, the fact that RFNs do absolutely nothing to heal or cure the underlying injury is completely overlooked. In many cases, the lawyers produce absolutely no evidence to establish the nature and extent of the underlying injury.

The answer can be found in the biomedical research. The primary cause of facet joint injury is damage to the capsular ligament⁴⁰.

Here, the missing link is often supplied by the DMX. In those cases where the DMX shows damage to the capsular ligament, objective proof exists to confirm the existence of the capsular ligament injury and, thus, the underlying injury which has been causing the pain in the medial branch nerve. **Because the ligamentous laxity that causes the facet joint pain also causes accelerated degeneration of the spine, patients who are candidates for RFN treatment can be expected to get worse over time because of this accelerated degeneration.**

When subsequent MRI scans provide evidence of the accelerated degeneration which results from the existence of the ligamentous laxity which, in turn, places more stress and strain on the intervertebral disc structure, the full consequences of the injury are brought to light.

32. Practice Pointers for Personal Injury Attorneys

The Golden Triangle of DMX, CRMA, and Upright MRI has revolutionized personal injury practice—or at least that portion that is using this earth-shattering technology. Those who are not using it are being left behind.

“Run of the mill whiplash cases” are no longer “minor soft tissue” cases worth only nuisance value.

Instead, the Golden Triangle provides objective proof of significant ligamentous injury that explains the chronic pain and disability resulting from Alteration of Motion Segment Integrity. This objective proof allows the jury to see the effects of the ligamentous injury and to understand why conservative treatment has not been successful. It provides the foundational basis for the presentation of expert medical evidence that the Alteration of Motion Segment Integrity will lead to accelerated degeneration of the spine, most notably especially the intervertebral discs with permanent damage.

Digital Motion X-rays of 90% of our clients have revealed Abnormal Alteration of Motion Segment Integrity, 30% with enough for an impairment rating of 25-28% using the AMA Guides.

In order to effectively represent clients with whiplash injuries, the personal injury attorney needs to understand the most basic tenets:

1. In order to bring justice to clients who have been victims of a traumatic whiplash injury, the severity of permanent ligamentous injury should be identified and the severity of the resulting disability established. These are not run-of-the-mill soft tissue injuries. They are serious and permanent disabilities justifying large settlements and/or jury verdicts.
2. All cases of significant whiplash trauma with persisting significant symptoms should be suspected for AOMSI and explored with a DMX study and a CRMA evaluation and measurement.
3. Whiplash forces cause permanent damage when ligaments are stretched beyond their “elastic” limit and cannot return to their normal shape. That happens when they are stretched beyond that limit and “plastic deformity” results.
4. Plastic deformity destroys the structural integrity of the spine and results in excessive stress on the intervertebral discs, resulting in accelerated degeneration. It also results in excessive stress to the muscles, resulting in chronic myofascial pain disorder with trigger points.
5. AOMSI can be objectively determined using the Golden Triangle of DMX, CRMA, and Stand Up MRI.
6. Once the specific area of ligament damages has been identified by DMX, specifically directed MRIs can focus in on the area of ligamentous laxity and objectively demonstrate the damage and scar tissue.
7. The large majority of medical doctors and chiropractic doctors are ignorant of the large volume of medical research that has recognized the medical significance of AOMSI and the use of the Golden Triangle to detect it. Accordingly, the use of this technology will not happen without the energetic efforts of the personal injury attorney.
8. It is important to work with health care providers that are knowledgeable and informed as to the science of AOMSI.
9. Even in cases where the DMX fails to detect AOMSI, the DMX video is a valuable trial exhibit to demonstrate to the jury the intricate and complex inter-related movements of the cervical spine. So many of these movements are “coupled” so that, for example, flexion and rotation work together in a particular body movement. What a wonderful tool for educating juries in personal injury cases.
10. Don’t ignore the whiplash of the brain, i.e., concussion or mild Traumatic Brain Injury. Whenever the neck has been “whipped,” the brain has also been “whipped.” The basic laws of physics dictate that the forces of whiplash are greater farther away from the fulcrum, telling us that the forces of whiplash are greater to the brain than the neck! Studies shown that up to 86% of concussion injuries are ignored in Emergency Medicine. Concussion experts estimate that over 50% of concussion injury victims do not seek medical attention. Our experience indicates that approximately 80% of new clients who have been in a moderate to severe motor vehicle collision have sustained a concussion injury that has not previously been diagnosed. The addition of a concussion injury, when properly worked-up, can add sizeable value to any personal injury claim.

11. At trial, the extensive use of medical illustrations, enlargement of excerpts from medical treatises, enlargements of the abnormalities shown on the DMX, and enlargements of the CMRA report is important to educate the jury. Proper use of these exhibits will carry the case with either a medical doctor or a doctor of chiropractic as the expert witness. Do not be afraid to use a Doctor of Chiropractic as the principal expert witness- assuming that the Doctor is fully knowledgeable regarding the issues of ligamentous laxity, DMX and CRMA. The defense will likely not be able to rebut this solid evidence because few IME doctors know anything about DMX and AOMSI.
12. The understanding of the concept of AOMSI can be useful in countering the opinions of Independent Medical Examiners (IMEs) for the defense. Many Independent Medical Examiners (IMEs), or Adverse Medical Examiners (AMEs) for the defense only examine for limited range of motion and never look for excessive range of motion that results from plastic deformity of the ligaments. The IMEs then argue that there is no objective evidence of injury or disability because of the absence of a finding of limited motion. What about excessive range of motion indicative of AOMSI? Their focus on the absence of limited range of motion totally ignores the fact that hypomobility is a much more serious medical condition than hypermobility! They can be effectively cross-examined on that “tunnel vision” opinion.
13. Where applicable, the percentage of impairment as established by the AMA Guidelines should be determined and made a major part of the case. This is true of impairment due to ligamentous laxity and also true for Pain Related Impairment (PRI). The involvement of an Occupational Therapist to evaluate the PRI can be useful. The medical workup should include evaluation of all conditions known to be related to whiplash injuries, including brain concussions (mild traumatic brain injuries), post-traumatic stress disorders (PTSD), vestibular/balance problems, and cervicogenic headache disorders.
14. DMX is also useful tool for the evaluation of ligamentous injuries of the lumbar spine. Remember that the measurement of abnormality are totally different for the lumbar spine. Translation of 4.5 mms. qualifies for an impairment rating of 25%.
15. Proper workup using these tools can sometimes result in settlement for a fair and reasonable amount. However, this approach may be totally foreign to many insurance adjusters which will mean that, in many cases, it will be necessary to take the case to a jury trial and a fair verdict and justice for the client. It is suggested that the objective should be, in many cases, directed at educating the defense attorney with the goal of the defense attorney passing that knowledge along to the adjuster. A skillful personal injury lawyer, equipped with this evidence, should not shy away from taking the case to trial. It just may be that the plaintiff’s bar will have to take these cases to trial and let the jury verdicts educate the insurance industry and the defense bar.
16. DMX can be an extremely valuable tool to show the jury the abnormal movement of bodily joints other than the those of the spine, such as the ankle, shoulder, wrist, hand, feet and knees.

33. Practice Pointers for Health Care Providers.

The following Practice Pointers are recommended for health care providers:

1. AOMSI cannot be detected until after the acute phase of injury when the muscle spasm has subsided because muscle spasm restricts the motion of the spine and makes it impossible to detect the laxity caused by the AOMSI.
2. Awareness of AOMSI is important. The concepts presented in this Handbook have been solidly established in the medical literature even before White and Panjabi’s landmark textbook in 1978. These concepts have been respected and adopted by the American Medical Association for many years. Recently, Dr. Edward C. Benzel, Chairman of the Department of Neurosurgery at the Cleveland Clinic in his textbook, Biomechanics of Spine Stabilization reaffirmed the basic principles first set forth by White and Panjabi.
The health care community, medical, osteopathic, and chiropractic, is generally still in the “dark ages” regarding the science reflected in the medical literature illustrated in this Handbook. It is high time for the practicing community to recognize this concept.
3. An accurate diagnosis of ligament injury is critical in the treatment of patients. The AMA has declared that AOMSI cannot be diagnosed by clinical examination alone. Dynamic imaging is necessary.
4. The use of proper imaging is especially critical in the treatment of patients. The American Medical Association has declared that AOMSI cannot be properly assessed without proper imaging. Some neurosurgeons now refuse to operate on the atlas-axis joint without first having the benefit of DMX imaging. It logically follows that a careful and complete diagnosis cannot be achieved without proper imaging.

Appendix A: GINA'S CASE – A CLASSIC EXAMPLE OF HOW DMX & MULTIPLE POSITION MRI CAN ESTABLISH PERMANENT LIGAMENTOUS DAMAGE

Serious ligamentous injuries have been dismissed as “soft tissue sprain/strain” injuries of minimal consequence because of the lack of objective proof.


We now have that proof of the ligamentous damage!!! DMX provides that objective proof.

We also now have objective proof of accelerated degeneration resulting from ligamentous laxity!!!

Gina's Case is a classic example.

BEFORE DMX:

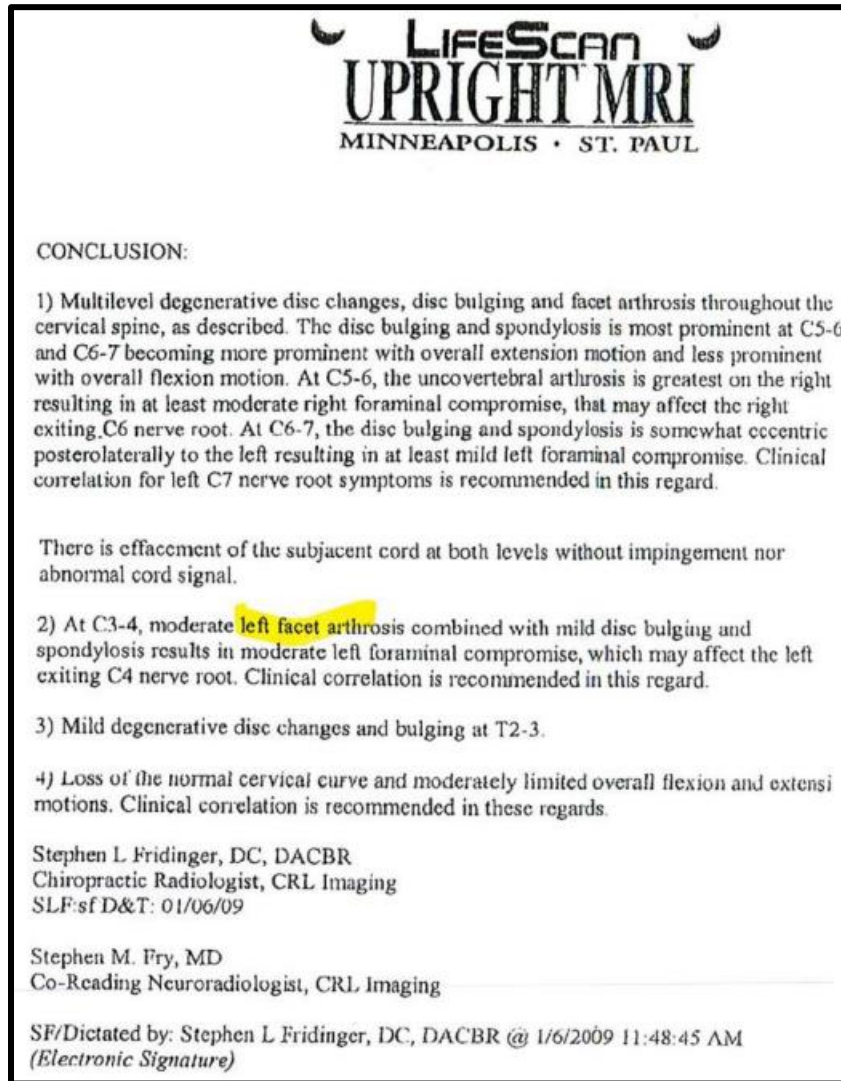
- Gina was a 14-year-old girl who sustained a whiplash injury.
- After 2 years of treatment, by DC, MD, PT and Massage (\$32,000.00), she continues to experience major pain and disability.
- The MRI was “unremarkable” in all aspects.
- The Chiropractic diagnosis was “sprain/strain.”
- The MD diagnosis was “ligamentous injury” with no objective proof.
- The offer of settlement was only \$2,000.00 more than the medical bills.

	CDI St. Louis Park 5775 Wayzata Blvd Suite 190 St Louis Park, MN 55416 Phone: 952-541-1840 Fax: 952-513-6881
To: Holly Westbrook, D.C. 8577 Columbine Rd Eden Prairie, MN 55344 Phone: 952-479-0043 Fax: 952-944-1673	Name: [REDACTED] CDI MRN: 93927590 Referring MRN: Phone: 952-856-6005 DOB: 05/11/1997 Gender: Female Exam Date: 09/17/2011 Referring Phys.: Holly Westbrook, D.C.
EXAM: MRI OF THE CERVICAL SPINE WITH EXTENSION, WITHOUT CONTRAST	
CLINICAL INFORMATION: Ongoing neck pain related to motor vehicle accident on 06/22/2011.	
TECHNICAL INFORMATION: Sagittal T1 and T2 FSE and axial T2 FSE, GRE and STIR images with 50° table tilt on the 0.63 T high-field open upright scanner, along with sagittal T2 FSE images with the patient seated, on extension.	
INTERPRETATION: 25° cervical lordosis with moderate anterior carriage of the head, mild left cervicothoracic convexity and no instability on 25° of extension from C2 to C7. No fracture, dislocation or anterior atlantoaxial subluxation. Normal craniovertebral junction, upper cervical complex and vertebral artery flow-voids, with left dominant system.	
C2-3 through T4-5: Normal disc and facet joints, patent central canal and foramina at each of these levels.	
Cervical and upper thoracic cord and visualized portion of the brainstem and cerebellum are otherwise normal, with no Chiari malformation, cord syrinx, mass or myelomalacia. No marrow based or paraspinal pathology.	
CONCLUSION:	
1. 25° cervical lordosis with anterior head carriage, mild left cervicothoracic convexity and no instability on 25° of cervical extension.	
2. Otherwise, normal MRI of the cervical spine, with no bulge or herniation, stenosis or impingement, including no dynamic herniation or impingement.	
3. No fracture, osseous neoplasm or infection and no intrinsic cord abnormality.	

Appendix B: Bruce's Case

Bruce's case is even more dramatic than Gina's in objectively proving accelerated degeneration secondary to ligamentous injury.

Bruce was injured in a car accident when he was 45 years old. His MRI showed some generalized degeneration, mostly mild desiccation and some facet arthrosis which would be typical and expected for a 45-year-old with a history of doing physical labor while working as a carpenter/fix-it-man, but nothing significant.



Four years later, a DMX showed major ligamentous laxity-much more than would occur naturally, especially when considering that he totally stopped doing any significant physical work after his accident.

IMPRESSION for patient BRUCE:

- Damage to the posterior longitudinal ligament is indicated by an anterolisthesis at C3 on C4.
- Damage to the capsular ligament is indicated by intervertebral foraminal encroachment of the facet joint at C3-C4 bilaterally.
- Damage to the alar and accessory ligaments is indicated by an overhang of the lateral mass of C1 to the left.

Again, repeat MRIs showed dramatic accelerated degeneration with 3 large herniations and impingement on the nerve roots at all 3 levels:

Appendix C: Tony's Case

In the first case in the upper Midwest in which DMX was offered into evidence, the result was amazing.

The case was LUCI V. PARROT which was tried to a jury in St. Croix County, Wisconsin. (Hudson, Wisconsin is the county seat.)

The last offer before trial was \$10,000.00.

The jury verdict at end of trial was \$743,188.95 DMX video was played to the jury,

 Their eyes were "bugged;"

 They were leaning forward in their seats to look; and

 They asked to see it replayed!

Doug Schmidt says,

"It was the most powerful and persuasive single piece of evidence that I have ever seen in a courtroom in over 40 years of trial experience."

Appendix D: Leila's Case

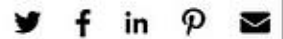
A 38-year-old female, who was involved in a rear impact, motor vehicle crash three years ago with what appeared to be a minor impact with little property damage. She presented with symptoms of severe headaches, balance issues and painful muscle spasm.

The patient's case went from zero value to 1.8 million. An epidemiologist recommended that the patient undergo a Digital Motion X-ray (DMX). The patient almost passed out after moving her head for the five-minute DMX scan. The DMX documented that the upper cervical ligaments were damaged so badly that it was causing C1 to slide over C2 causing an impingement in her vertebral arteries and nerve roots at C1.

The patient was previously referred for static x-rays and a cervical MRI. The static imaging procedures were unremarkable for spinal instability.

Woman sustained spinal cord impingements after accident - \$1,800,000 settlement

Virginia Lawyers Weekly // August 29, 2022



Type of action: Auto accident; personal injury

Injuries alleged: Cervical sprain/strain – soft tissue with eventual diagnosis of cervical syrinx (cyst) in spinal cord along with two spinal cord impingements after digital motion X-ray

Tried before: Mediation

Name of judge or mediator: Judge Jane Marum Roush (Ret.)

Date resolved: 2/7/2022

Special damages: Past medicals: \$395,421.74; future medicals: \$432,422.46; past lost wages: \$72,000; future lost wages: \$36,000; and future lost earning capacity: \$1,168,667

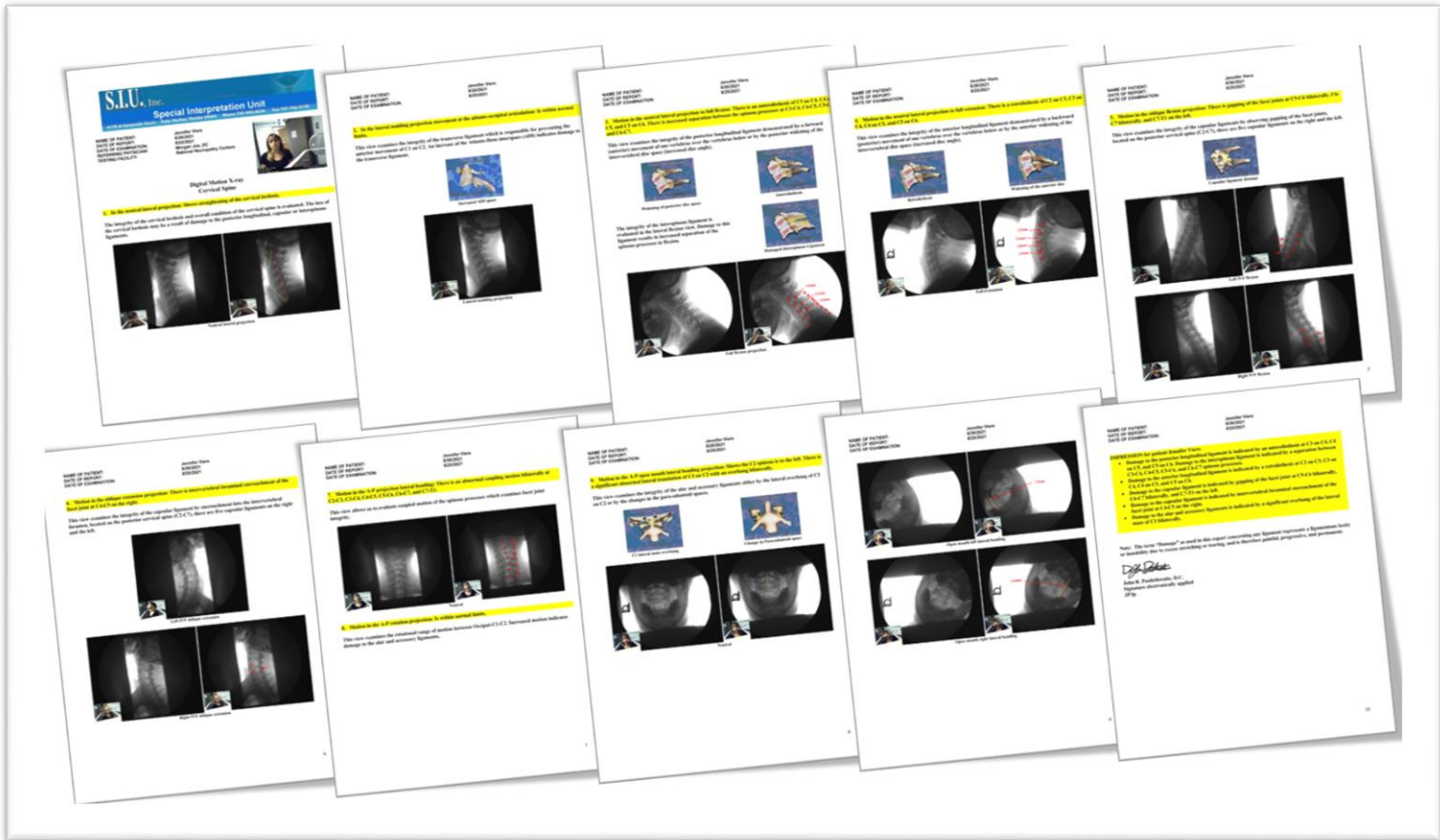
Demand: \$11,500,000

Offer: \$1,800,000

Verdict or settlement: Settlement

Amount: \$1,800,000

Attorneys for plaintiff (and city): Leila H. Kilgore, Fredericksburg; Francis Hajek, Charlotte



To view the ultimate weapon for this case, a full 10-page Digital Motion X-ray report, please [click here](#).

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