UNDERSTANDING DYNAMIC MOTION X-RAY/ FLUOROSCOPY PROCEDURES, FINDINGS AND MEDICAL NECESSITY

Thank you for taking the time to look over the following synopsis of Dynamic Motion X-ray (DMX) procedures. Because of the importance of this procedure and the specifics of the procedure, the following brief synopsis has been put together to assist you in understanding the procedure.

**Medical Necessity of the DMX studies:**

Our offices require medical necessity exist before any doctor orders a DMX study on any patient or any body part. Our primary region where we utilize DMX Studies is the cervical spine. Medical Necessity in our office requires that the patient meet a minimum of one of the following criteria:

A. Persistent Signs or Symptoms or unsatisfactory response to chiropractic care
B. Suspected Persistent Intersegmental Joint Dysfunction
C. Inconclusive Intersegmental Joint Dysfunction via X-ray / CT / MRI
D. Headache, Dizziness or Blurred Vision
E. Pain increased with Movement
F. Increased pain and clicking on opening and closing of the jaw.
G. Confirm Ligamentous Instability in the upper 30% of the cervical spine, which is supported by ligaments only and contains no discs. (Alar-Accessory-Transverse Ligaments)
H. Confirm Ligamentous Instability to the complete cervical spine in flexion-extension views. (Anterior Longitudinal Ligament, Posterior Longitudinal Ligament, Inter-spinous Ligament, and Compression Fractures)
I. Confirm ligamentous instability at facet joints in flexion-extension oblique views. (Capsular Ligaments)
J. Confirm referred pain syndrome from capsular ligamentous injury. (Scleratomal Pain)
K. Confirm Swallowing difficulty or complaint of swelling in the throat.

*Based on the above criteria it is medically reasonable to perform a Dynamic Motion X-ray of multiple arcs of the cervical spine when indicated. It is medially reasonable for a biomechanical pain presentation to receive a biomechanical diagnostic imaging study.*

**Understanding of Purpose and Use of DMX Study of the Cervical Spine:**

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 the only moving diagnostic test that is performed in a weight bearing position. (This is not 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.
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 are commonly seen in the knee and shoulder. Sub-failure ligament injuries are most commonly seen in the Cervical Spine, TMJ, and 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 discs in the upper 30% of the cervical spine between Occiput, C1, and C2. Digital Motion X-ray is used in demonstrating posttraumatic instability in the neck that may be responsible for posterior neck pain, headaches, and referred pain.

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. A

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 anatomical structure (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.

Ligamentous injuries are painful, progressive, and permanent in nature. These ligaments are most vulnerable when the head is rotated and flexed as commonly occurs in whiplash type injuries.

(1) Pain is generated by the nocireceptors (part of the nerve root that transmits pain messages to the brain) when the ligaments have been damaged.

(2) By nature, healing of the ligaments occur with fibrous repair (scar tissue) rather than by the regeneration of original elastin tissue, thereby leaving the injured ligament permanently weaker and more susceptible to future injury. The altered biomechanics of an unstable joint lead to progressive degenerative changes 6-10 times faster than normal. These changes involve decreased disc height that leads to IVF (intervertebral foramen) encroachment and spur formation. These ligaments are most vulnerable when the head is rotated and flexed as commonly occurs in whiplash injuries.

As stated in the AMA Guide to Permanent Impairment (Fifth Edition), ligamentous injuries are rated for impairment. If one or more ligaments are damaged, 5-8% whole body permanent impairment can be assigned. If aberrant movement exceeds 3.5mm, 25% whole body permanent impairment can be assigned.

In addition Digital Motion X-ray has the ability to decrease the number of Malingers by proving or disproving an injury exists.

The FDA has classified the dynamic motion x-ray system owned and operated by Chipley Chiropractic, PLLC, 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", and the machine has been classified as a "Class II" device. Please be advised that this device is properly certified and registered with the State of West Virginia.

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.

A Sampling of Medical and Chiropractic Support of DMX Studies:
Recent medical literature, including several citations in journals such as SPINE and the Journal of Spinal Disorders, support the importance of dynamic motion x-ray for the evaluation of the cervical spine.

**American Academy of Pain Management Practical Guide to Clinicians, Fifth Edition** states, "...digital motion radiography is currently a valuable diagnostic method in evaluating painful hypermobility and instability of capsular and axial ligaments in the cervical spine."

**The American Medical Association, Guides to the Evaluation of Permanent Impairment Fifth Edition** states, "Alteration of motion segment integrity is defined from flexion and extension radiographs as a least 3.5 mm of translation of one vertebra on another, or angular motion of more than 11 degrees greater than each adjacent level..." as a criteria to determine the "Impairment of the Whole Person".

**The Occupational Medicine Practice Guidelines, Second Edition 2004** (American College of Occupational and Environmental Medicine) states, "If probable ligamentous injury with persistent pain, consider fluoroscopically directed flexion study."

Donald Resinck: Professor of Radiology, University of California, San Diego. Diagnosis of Bone/Joint Disorders: 1988, chapter 3. "**Videofluoroscopy is useful in the evaluation of joint movement. Used during R.O.M., (range of motion) it identifies the level of Instability secondary to ligamentous damage.**"

The Cervical Spine: the Cervical Spine Research Society: 1989, page 260. "**Video fluoroscopy is a dynamic technique that allows precise positioning during R.O.M. studies. Anterior gapping of a disc space sudden translation of a vertebral body on another may indicate intersegmental instability.**"

Buonocore, Edward, MD et.at.k Cineradiograms of Cervical Spine in Diagnosis of Soft-tissue Injuries, Journal American Medical Association. The author concludes that cineradiography adds another diagnostic method of evaluating suspected soft-tissue injuries of the cervical spine by demonstrating its motion during exercise. Furthermore, the cineradiographic study will have its greatest value if it can detect abnormal motion in patients who show normal spines on standard roentgenograms and before degenerative changes have occurred.

John Bland: Disorders of the Cervical Spine: 1987, page 144. "**Video fluoroscopy is the most valuable technique in analyzing cervical spine motion.**"

Jones, Malcomb, D., MD, Cervical Spine Cineradiography After Traffic Accidents, Archives of Surgery. Cineradiographic studies demonstrated 1 or more abnormalities in 43 of 50 patients involved in rear-end vehicle collisions."

John Bland: Professor of Medicine, University of Vermont. Disorders of the Cervical Spine: 1987, page 134. "The Stability of the cervical spine depends on bony structures only to a minor degree; **stability depends to a major degree on the ligamentous structures.**"

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.

Ruth Jackson: instructor of Orthopedic Surgery; Baylor University, the Cervical Syndrome: 1977 "**Video fluoroscopy shows areas of limited or unstable motion resulting from ligamentous and capsular injuries.**"

Jones, Malcomb, D., MD, Cineradiographic Studies of Abnormalities of the High Cervical Spine, Archives of Surgery. The author begins by noting cineradiography is becoming widely available and reports of its use in orthopedic problems, particular those of the cervical spine. Cineradiography, it was concluded that the use of cineradiography has elucidated abnormalities seen on plain roentgenograms of the cervical spine.

Woesner, Merlin, E., MD, and Mitts, The Evaluation of Cervical Spine motion below C2: A comparison of Cineroentgenographic and Conventional Roentgenographic Methods. A Comparison study of 40 randomly selected patients who had roentgenographic investigation of the cervical spine by both cineradiography and conventional lateral roentgenograms in flexion, neutral position, and extension was made for the analysis of motion. In 14 of the 40 patients, abnormal motion was detected in the spine that was not seen on the plain roentgenograms.

It is further appropriate to determine the level of this individual's long-term prognosis related to injury. Ligamentous instability is recognized as "whole person" impairment by the American Medical Association (AMA). Any translation of one vertebral body on another in the Cervical Spine is abnormal, and as little as 3.5mm is considered grounds for 25% whole person impairment. It should be noted that the ACCR and Committee on Scientific Affairs has determined that the utilization of Fluoroscopy is useful imaging modality for the demonstration of spinal intersegmental joint dysfunction.

Spinal Impairment Categories: AMA Guides (Diagnosis Imaging of the American Chiropractic Association/Position Statement of 6/13/91). "With the publication of these guidelines...the American Council of Chiropractic Radiology no longer considers Spinal Video fluoroscopy as investigational within the chiropractic profession."

Fluoroscopy is supported by the ACOEM (American College of Occupational and Environmental Medicine) Guidelines.


Also in this regard, the 1993 Mercy Center consensus Conference rated Video fluoroscopy as Promising, with evidentiary ratings of Class II and III and a consensus rating of #1 (the highest level).

Excerpt from the proceedings of the Mercy Center Consensus/Section on Video fluoroscopy procedures. 1993. Scott Haldeman D.C., M.D., PhD. Commission Chairman. These Video fluoroscopy procedures are effective for evaluation for the quality of spinal motion. It is unique in this respect since, unlike stress vies, it not only provides a view of total excursion, but also how the segments arrived there.

The Centers for Medicare and Medicaid Services further support the appropriateness of fluoroscopy as an examination technique utilized to determine biomechanical abnormalities (subluxation). Medicare coverage database; LCD for Chiropractic Service (manual spinal manipulations) (L15759).
It is important in the care of the patient to establish the presence of ligamentous damage, as these ligaments do not heal, and this movement of the articular surfaces results in pain via fibers of the autonomic nervous system, and long-term degenerative changes. In addition, the damaged ligaments create a fragile structures which is more suspected to future trauma.

In view of the above, it is my opinion that fluoroscopy is an appropriate addition to a diagnostic armamentarium and it has played a significant role in this case. Perhaps the best single indicator of appropriateness for a diagnostic imaging study is resultant positive.

Please be aware that this is only a partial listing of some of the supportive medical and chiropractic literature that related to Dynamic Motion X-ray. The supportive literature as a whole is significant but this sampling should assist you in your understanding of the benefit of this procedure.

I expect this information will suffice for the time being. I have more relevant information in terms of the DMX in court, DMX and the Daubert Challenge, and how the DMX helped to overturn a verdict in the Appellate Court.

There is an overwhelming wealth of literature supporting the medical necessity of Digital Motion X-Ray. DMX is a recognized diagnostic test. Many insurance companies reimburse this procedure in full.

The state of West Virginia is one of 3 states that require additional training for ownership of a DMX unit. They do not require this training to order procedures, however they do require this training for ownership so that the doctor will be competent in performance and interpretation of procedures. Dr. Chipley has completed the prescribed hours of training and passed a test and been awarded the certification to own and operate a Dynamic Motion X-ray Unit. This certification is through the WV Board of Chiropractic Examiners.

Chipley Chiropractic chooses to offer the highest standard of care possible to our patients. Therefore, I have hired a WV State Licensed Radiology Technician (RT) to perform the studies with the Chipley Chiropractic DMX machine. Our RT, Lisa Asbury, was trained in motion x-ray procedures as part of her schooling. She has 10 years of experience in performing DMX studies and she was employed to perform DMX studies by WV Dynamic Motion Imaging, Inc. prior to joining the Chipley Chiropractic Team.

Likewise, we pay for a Medical Radiologist to review and interpret all studies of the Cervical Spine. We also review the studies ourselves and confer with this Medical Radiologist with any questions I may have about a given study. Dr. Louis Kastan, our medical Radiologist, is in private practice and has been reading these studies for multiple DMX centers for the past 8 years. His credentials are impeccable and include teaching at the University of Louisville School of Medicine in the Radiology Program.

As you should be beginning to understand, The DMX equipment is not a standard x-ray machine and it does not perform static film images. This is an expensive and technologically advanced piece of equipment.

A study is an arc of motion within the cervical spine looking for specific ligamentous damage. Every comprehensive examination of the cervical spine includes 8 completely independent studies that each focus on a specific and different anatomical structure.

Each arc of motion requires a specific setup of the patient and a specific movement by the patient. This arc of motion is being performed to look at a specific anatomical structure. The patient is taken through a specific Arc of motion a minimum of 3 times and the study is recorded on High Resolution DVD. The medical radiologist and the doctors of Chipley Chiropractic then interpret each arc of motion individually.

Unlike conventional x-rays, the purpose of this test is not to simply visualize the cervical spine as a whole for fractures or subluxation. With the DMX study, the primary function of the study is to look for ligamentous injury. Multiple views are not required to find a ligamentous
injury. Each unit of the study is evaluating a specific ligament or set of ligaments. Each Unit Stands Alone As a Definitive Test for Ligament Damage of the Specific Ligament(s) (Anatomical Structure) that the specific unit has been designed to visualize.

Below we have explained each unit and the associated anatomical structures that are studied. These units are stand-alone procedures and they do not require other units for interpretation of the specific anatomical structure (ligament) being evaluated.

**Unit 1 Lateral nodding Motion Arc –
Global Study of the following Anatomical Structure: Transverse Ligament**

This movement tests the integrity of the transverse ligament, which is responsible for preventing the anterior movement of Cl on C2. An increase of the Atlanto-Dens interspace (ADI) indicates damage to the transverse ligament, which may cause brain stem and spinal cord compression, and neurological pain characterized by numbness, burning, and tingling (paresthesia).

**Unit 2 Lateral Flexion and Extension Motion Arc –
Global Study of the following Anatomical Structures: Posterior Longitudinal Ligament, Anterior Longitudinal Ligament, Interspinous Ligament, Compression Fracture of the Facet Joint**

There are two ways to demonstrate the damage to the posterior longitudinal ligament: A) An anterolisthesis is a disruption of George's line, which is quantified by seeing the sliding forward (anterior) of one vertebra over the vertebrae below. & B) The posterior widening of the intervertebral disc space (increased disc angle).

The integrity of the interspinous ligament is evaluated in the lateral flexion view. Damage to this ligament results in increased separation of the spinous processes in flexion.

The posterior longitudinal and interspinous ligaments are two of the posterior stabilizing structures of the cervical spine. Damage to these ligaments allows straightening or reversal of the cervical curve.

There are two ways to demonstrate the integrity of the anterior longitudinal ligament: A) A retrolisthesis is a disruption of George's line, which is quantified by seeing vertebrae above sliding backwards (posteriorly) over the vertebrae below. B) The anterior widening of the intervertebral disc space (increased disc angle). The anterior longitudinal ligament is one of the anterior stabilizing structures of the cervical spine. Damage to this ligament alters the biomechanics of the cervical curve.

When a compression fracture of the facet is present, the facet appears as a seagull wing deformity (V-dented). This deformity is a result of excessive hyperextension of the inferior facet of the vertebrae above on the superior facet of the vertebrae below. The facet will permanently retain its deformity.

**Unit 3 – Right Oblique Flexion and Extension Motion Arc
Global Study of the following Anatomical Structure: Right Capsular Ligaments**

Located on the posterior cervical spine (C2-C7), there are five capsular ligaments on the right.

Gapping of the facets indicates damage to the capsular ligaments. These ligaments help maintain the cervical lordosis or backward curve to the neck, and add strength to the posterior aspect of the cervical spine. Damage to these ligaments can cause localized "posterior neck pain" or referred sclerantogenous pain from the shoulder to mid back.

Capsular ligament damage allows an increase in motion along the facet plane, which leads to intervertebral foramenal encroachment (IVF). The closing down of the IVF will cause compression of the nerve root, which leads to neurological pain characterized by numbness, burning, and tingling (paresthesia).
Unit 4 – Left Oblique Flexion and Extension Motion Arc  
Global Study of the following Anatomical Structure: Left Capsular Ligaments  
Located on the posterior cervical spine (C2-C7), there are five capsular ligaments on the left.  
Gapping of the facets indicates damage to the capsular ligaments. These ligaments help maintain the cervical lordosis or backward curve to the neck, and add strength to the posterior aspect of the cervical spine. Damage to these ligaments can cause localized "posterior neck pain" or referred sclerantogenous pain from the shoulder to mid back.  
Capsular ligament damage allows an increase in motion along the facet plane, which leads to intervertebral foraminal encroachment (IVF). The closing down of the IVF will cause compression of the nerve root, which leads to neurological pain characterized by numbness, burning, and tingling (paresthesia).

Unit 5 – Anterior to Posterior Cervical Lateral Flexion Motion Arc  
Global Study of the following Anatomical Structure: Facet Joint Integrity  
This view allows us to evaluate coupled motion of the spinous processes, which examines facet joint integrity. Lateral bending of the cervical spine results in a rotation of the spinous process to the opposite side. Lack of this rotation indicates fixations.

Unit 6 – Rotation Motion Arc  
Global Study of the following Anatomical Structure: Alar and Accessory Ligaments  
This view examines the rotational range of motion between Occiput-C1- C2. Seventy percent (70%) of all neck rotation occurs in this upper cervical spine region. Lack of motion indicates fixations. Increased or excessive motion indicates damage to the alar and accessory ligaments.

Unit 7 – A-P Open Mouth Lateral Flexion Motion Arc  
Global Study of the following Anatomical Structure: Alar (Atlanto- Occipital) and Accessory Ligaments  
There are two ways to demonstrate the integrity of the alar (atlanto-occipital) and accessory ligaments. 1) A lateral mass overhang of C-1 on C-2 when laterally bending the head to the right or left. 2) Change of the para-odontoid space when laterally bending the head to the right or left.  
Damage to the alar and accessory ligaments allow hypermobility of C1 on C2. This hypermobility leads to headaches and upper cervical neck pain. Possible vertebral artery compression may result in the symptoms of vertigo and/or dizziness.

Unit 8 – A-P TMJ Open - Close Motion Arc  
Global Study of the following Anatomical Structure: Temporo-Mandibular Joint  
This final arc of motion looks for dysfunction in the movement and natural tracking of the TMJ structure. If significant dysfunction is noted on interpretation, additional motion arcs may be needed to better evaluate significance of the dysfunction.  
Because of the past years of using this technology and the help the procedures offered in diagnosis and treatment directly affected by findings of these studies, it became important to me to be able to offer this service to those patients who clearly had signs of ligamentous injury. All research to date supports the validity of the test and it often shows up otherwise missed traumatic injuries to ligaments. Not offering this test to those in need is a much greater injustice.
Based on research and personal clinical experience, this test is more valuable than the majority of expensive hospital procedures that usually are normal. Clearly hospitals over perform CT scans and MRI studies on patients involved in low speed crashes where there is no real neurological evidence of disc failure or cranial hemorrhaging. When was the last time you saw a positive finding on a head CT at the ER after a low speed crash?

Historically, physicians relied upon non-moving diagnostic procedures, such as x-rays, flexion-extension films, and MRI to diagnose whiplash injuries. Unfortunately during these test patients are required to "stand still, hold your breath, and don't move" while the exam is taking place. This in itself was problematic because most people experience pain when they move, and not when they are still or lying down. These static/non-moving diagnostic tests will usually come back with a normal or unremarkable finding.

Pain is a sign of injury. One source of pain is generated by nociceptors (pain receptors) in your ligaments. When placed with excessive movement and/or forces, nociceptors in ligaments will "fire", and pain is experienced. The way to find the cause of pain after whiplash is to see the patient in motion.

More often then not, when a patient is experiencing a sign of a ligamentous injury and they were in a crash, there is an injury.

In conclusion, this is incredible technology that has been actively used in WV since around 2000. It is accepted in the medical and chiropractic community and clearly it is under utilized. We utilize this study because it helps us offer the best treatment to our patients. We have been using this technology since about 2002 and we have been so impressed that we have gone through significant steps to own and operate our own DMX system to offer a higher standard of care to our patients.

Sincerely,

Dr. Julian Chipley