

## **Soft tissue injury protocol (STIP) using motion MRI for cervical spine trauma assessment**

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Vincenzo Giuliano, Concetta Giuliano, Fabio Pinto, Mariano Scaglione

FROM ABSTRACT:

The purpose of this study was to establish a noninvasive scoring method, using motion MRI, to determine the degree of clinical impairment in traumatized cervical spines.

This method is called the soft tissue injury protocol (STIP) scoring method.

The cervical spines of 100 adult accident victims were evaluated prospectively using motion MRI at 12 weeks following hyperflexion/hyperextension injury from rear, low-impact motor vehicle collisions.

Subjects were scored for degree of functional impairment based on an eight-point scale derived from the following clinical criteria: hypolordosis, motion restriction, disk herniation, and spinal stenosis.

Five classes of impairment, ranging from normal to severe impairment, were identified as a basis for therapeutic management.

Using the STIP scoring method, 94% of patients (94 of 100) were determined to have nonsurgical injuries.

Class 1 and 2 injuries indicated mild impairment and were found in 68% of patients, who were considered to have reached maximum medical improvement at 12 weeks after injury. **[IMPORTANT: 68% reached maximum medical improvement at 12 weeks after injury.]**

A Class 3 injury indicated moderate impairment and was found in 26% of patients, who required an additional 12 weeks of rehabilitative and medical treatment to achieve maximum medical improvement. **[IMPORTANT: 26% did not reach maximum medical improvement until 24 weeks after injury.]**

Class 4 and 5 injuries indicated severe impairment; these were identified in 6% of patients and required surgical intervention. **[IMPORTANT: 6% required surgery]**

Five of the six patients requiring surgery (83%) achieved maximum medical improvement at 36 weeks after injury.

The STIP scoring method is a practical, noninvasive method of determining the degree of clinical impairment, as a basis for distinguishing injury requiring medical

treatment from injury requiring surgical treatment, in cases of subacute cervical spine trauma.

#### THESE AUTHORS ALSO NOTE:

“Motion MRI has been shown to demonstrate significant differences in biomechanical function between normal patients and injured patients following rear, low-impact motor vehicle collisions.”

“More than 3 million cases of cervical spine injury related to motor vehicle accidents are reported annually.”

“The motion MRI method provides assessment of segmental spinal motion and disk pathology as a basis for evaluating the integrity of the diskoligamentous complex and interspinous ligament function.”

These authors integrated the motion MRI method (STIP method) into a scoring system determining the degree of clinical impairment, as a basis for medical versus surgical management of injury.

All 100 patients were injured in a rear-end, low-impact motor vehicle collision.

All injured patients had normal cervical radiographs, but positive clinical signs and symptoms (typically pain, pain radiation, numbness, and motion restriction) at 12 weeks after injury.

Patients with pre-existing medical conditions were excluded from this study, including prior cervical spinal surgery, disk herniation, spinal stenosis, and cervical disk degeneration or spondylosis.

Spinal cord compression and myelopathy are a contraindication to motion MRI.

These MRIs were performed with the patient lying in the supine position, and initiating their own movements.

#### RESULTS

“The key distinction between class 3 and class 4 injuries, both of which present with disk herniation, is the presence of cord compression, a determinant for surgical intervention.”

“Class 5 injuries present with frank cord compression due to a large disk herniation on the initial examination. Class 5 patients are considered too unstable for the motion MRI examination, requiring direct surgical intervention.”

94% of patients (94 of 100) were determined to have nonsurgical injuries.

“Class 1 and 2 injuries indicated mild impairment, were found in 68% of patients (68 of 100), and were considered to have reached maximum medical improvement at 12 weeks after injury.”

“A class 3 injury indicated moderate impairment; these were found in 26% of patients (26 of 100), and required an additional 12 weeks of rehabilitative and medical treatment to achieve maximum medical improvement.”

Class 4 and 5 injuries indicated severe impairment, and required surgical intervention.

In this study, “maximum medical improvement was achieved in 68% of patients (68 of 100) at 12 weeks, in 94% (94 of 100) at 24 weeks, and in 99% (99 of 100) at 36 weeks after injury.” **[Remember, maximum medical improvement does not mean completely fixed without residuals. It means that further regularly scheduled treatment will not necessarily result in additional objective of subjective improvement of clinical status.]**

Typical class 1 injury:

- 1) Normal cervical lordosis.
- 2) Normal segmental motion.
- 3) No disk herniation, and no spinal stenosis.

Typical class 2 injury (mild functional impairment):

- 1) Hypolordosis.
- 2) Segmental motion restriction in both flexion and extension.
- 3) No disk herniation, and no spinal stenosis.

Typical Class 3 injury (moderate functional impairment):

- 1) Hypolordosis
- 2) Segmental motion restriction in both flexion and extension
- 3) A small central disk herniations, which increases the degree of spinal stenosis with motion but does not result in cord compression.

Typical class 4 injury (significant functional impairment):

- 1) Hypolordosis.
- 2) Segmental motion restriction in both flexion and extension.
- 3) A disk herniation resulting in cord compression with motion.

## DISCUSSION

“Kinematic, or motion MRI, offers the most useful functional assessment of soft tissue injury.”

“Disk herniations and injuries to the posterior diskoligamentous complex are well seen by conventional MRI; however, motion evaluation has shown the intervertebral disk to be morphologically deformable, accentuating spinal stenosis.”

**[IMPORTANT]**

“Segmental motion restriction and segmental fixation abnormalities are readily apparent on kinematic motion MRI, providing an assessment of the integrity of the interspinous ligament function and integrity of the posterior longitudinal ligament, which are susceptible to hyperflexion/hyperextension injury during rear, low-impact motor vehicle collisions.”

In this study “Class 1 and class 2, together representing approximately 68% of injuries, responded well to initial manipulative therapy, with maximum medical improvement at 12 weeks after injury. These patients typically have hypolordosis and mild segmental motion restriction, but no disk herniations.”

**[WOW! These patients were managed with manipulation.]**

“Class 3 and 4 injuries involved more serious injuries to the diskoligamentous complex and interspinous ligaments, resulting in more significant clinical impairment, typically with disk herniations which accentuate spinal stenosis with flexion, and significant segmental motion restriction.”

“In no instance was disk herniation and spinal stenosis observed in the absence of hypolordosis and segmental motion restriction.” **[IMPORTANT: paraphrase: ALL PATIENTS WITH DISK HERNIATIONS AND SPINAL STENOSIS ALSO HAD HYPOLORDOSIS].**

“Class 3 injuries typically involved small disk herniations that do not result in cord compression following motion.”

“Unlike those with class 4 injuries, patents in class 3 responded well to conservative management with manipulative therapy, but required extended treatment up to 24 weeks after injury to achieve maximum medical improvement.” **[IMPORTANT, again noting that patients with small disk herniations respond well to manipulative therapy in about 24 weeks (nearly 6 months)].**

“Class 4 injuries involved cord compression due to a disk herniation, induced by flexion maneuvers, and were considered to require surgical treatment. These patients did recover after surgery, reaching maximum medical improvement by 36 weeks after injury in five out of six cases (83%).”

This study shows “that an overwhelming number of patients, approximately 94%, can be treated medically, with maximum medical improvement achieved within 24 weeks after injury.”

KEY POINTS FROM DAN MURPHY:

1) Most importantly, this study proves that injuries from low-impact rear-end collisions can result in “serious impairment” and the need for “surgical intervention” in about 6% of those injured.

- 2) This article establishes that motion MRI can document injuries ranging from minor to severe (requiring surgery) in the presence of normal cervical radiographs (all 100 injured patients in this study had normal cervical radiographs).
- 3) Flexion / extension motion MRIs can definitively establish hypolordosis, assessment of segmental motion, disc pathology, disc herniation, the integrity of the diskoligamentous complex, interspinous ligament function, disc compression of the cord as a consequence of motion, and spinal stenosis.
- 4) Injuries from low-impact rear-end collisions causing mild impairment will reach maximum medical improvement in about 3 months of treatment. **[NOTE, 12 weeks, not 6 weeks].**
- 5) Injuries from low-impact rear-end collisions causing moderate impairment is found in about 26% of patients, and they required about 6 months of treatment to achieve maximum medical improvement. **[Again 6 months, not 6 weeks]**
- 6) Very importantly, this article notes that 68% of the injured patients had reached maximum medical improvement at 12-14 weeks, yet they also note that these same patients were still suffering from "pain, pain radiation, numbness, and reduced motion." This means that patients with ongoing signs and symptoms (subjective and objective residuals) might still be classified as having reached maximum medical improvement. This implies that these patients are suffering from permanent injury.
- 7) These motion MRIs were performed with the patient lying in the supine position. **[I believe that weight bearing motion MRIs, like those currently being done at Life Chiropractic College West, are more demonstrative of clinical pathology and therefore have more clinical relevance.]**
- 8) Importantly, classification of injury in this study used standard findings such as disc herniation and spinal stenosis, but also typical chiropractic findings such as hypolordosis and restricted segmental motion. **[Actually, Very Important]**
- 9) Motion MRI is the most useful functional assessment of soft tissue injury.
- 10) Importantly, 94% of these patients, representing minor to moderate impairments, responded effectively to manipulative management over a period of 6 months.
- 11) The most important finding in this study is that it establishes that there are a large number of patients (26%) injured in low-impact rear-end collisions who require manipulative management over a period of 6 months to reach maximum medical improvement.