

Increased Sagittal Plane Segmental Motion in the Lower Cervical Spine in Women With Chronic Whiplash-Associated Disorders, Grades I-II: A Case-Control Study Using a New Measurement Protocol

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FROM ABSTRACT:

Study Design.

Case-control study comparing sagittal plane segmental motion in women (n = 34) with chronic whiplash-associated disorders, Grades I-II, with women (n = 35) with chronic insidious onset neck pain and with a normal database of sagittal plane rotational and translational motion.

Objective.

To reveal whether women with chronic whiplash-associated disorders, Grades I-II, demonstrate evidence of abnormal segmental motions in the cervical spine.

Summary of Background Data.

It is hypothesized that unphysiological spinal motion experienced during an automobile accident may result in a persistent disturbance of segmental motion.

[WOW, this describes the sublaxation complex].

It is not known whether patients with chronic whiplash-associated disorders differ from patients with chronic insidious onset neck pain with respect to segmental mobility.

Methods.

Lateral radiographic views were taken in assisted maximal flexion and extension.

A new measurement protocol determined rotational and translational motions of segments C3-C4 and C5-C6 with high precision.

Segmental motion was compared with normal data as well as among groups.

Results.

In the whiplash-associated disorders group, the C3-C4 and C4-C5 segments showed significantly increased rotational motions.

Translational motions within each segment revealed a significant deviation from normal at the C3-C4 segment in the whiplash-associated disorders and insidious onset neck pain groups at the C5-C6 segment in the whiplash-associated disorders group.

Significantly more women in the whiplash-associated disorders group (35.3%) had abnormal increased segmental motions compared to the insidious onset neck pain group (8.6%) when both the rotational and the translational parameters were analyzed.

Conclusion:

Hypermobility in the lower cervical spine segments in 12 out of 34 patients with chronic whiplash-associated disorders in this study point to injury caused by the accident.

This subgroup, identified by the new radiographic protocol, might need a specific therapeutic intervention.

THESE AUTHORS ALSO NOTE:

The mechanism of whiplash-type injuries is that the cervical spine undergoes a transient abnormal S-shaped motion during whiplash loading.

"Abnormal increased segmental motions with concomitant sliding and compression in the facet joints before the total physiologic range of flexion-extension is reached has been documented."

It has been "reasoned that this abnormal motion may be responsible for potential damage to the soft tissues of a cervical motion segment."

"Clinicians believe that the presence, development, or progression of abnormal increased segmental cervical motions indicates a poor prognosis after motor vehicle collisions (MVCs)."

"Flexion-extension radiography has been in clinical use for over 50 years to detect abnormal segmental motions in the spine."

"A new protocol that precisely documents rotational and translational segmental motion is employed in this study. Motion data are independent of radiographic magnification and distortion as well as of patient alignment."

"This study compares sagittal plane motion of segments C3-C4 and C5-C6 of two cohorts, women with chronic WAD, Grades I-II, and women with chronic insidious onset neck pain (IONP) with a normal database as well as among cohorts. The aim is to reveal whether women with chronic WAD, Grades I-II, exhibit radiologic evidence of abnormal segmental motion (hypo- or hypermobility) in the lower cervical spine."

In this study, digital radiography was used in a lateral sitting position.

Segmental motion analysis was evaluated at segments C3-C4, C4-C5, and C5-C6.

"The women underwent an assisted flexion-extension examination of the cervical spine."

The examiner obtained maximal flexion-extension radiographs by grabbing the patient's head and positioning it.

A vapocoolant spray (Fluori-Methane) was used on the posterior aspect of the neck and shoulder girdle to relax the muscles.

The examiner moved the patient's head and neck slowly further into maximal flexion. A radiograph was taken in this position. After 10 seconds' rest in the upright position, a similar procedure was used for the maximal extension position.

Vertebral contours were manually mapped and digitized. Computer programs subsequently define objective landmarks on the vertebral contours. Segmental flexion and extension rotations and translations are then assessed.

[We can do a similar procedure on our patients by using the system from WWW.SpinalLogic.com].

The ranges of motion can be compared to a normal database derived from flexion-extension views of healthy, adult patients.

For segments C3-C4, C4-C5, and C5-C6, the differences between rotational motion of the WAD group and the IONP group as well as the normal database were compared.

"Individual segments were also designated as hyper- or hypomobile with respect to rotation and translation."

"Hypomobility with respect to rotational or translational motion was not observed."
[IMPORTANT]

RESULTS

Significantly more women in the WAD group had segmental rotational or translational hypermobility, 35.3% compared to 8.6% in the IONP group.

"No hypomobility was observed in the three segments analyzed."

DISCUSSION

Studies show that an increased segmental displacement around the neutral spine position is a more sensitive parameter for abnormal increased segmental motion than the range of motion. **[IMPORTANT, "increased segmental motion"]**

In this study, "Rotational motion of the segments C3-C4 and C4-C5 in the WAD group were significantly increased compared to both the IONP and the normal database."

"The women with chronic WAD in this study revealed significantly increased prevalence of combined rotational and translational hypermobility in the middle cervical spine segments compared to women with chronic IONP."

"In our opinion, the translational parameter as it is defined in this study is the most accurate parameter available to judge abnormal *in vivo* segmental motions in the spine."

"The major limitation of this study is that only three segments were analyzed."

"The upper cervical spine segments are more commonly injured when the head and neck are in a flexed and a rotated position at the moment of the MVC," and these joints may have abnormal increased segmental motion causing chronic pain.

"Increases in segmental motion have been correlated to soft tissue injuries of the spine."

"The intervertebral disc is the most important structure preventing abnormal increased segmental translational motion." **[IMPORTANT, as it suggests that if there is segmental hypermobility that the disc has been injured].**

"The increased segmental motion found in some women with chronic WAD in this study, possibly due to occult or incomplete soft-tissue injuries not easily healed, may be an important predisposing factor for their chronicity." **[IMPORTANT]**

"Classifying patients with WAD on the grounds of decreased or normal range of sagittal plane rotational motion without considering the possibility of underlying abnormal increased segmental motions is misleading."

[I have always said: "one can have normal global motion with the presence of serious segmental motion problems."]

"The emphasis on range of rotational motion exercises in the acute phase has to be modified according to the segmental mobility status of each individual patient." **[Again, VERY IMPORTANT]**

The patients in this study also showed that the "C4-C5 segment in the WAD group was in a significantly more flexed position compared to an asymptomatic group."

"The WAD group also exhibited a greater tendency towards a decreased lordosis in the lower cervical spine and a relatively increased lordosis in the upper cervical spine." **[INTERESTING]**

These findings “suggest that some patients with whiplash need a specific exercise therapy targeting the deep segmental muscles to enhance proper segmental alignment and movement control of segmental motions in the cervical spine.”

[WOW, This sounds like they need chiropractic adjustments and multidirectional exercises]

CONCLUSIONS

In this case-control study, all measures pointed towards significantly increased segmental motions in the WAD group, “suggesting that some patients with chronic whiplash may have increased segmental motion in the middle cervical spine segments.”

“This may be an important predisposing factor for their chronicity.”

KEY POINTS FROM AUTHORS

“Posteroanterior translational motion is a sensitive parameter for indicating abnormal segmental motion.”

“This parameter and the actual rotational parameter identified significantly more women with increased segmental motion in the WAD group compared to the IONP group.”

KEY POINTS FROM DAN MURPHY:

- 1) Unphysiological spinal motion experienced during an automobile accident may result in a persistent disturbance of segmental motion. I believe that chiropractors would refer to such findings as a “chronic subluxation complex.”
- 2) In this study, translational segmental hypermobility was more predictive of chronic whiplash pain than rotational hypermobility.
- 3) The authors believe that the segmental hypermobility documented in this study are the result of injury caused by the accident.
- 4) The mechanism of whiplash-type injuries is that the cervical spine undergoes a transient abnormal S-shaped motion during whiplash loading.
- 5) Whiplash biomechanics causes an abnormal increased segmental motion with concomitant sliding and compression in the facet joints before the total physiologic range of flexion-extension is reached.
- 6) This abnormal motion causes damage to the soft tissues of the cervical joints.
- 7) The presence, development, or progression of abnormal increased segmental cervical motions indicates a poor prognosis after motor vehicle collisions.

- 8) Flexion-extension radiography has been used for over 50 years to detect abnormal spinal segmental motions.
- 9) The assessment of abnormal segmental mobility on radiographs requires maximum flexion-extension patient positioning.
- 10) The upper cervical spine segments are most injured when the head and neck are in a flexed and a rotated position at the moment of injury.
- 11) Increases in segmental motion are correlated to soft tissue injuries.
- 12) The intervertebral disc is the most important structure preventing abnormal increased segmental translational motion. This suggests that if there is segmental hypermobility that the disc has been injured.
- 13) The increased segmental motion due to occult or incomplete soft-tissue injuries may not heal and be an important predisposing factor for chronic pain.
- 14) Classifying patients with WAD on the grounds of decreased or normal flexion-extension motion without considering the underlying abnormal increased segmental motions is misleading. Again, one can have normal global motion with the presence of serious segmental motion problems.
- 15) For these patients, segmental stability exercises are more important than range of motion exercises or regional strengthening exercises.
- 16) In whiplash patients, the C4-C5 segment was significantly more flexed, and the whiplash patients had a greater tendency towards a decreased lordosis in the lower cervical spine.
- 17) Some patients with whiplash need a specific exercise therapy targeting the deep segmental muscles to enhance proper segmental alignment and movement control of segmental motions in the cervical spine. This sounds like they need chiropractic adjustments and multidifi exercises to me.
- 18) Some patients with chronic whiplash may have increased segmental motion in the middle cervical spine segments, and this may be an important predisposing factor for their chronicity.