Smooth Pursuit Neck Torsion Test
A Specific Test for Whiplash Associated Disorders?


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FROM ABSTRACT
Study Design.
A consecutive, prospective, blinded clinical study.

Objectives.
To determine if the smooth pursuit neck torsion (SPNT) test can differ between WAD and alternative diagnoses.

Summary of Background Data.
About ten percent of whiplash injured individuals in the western world develop chronic conditions called whiplash associated disorders (WAD).

Many medicolegal conflicts have been caused by the lack of objective findings.

However, preliminary studies have demonstrated the efficacy of the smooth pursuit neck torsion (SPNT) test.

Methods.
A study group of 160 patients with WAD and a control group of 122 patients with non-traumatic neck pain (cervical spondylosis (52), cervical dizziness (47) and fibromyalgia (24)) were chosen for a validity study.

The SPNT test is a smooth pursuit eye movement test.

The subjects are placed in a neutral position, and then they turn 45 degrees to the right and to the left. The difference between the average gain in neutral and torsion positions is the test parameter.

Results.
The validity of the SPNT test as a specific test for diagnosing WAD was: sensitivity 72%, specificity 92%, predictive value as a positive test 92%, predictive value as a negative test 71%. The odd ratio was 28.6.

Conclusions.
This study supports the view that the smooth pursuit neck torsion test is useful for diagnosing whiplash associated disorders.

THESE AUTHORS ALSO NOTE:
The symptoms of whiplash associated disorders (WAD) for more than 6 months after an accident, are:
Neck pain
Memory problems
Concentration difficulties
Headache
Paresthesias
Weakness of arms
Dizziness
Visual disturbances

These authors used the otoneurological SPNT test to distinguish between WAD and alternative diagnoses.

“The inclusion criteria were WAD of grades II or III, according to the Quebec classification—i.e., grade II, neck pain and myoskeletal findings, like restriction of neck motion, point tenderness and a duration of at least 6 months after the injury; grade III, neck complaints and neurological signs.”

SMOOTH PURSUIT NECK TORSION TEST

The smooth pursuit neck torsion (SPNT) test is partly a test of the smooth pursuit (SP) eye movement system and partly a test of the proprioceptors in the neck.

The SPNT test is performed as follows:
the person sits in neutral position in front of a screen with a red dot moving horizontally to and fro. The person has to follow the target visually without moving the head. This ability is a test parameter, expressed as a gain.

The chair of the individual is then turned 45 degrees to the one side so the torso is turned away, but the head is still pointing forward, supported by an assistant, at a maximum angle of 45 degrees—or at some angle which did not increase pain, stress and/or other discomfort. The eye-tracking test is then repeated.

Next, the procedure is repeated to the opposite side.

“There is a short pause between each change of posture with the purpose to eliminate vestibular influence.”

“In all three test situations (i.e., neutral torso position, torso turned to the right, and turned to the left) the patients ability to follow the red dot is registered and the gain is calculated.”

“Ideally, an individual manages to follow the target 100% (i.e., the ratio between the velocity of smooth pursuit eye movements and of the target is then 1.00).”
“However, normally the eye does not keep pace, then it needs to catch-up to the target which is done by very fast corrective eye movements called corrective saccades.”

The velocity of these saccades are about 600 degrees per second compared to the target maximum velocity of 20 degrees per second.

“These corrective saccades decrease the gain from 1.00 to about 0.80-0.90 in an healthy individual.”

VISUAL ANALOGUE SCALE FOR PAIN

“The subjects were asked to indicate their minimum and maximum levels of pain during the last week on visual analogue scales from 0 to 10, where 0 means no pain, and 10 the maximum degree of pain.”

The median VAS pain score of the patients with WAD was 6.0 and of the control groups 5.0.

There were no significant difference noted between the WAD group and the control group in life satisfaction.

RESULTS

There was a significant difference between the WAD group and the controls in all gains with the torso turned to the right or left.

“In neutral position, as expected, a slight difference was noticed.”

“No relation was seen between age, gender, duration of the disease, and life satisfaction items, on the one hand, and SPNT, on the other.”

All groups had a neutral gain .86 to .88.

For the most part, the control groups, including healthy controls, maintained a gain around .82 to .85 with torsion.

The WAD group, however dropped to a gain between .69 to .75. This is significant.

DISCUSSION

“Our data support the hypothesis that the SPNT test can be used to distinguish between WAD and alternative diagnoses.”

“The difference in SPNT test results between the patient and control groups is
ascribed to be an effect of acceleration-deceleration on the neck and the proprioceptors.” [VERY IMPORTANT]

“We suggest that this G-impact caused hypersensitivity of the proprioceptors.”

However, “only a few commercial systems for smooth pursuit eye movement registration have a sufficiently high sampling capacity for digital interpretation.”

“The smooth pursuit eye movement performance is difficult to malinger.”

“Malingered eye movements tend to be rather bizarre saccades of varying dimensions that are easy to detect.”

POSTURAL BACKGROUND OF THE SPNT TEST

Vision dominates over vestibular and proprioceptive function in static and dynamic fixation.

“Human balance is controlled by interactions and integrations of reflexes of the vestibular, the visual, and the proprioceptive systems.”

“The smooth pursuit eye movement system includes the midcerebellum and the vestibular nuclei complex.”

“The most important reflex of the neck is the cervico-collic which is integrated in the midcerebellum and the less important cervico-ocular reflex in the vestibular nuclei complex.”

The cervico-collic reflex is generated from the muscle spindles in the deepest neck muscles.

The cervico-ocular reflex originates in proprioceptors in the neck muscles and the cervical joints of the upper cervical spine, and pass via the vestibular nuclei complex to the eye muscles.

The neck muscle spindles are small sensory organs whose main tasks are to register movements and positions involved in muscle coordination, and regulate the nervous reflex-mediated muscle stiffness.

Studies have shown that chronic inflammation alters muscle spindle activity generating painful muscle disorders.

“Muscle spindles, but not joint receptors, seem to be the main generators of cervical proprioception and kinesthesia.”

“The only obvious difference between the groups are the acceleration-deceleration
“Impact on the neck, therefore a hypersensitivity of the proprioceptors is suggested as an explanation of the SPNT test results.”

“Evidence has been presented that the smooth pursuit eye movement system may be affected by abnormal proprioceptive activity.”

“The cervico-collic and cervico-ocular reflexes are assumed to form the basis for the SPNT test.”

“A brainstem lesion is probably not the cause of an abnormal SPNT result, since brainstem audiometry is normal in a majority of patients with WAD.”

Also, “the SPNT test was normal in a series of 50 patients with brainstem disorders.”

CONCLUSION

“This study supports the view that the SPNT test can be used to distinguish between WAD and alternative diagnoses.”

“For reproducing the results analogue interpretation or digital with high sampling rate is needed.”

KEY POINTS FROM DAN MURPHY

(1) This article adds to the evidence that the primary injury in whiplash is to the joints, ligaments, and small deep muscles of the cervical spine.

(2) The injury to these tissues alters the function of the mechanoreceptors, resulting in altered proprioception.

(3) Part of the altered mechanoreceptor function is caused by inflammation.

(4) Altered mechanoreception alters the neurological input to the cerebellum and brainstem, especially the vestibular nucleus.

(5) This altered mechanoreception input into the cerebellum and brain stem can be documented with the SPNT test if you have the right equipment. This is because the SPNT test is specifically designed to test eye movement function while stressing cervical spine tissues and their mechanoreceptors.

(6) The altered mechanoreception caused by whiplash injury to the cervical spine can be long-lasting and result in chronic whiplash symptoms or WAD.