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ASSESSMENT AND COMPARISION OF CERVICAL JOINT POSITION SENSE IN SUBJECTS WITH CHRONIC NECK PAIN VS NORMALS

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ABSTRACT

Background: The abundance of mechanoreceptors in the cervical spine and their central and reflex afferent connections to the vestibular, visual and postural control system suggests that the cervical proprioceptive information provides important somatosensory information influencing postural stability, head orientation and eye movement control. Disturbances to the afferent input from the cervical region is thought to underlie symptoms of dizziness, unsteadiness, visual disturbances and signs of altered postural stability, cervical proprioception and head and eye movement control in people with chronic neck pain. This study aimed to assess and compare cervical joint position sense in subjects with chronic neck pain vs normals.

Methods: Total 60 subjects, divided into two groups chronic neck pain group (n = 30) (12 males and 18 females with mean age of 40.7 years) and control group (n = 30) with age and gender matched normal individuals were assessed for baseline data and demographic variables. Head repositioning accuracy test was used to assess cervical joint position sense in degrees.

Results: The difference in the head repositioning error values were found to be extremely significant ($p < 0.0001$) for all the neck movements for subjects with chronic neck pain as compared to normals.

Conclusion: Cervical joint position sense in subjects with chronic neck pain is found to be altered as compared to age and gender matched normals.

Key words: Cervical joint position sense, Chronic neck pain, Haed repositioning acurracy test, Head repositioning error.

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INTRODUCTION

Cervical (neck) pain as given by the International Assosiation for the study of pain is defined as pain percieved as arising from any where within the region bounded superiorly by the superior nuchal line, inferiorly by an imaginary transverse line through the tip of 1st thoracic spinous process and laterally by sagittal planes tangential to the lateral borders of neck.[1, 2]

The dense network of mechanoreceptors in the soft tissues of the cervical region are unique with respect to the arrangements of the muscle spindles[3] , they exist as single muscle spindles or are linked in pairs, parallel or tandem. Neck muscle spindles are also compartmentalized in series within the muscle, allowing a response to both stretch and contraction. The dense mechanoreceptors and muscle fibre composition supports their key role in proprioception.[3]

Cervical afferents play an important role by reflex mediated activity and subsequent connections between visual and vestibular apparatus.[4,5] Information from the muscle spindles is of primary improtance for cervical proprioceptive acuity and this information is combined with input from the vestibular and visual systems.

Cervical (neck) pain can cause alterations in cervical somatosensory information. Alterations of the afferent input from the cervical region is thought to underlie varied number of symptoms like dizziness, unsteadiness, visual disturbances and signs of altered postural stability, cervical proprioception and head and eye movement control.

In chronic pain, mechanoreceptors continue to be sensitive to noxious stimuli due to changes in central nervous system and decreased central inhibition.[6] This results in an increase in nociceptive input which disturbs somatosensory input for sensorimotor control. The disturbances in the sensorimotor control may result from either an increase or decrease in cervical somatosensory afferent activity. Thus, the aim of this study was to assess and compare cervical joint position sense in subjects with chronic neck pain vs normals.

MATERIALS AND METHOD

Approval for the study was taken from the institutional ethics committee and all the subjects provided their informed consent. The study design was a prospective experimental type, conducted in the physical therapy outpatient department of a tertiary care hospital. Total 60 subjects, were divided into two groups: Chronic neck pain group (n = 30) including subjects with chronic neck pain (12 males and 18 females with mean age of 40.7 years) and Control group (n = 30) subjects which were age and gender matched normal individuals. Both the groups were assessed for baseline data, demographic variables and cervical joint position sense using head repositioning accuracy test.

Inclusion criteria:

- People with chronic neck pain of non-traumatic origin for more than 6months.
- Age group 25-50 years.

Exclusion criteria:

- People with neck pain of traumatic origin.
- People with known disease that affects nervous system.
- People with known disease that affects vestibular system.
- People with Vertebro basillar artery (VBA) dysfunction.
- Any systemic, musculoskeletal or psycological disorder.
- People unwilling to join the study.

Cervical joint position sense was measured using head repositioning accuracy test.[7] This was assessed by using a laser pointer mounted on a light weight headband and a circular graduated target placed on the wall in front of the subject aligned with subjects reference head position. A sleeping eye band was used to occlude the subjects vision during the test. Each subject was seated on a chair 90cm away from the wall with support to the lower back and the thighs were horizontal and knees flexed at 90^0. Subjects were asked to focus on self-perceived neutral head position, the laser pointer situated at 90^0 to the circular target which was positioned just that the laser pointed on the targets center. The subject was blindfolded and asked to perform slow active neck movements one by one (viz. flexion, extension, Rt. rotation, Lt. Rotation, Rt. Lateral flexion, Lt. Lateral flexion) and then come back after every movement to the resting position. The difference between the starting and resting position was noted in centimeters (absolute error). 3 trials were given for each movement and the examiner manually repositioned the subjects head back to resting position after every trial, average of the 3 trials was noted and then converted into degrees for data analysis.[8, 9]

Fig 1: sitting position for head reposition accuracy test.

Fig 2: Head reposition accuracy test.

DATA ANALYSIS AND RESULTS

The data thus obtained was statistically analysed using software Graph pad prism version 5 for windows 7. Inter group analysis was done using unpaired t test at 5% level of significance.

Table 1: Head repositioning error degree in chronic neck pain group v/s control group

Cervical movements	Head repositioning error (degrees)		Unpaired t test
	CNP group (mean ± sd)	Control group (mean ± sd)	p value
Flexion	5.32 ±2.52	1.47 ±0.78	< 0.0001*
Extension	5.76 ±2.56	2.35 ±0.98	< 0.0001*
Rt. Lat. Flexion	5.40 ±2.47	2.10 ±0.78	< 0.0001*
Lt.Lat. Flexion	5.20 ±2.51	2.12 ±0.95	< 0.0001*
Rt. Rotation	5.22 ±2.43	1.78 ±1.08	< 0.0001*
Lt. Rotation	5.05 ±2.12	1.67 ±0.84	< 0.0001*
CNP: chronic neck pain, sd: standard deviation, Rt: right, Lt: left, *extreemly significant			

DISCUSSION

This study assessed the cervical joint position sense, in subjects with chronic neck pain within the age group of 25-50yrs, and normals which were age and gender matched. The data analysis and the results indicate the presence of deficits in cervical mechanoreceptor function in subjects with chronic neck pain group. The head repositioning error values were significantly greater in chronic neck pain subjects than in normals.

The difference in the HRE values were extremely significant ($p < 0.0001$) for all the neck movements namely flexion, extension, Right Rotation, Left Rotation, Right lateral flexion, Left lateral flexion.

The affection of the cervical mechanoreceptors and altered proprioceptive sense can be attributed to the direct effects of pain: Woolf (1994) suggested that proprioception from muscles may serve as a pain gate that blocks or inhibits nocioceptor transmission into the spinal cord and higher centers of the centeral nervous system.[10,11,12] Large diameter A Beta fibres from proprioceptors and mechanoreceptors synapse on interneurones, which inhibit nocioceptor transmission of the wide dynamic range receptors serving the paleospino-thalamic system in Lamina V of the dorsal horn. This is a potential mechanism whereby deficiency of afferent proprioceptive input may contribute directly to the development of central sensitization, functional impairment, and morphological changes in the cervical muscles as well as the psychological or work related stresses, which may affect cervical somatosensory function via activation of the sympathetic nervous system.

The cervical proprioceptive information provides important somatosensory information influencing postural stability, head orientation and eye movement control.[13, 14, 15] Various mechanisms lead to the dysfunction of the cervical proprioception in turn influencing sensorimotor control. Also the numerous reflex connections between the cervical structures and the vestibular and visual systems imply that the changes in somatosensory information could result in disturbances in reflex activity relating to postural stability and coordinated stability of the head and eye due to chronic neck pain.[16]

CONCLUSION

This study suggests that cervical joint position sense in subjects with chronic neck pain is altered as compared to their age and gender matched normals.

CLINICAL IMPLICATIONS

In subjects with chronic neck pain there is dysfunction of cervical somatosenory input which leads to varied number of symptoms like dizziness, unsteadiness and signs of altered cervical proprioception thus making the sensorimotor control assessment important in subjects with chronic neck pain and including treatment goals directed towards rehabilitation of the sensorimotor control dysfunction.

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