

DETERMINATION OF SIMPLE REACTION TIME IN INDIVIDUALS WITH CERVICAL SPONDYLOSIS

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ABSTRACT

Introduction: Cervical spondylosis is a common degenerative condition of the spine that is on a rise. Owing to the chronic pathology of the condition, the proprioceptive and kinaesthetic receptors are affected. Appropriate and accurate response to various stimuli in the space requires timely reactions. Due to the changes in these receptors, reaction time maybe prolonged in individuals.

Objectives: To determine simple reaction time in individuals with cervical spondylosis and normal. To compare the simple reaction time among the normal and cervical spondylosis subjects.

Material and methods: Design-Experimental study on 50 individuals with cervical spondylosis and 50 normal subjects between the ages of 30-50yrs of age. Materials- A computer software that is the deary liewald reaction time task (Version-3.1, Reliability- 0.94) to measure simple reaction time (SRT). Two practise trails and 20 real time reaction was collected in ms and used for statistical analysis.



Results: There was a significant statistical difference in the mean reaction time between the normal (290.72ms) and cervical spondylosis (486.78ms) individuals using Unpaired t-test ($p < 0.05$).

Conclusion: The study concluded that there is a significant increase in the simple reaction time of cervical spondylosis individuals

KEY WORDS: cervical spondylosis, simple reaction time, deary liewald reaction time tester.

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INTRODUCTION

Cervical spondylosis is a common degenerative condition of the cervical spine in the general population and occurs mostly from the third decade of life. Incidences of cervical spondylosis

amongst the population is on a rise. It affects the vertebral bodies, intervertebral discs of the neck, and may progress into disc herniation, bone spur formation, compression of the spinal cord, or in severe cases cervical spondylitic

myelopathy [1].

Owing to the pathology of this condition, the proprioceptive and kinaesthetic sensibility is also affected due to the changes in the receptors [2]. Our cervical spine is designed to produce a relatively large mobility and bears less weight in general as compared to the other regions of the spine. Our head moves nearly 600 times per hour irrespective to being awake or asleep [3]. The head and neck orientation with respect to space is essential for receiving and perception of the various stimuli that are present in space. Everyday tasks like driving, crossing the streets etc., requires man to respond to such stimuli voluntarily and accurately. Delay in appropriate and quick response can lead to injuries and fatality. Similarly, while playing a sport like tennis, the player requires not just mental alertness but a coordinated work among the systems to produce an accurate motor response. Any delay of response here can lead to the player missing a hit and losing point in the game.

With chronic pathology of the neck the receptors are disrupted and may lead to a delay in the reaction time as reaction time involves both sensory and motor alertness, the factors affecting sensory as well as motor system can affect the reaction time.

Reaction time can be described as the time taken between the application of a stimuli to the time taken to conduct an appropriate and timely response to it. Our reaction requires intact sensory skills, cognitive processing and motor performance.

Past studies on reaction time have been conducted on various sports players and comparing that to normal considering the need of quick responses related to the field. Studies on comparison between the age group, gender and with various other apparatus to record visual or auditory reaction time have been conducted in the past.

A study that was conducted by Ravi Shankar Reddy shows affection of the proprioception in cervical spondylosis individuals directs towards the change in proprioceptive receptors [2].

Another study performed by George D. Rix on cervicocephalic kinaesthetic sensibility in patients with chronic, non-traumatic cervical

pain concluded that head repositioning errors are significant in the population group [4].

These studies directs towards the possible affection of reaction time in cervical spondylosis individuals due to the cascade of pathophysiological changes especially concerning the receptors that takes place with the chronicity of the disease.

Hence, this study was undertaken using a free, easy to computer software that is the dearyliwald reaction time tester to measure simple reaction time where there is one stimuli and one response to find out whether cervical spondylosis impairs simple reaction time of an individual.

MATERIALS AND METHODS

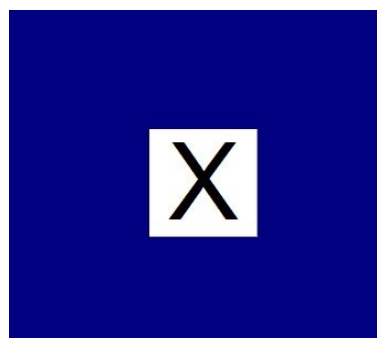
Study design- The experimental study was performed over a period of 1 year in an OPD setup.

Subject selection- 50 individuals with chronic cervical spondylosis and 50 normal individuals were selected and screened based on the following inclusion and exclusion criteria:

Inclusion criteria: 30 to 50 year old individuals, Individuals diagnosed with cervical spondylosis, Individuals with a normal vision with/without spectacle use, Chronic cervical spondylosis, Individuals willing to participate

Exclusion criteria: Recent/ previous injury or trauma to CX spine, Headache, Recent/ previous surgery done to cervical spine, Shoulder pathology, Neurological/ psychological conditions, Vertigo both cervical and vestibular, Undergoing physiotherapy treatment, Any present symptoms of acute pain, Any present symptoms of tingling, numbness or radiating pain.

Fig 1: X is the stimulus that appears on the screen. Participants were asked to press the space bar as a response to the stimuli.



The study was approved by the Institutional Ethical Review Board. Individuals willing to participate filled out consent forms. Instructions were given to explain the aim and nature of the test. 2 practice trails were given before the actual time recorded. The participants performed 20 real time trails.

RESULTS

Table 1: Shows the difference in the mean, standard deviation of time (ms) taken in the two groups.

Groups	Mean	Standard deviation	P value
Cervical spondylosis	486.48	114.97	<0.0001 (assumed <0.05)
Normal	290.72	29.032	

The results of the unpaired t-test shows that there is a significant difference in the mean simple reaction time (ms) between the normal and the cervical spondylosis subjects.

DISCUSSION

The purpose of our study was to determine simple reaction time in individuals with cervical spondylosis and compare that to the normal subjects. 50 cervical spondylosis individuals participated in the study and the time for the 20 trials was recorded. Similarly, 50 normal individuals that participated were given 20 real time tasks and the time was recorded. From the results obtained we can say that there is a significant difference in SRT in individuals with cervical spondylosis from normal p value (<0.05).

This is attributed to decreased motor response to sudden stimuli associated to altered kinesthetic sense and reduced sensory motor processing in cervical spondylosis.

The study performed by Gregory GP in 1998 discussed the common vertebral joint problems, stating the sensory information from mechanoreceptors in the skin, muscles, tendons and the joints plays an important role in the joint stability [5].

Degenerative changes associated with cervical spondylosis results in disturbed motor control eventually leading to decreased cervicocephalic kinesthetic sensibility and reduced reaction or response to sudden, spontaneous stimuli (A study by Arun Maiya G, Ravi Shankar Reddy;

2011) [2]. In addition, the active insufficiency of the muscle may be altered in the length-tension relationship of the muscle that cross the inter-vertebral disc or indirectly affected the sensitivity of the muscle spindles in the deep spindle rich muscles [6].

The contribution of joint receptors to the cervicocephalic kinesthetic sensibility is affected. Although the cervical facet joint capsules contain a significant density and distribution of different mechanoreceptors, the small intrinsic muscles (particularly deep suboccipital muscles) are likely to have a primary role in signalling the cervical proprioceptive information involved in the conscious perception of equilibrium, position, and spatial orientation when vision is occluded [7].

These studies concluded that with the alterations seen in the kinaesthesia and proprioception the head and neck orientation with respect to the trunk maybe altered that in turns leads to interference of the motor control in the individuals. These studies help suggesting the cause of an increased reaction time in cervical spondylosis individuals.

The factors that could have led to an altered or increase in the reaction time during the time of test involves presence of external disturbances like sound, light or presence of pain at the time of study, and importantly mental and physical alertness was cautiously avoided. Future studies following a pre and post physiotherapy rehabilitation programme for a change in reaction time can be performed. Choice reaction time, which involves multiple stimuli and responses, can also be conducted to increase the complexity of the task. In addition, reaction time in other neck pathologies can be performed.

CONCLUSION

The study concludes that there was a significant increase of simple reaction time in individuals with cervical spondylosis as compared to that of normal. This helps us to incorporate an exercise protocol, which includes reaction tasks to improve the mean reaction time in the cervical spondylosis individuals.

Conflicts of interest: None

ABBREVIATIONS

SRT - Simple reaction time

Ms - Milliseconds

CX - Cervical

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