

## Research article

**Comparison of hand eye coordination on individuals with and without cervical radiating pain**Senthil Kumar B.<sup>1</sup>, Subbaiah S.<sup>2</sup>, Arun B.<sup>3</sup>, Jagatheesan Alagesan<sup>4</sup><sup>1</sup>Saveetha College of Physiotherapy, Saveetha Institute of Medical and Technical Sciences and UCA College of Physiotherapy, Chennai, Tamil Nadu, India<sup>2</sup>Department of Orthopaedics, Saveetha Institute of Medical and Technical Sciences, Chennai, Tamil Nadu, India<sup>3</sup>Physiotherapist Grade II, Government District Headquarters Hospital, Erode, Tamil Nadu, India<sup>4</sup>Saveetha College of Physiotherapy, SIMATS, Chennai, Tamil Nadu, India*(Received: June 2021**Revised: January 2022**Accepted: March 2022)*Corresponding author: **Senthil Kumar B.** Email: [senthilkumar79@yahoo.com](mailto:senthilkumar79@yahoo.com)**ABSTRACT**

**Introduction and Aim:** Cervical Radiculopathy involves the compression of nerve roots causing an alteration of neurological functions in the upper limb. Neurological deficits like numbness, muscle weakness and loss of fine movements of the upper limbs were noted. Hand eye coordination is the ability to use motor and visual skills to produce a coordinated movement. The aim of this study is to compare the Hand eye Coordination in patients with Cervical Radiculopathy, nonspecific neck Pain and Normal healthy individuals.

**Materials and Methods:** Ninety participants who volunteered for the study were obtained from the Out Patient Department of UCA College of Physiotherapy, and they were divided into 30 without any neck pain for the past 1 year, 30 with nonspecific neck pain (no radiating pain) and 30 with radiating pain on one side. All were given two tasks on hand eye coordination, a) Balloon tossing test and b) Wall ball toss test. Two trials were given to all the participants and after a rest period they were asked to perform the task for three repetitions, and the mean was taken and noted for analysis.

**Results:** The collected data were analysed using SPSS 21.0. The result of the study shows that there was a significant difference  $P < 0.0001$  in both the test on cervical radiculopathy participants when compared with other two groups.

**Conclusion:** This study concluded that Cervical Radiculopathy has strong influences on hand eye coordination and also strongly stated that there was some difficulty in doing appropriate movements when compared with the normal or nonspecific neck pain counterparts.

**Keywords:** Cervical radiculopathy; hand eye coordination; balloon tossing test; wall ball toss test; nonspecific neck pain.

**INTRODUCTION**

**H**and eye coordination is the ability to do activities which require the simultaneous use of hands and eyes. It is a complex cognitive skill which unites visual and motor skills in the person and allowing the hands to guide by the visual stimulations (1). It is an important skill that adults use in countless activities of daily living. It is a very complex and elusive problem which is complicated by the disrupted presentation of brain (2).

Neck pain is one of the common musculoskeletal conditions with high prevalence which affects the physical, social and psychological aspects of the individual (3). Prevalence of neck pain ranges from 16.7% to 75.1% globally (4). Cervical radiculopathy is an affliction of cervical spinal nerve root, mostly caused by disk herniation or some space occupying lesions like osteophytic changes in cervical vertebra

or tumours (5). Cervical radiculopathy cause referred pain to the level of compression, paraesthesia and numbness (6). Neck pain occurs with poor posture are called as nonspecific neck pain, there is no involvement of the nerves or nerve root. If there is a compression of the nerve root by osteophytes or the disc results in radiating pain called as radiculopathy (7). Cervical Radiculopathy can be a debilitating disease which causes significant impairment. Sustained poor posture with abnormal physiological loads in the neck compromise the pain sensitive structures and thereby alter the function of the cervical spine causing a musculoskeletal imbalance in the upper limbs (8).

Radiculopathy could cause a significant nerve root compression and should be expected to produce weakness in muscles innervated by the nerves. Cervical radiating pain is always not predictable in nature, the pain may be spontaneous and transient (9). Radiating pain may occur due to hypermobility of the

facet joint which lead to ligamentous hypertrophy as well as bony hypertrophy, there may be disc herniations which also cause compression of the nerve roots (10). Radiating pain caused prolonged compression or repetitive stress to the nerves may result in inflammation, fibrosis and demyelination of the nerves. Compressive forces are thought to result in varying degrees of vascular damage which obstruct the venous flow resulting in congestion and oedema which result in arterial ischemia (11). Fibrosis of the nerve may prevent the normal sliding mechanism in the nerves and the demyelination can lead to abnormalities in axonal signalling (12).

Hand eye coordination was generally assessed using various methods, one of the best is balloon tossing method, where the participant tries to bounce a balloon vertically up, back and forth with the affected hand, as long as possible, followed by the normal hand. The second test is wall ball bounce which the participants stood 2M away from a wall and tossed a tennis ball onto the wall in a self-passed manner. The subject had to catch the ball on return with a single hand at first attempt without fumbling (13).

Literatures show that there was a marked alteration in the hand function in subjects with the radiating pain (14). Few studies also show marked reduction of the hand grip about 20%—30% on the painful side when compared with non-painful side (15). Since there was no study which compares the hand eye coordination on Cervical Radiculopathy and also not compared the normal participants, this study hypothesised to compare the hand eye coordination between the normal, nonspecific neck pain and cervical radiculopathy participants.

## **METHODOLOGY**

The study was approved by Institutional Ethical Committee Saveetha Institute of Medical and Technical Sciences, Chennai. Cross sectional study design which involves 90 participants for this study, all the participants were selected by purposive sampling method. Thirty participants without neck pain, 30 participants with nonspecific neck pain and 30 participants with cervical radiculopathy were considered for the present study. It was conducted in the outpatient department, UCA College of Physiotherapy, Chennai. Once the study was ethically approved, recruitment of the participants was done based on selection criteria. This study involved age group of 18-40 years, both gender, 30 participants without any neck pain for the past 1 year, 30 participants with nonspecific neck pain without any radiating symptoms or severe pain, and 30 participants currently complained of neck pain with radiating down to arm and forearm on one hand, participants with neck pain were not more than 6 in the numerical

pain scale, cervical radiating pain participants should have positive test of two out of four tests a) Spurling's test b) Compression test c) Distraction test d) Bakodys sign and no pain not more than 2 years. This study rejects participants with any trauma to neck or any peripheral muscle weakness or with any neurological disorders. All the participants were recruited by a separate researcher who is not part in this study. A clear explanation to the recruited participants about how the study was going to conduct and a written informed consent was obtained from all the participants. The study was conducted for six weeks. The participants once signed the consent they were instructed to do two test balloon tossing task and wall ball toss test. In the beginning two trials were given to the participants to get knowledge about the task for 5 minutes. After completion of the trials 10 minutes break was given to the participants and then asked them to do the task. Three repetitions were done with 5 minutes interval between the repetitions and the mean value of the three repetitions was used for the data analysis. All the statistical analysis was done using SPSS 21.0.

## **RESULTS**

The collected data were analysed using SPSS 21.0. This study analysis with unpaired't' test for all the three groups. The unpaired't' test for Balloon tossing task on comparing normal participants with nonspecific neck pain is 2.53 at p value of 0.014, which shows there is no significant difference between the groups. Although there was a moderate significance on the mean values between these groups, but on statistical analysis it was not well addressed. The unpaired't' test comparing normal participants with cervical radiculopathy is 30.09 at p value of 0.0001, which shows there is a significant difference between the groups. The unpaired't' test comparing nonspecific neck pain participants with cervical radiculopathy is 24.5 at p value of 0.0001, which shows there is a significant difference between the groups. The unpaired't' test for wall ball toss test on comparing normal participants with nonspecific neck pain is 2.50 at p value of 0.015, which shows there is no significant difference between the groups. Although there was a mild variation in the mean values, on statistical analysis shows no marked significance. The unpaired't' test comparing normal participants with cervical radiculopathy is 35.2 at p value of 0.0001, which shows there is a significant difference between the groups. The unpaired't' test comparing nonspecific neck pain participants with cervical radiculopathy is 20.9 at p value of 0.0001, which shows there is a significant difference between the groups. This is shown in Table 1.

**Table 1:** Student's 't' test analysis for balloon tossing test and wall ball toss test

Groups	Mean	Unpaired 't' value	S. D	p value
Normal vs Nonspecific neck pain	38 ± 0.98	2.53	1.27	0.014
	37.2 ± 1.51			
Normal vs Cervical Radiculopathy	38 ± 0.98	30.9	1.36	0.0001
	27.1 ± 1.66			
Nonspecific neck pain vs Cervical Radiculopathy	37.2 ± 1.51	24.5	1.58	0.0001
	27.1 ± 1.66			
Normal vs Nonspecific neck pain	37.7 ± 1.21	2.50	1.27	0.015
	36.5 ± 2.16			
Normal vs Cervical Radiculopathy	37.7 ± 1.21	35.2	1.13	0.0001
	27.4 ± 1.04			
Nonspecific neck pain vs Cervical Radiculopathy	36.5 ± 2.16	20.9	1.70	0.0001
	27.4 ± 1.04			

## DISCUSSION

The purpose of the study is to compare the hand eye coordination on individuals with and without Cervical Radiculopathy. Three groups of participants were involved in this study and consist of normal individuals, individuals with nonspecific neck pain and Cervical Radiculopathy.

Various literatures show that there is a strong relationship exists between the neck and the upper limb muscles, since all the nerve root arises from the cervical vertebra any changes in the normal alignment of the cervical vertebra would cause alteration in the functions of the distal area (14).

Disc protrusion or degeneration in the cervical spine cause nerve root impingement which result in alteration of functional activities in the upper limb (16). Lower cervical nerve root compression results in hand function deterioration. C7, C8 nerve root could cause weakness of muscles of the hand and fingers. There will be a rapid atrophy of the interosseous muscles which cause difficult in gripping activities as well as to make fine motor activities (17).

This study identifies that there was a significant reduction of the hand eye coordination activities in participants with cervical radiculopathy, it was hypothesized that the myotomal involvement can lead to muscle weakness in the upper limb (18) which was difficult for the individuals to do the hand eye coordination activities as like as the other group of participants. These findings also supported by various studies done by multiple researchers on grip strength identifications and pinch grip ect. (19, 20). Few other studies have identified the level of cervical vertebra involvement and compared the weakness of the limbs, as this study didn't do a separate analysis on each level.

This study was also found that the participants with nonspecific neck pain also shows minimal changes in the hand eye coordination still it was not a significant difference obtained when compared with the normal individuals (21). Similar study was done with the shoulder pathology and identified that there were some differences existing in hand eye coordination (22). Few articles states that the neck pain individuals have deconditioning on the upper limb which aids to disability. So, it was clear that there was a strong relationship exists between the neck pathologies and the upper limb disabilities (20).

This study provides a strong insight on the association of the cervical conditions especially the radiculopathy on the hand eye coordination, further study is warranted to identify the role of Physiotherapy management for improving the same. This study has limitations like there is no control of the participants' activity and the length of the neck pain and the level of the neck pain were not well analysed, future directions need to do an extended study on these components. This study also given an insight to the practioners to add upper limb exercises in addition to the neck pain management.

## CONCLUSION

This study concluded that there was a significant change in the hand eye coordination in cervical radiculopathy when compared with the normal or nonspecific neck pain counterparts.

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## CONFLICT OF INTEREST

Authors declare that there is no conflict of interest.

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