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Evaluation of Cervicocephalic Kinesthetic Sensibility in Subjects with Chronic Neck Pain: A Cross – Sectional Study

Dr. Santosh. Metgud[1], MPT, Ph.D, Associate Professor, Head of Department of Orthopedic Manual Therapy, KAHER Institute of Physiotherapy, Belagavi

Apeksha Hungund[2], BPTMPT (OMT) student, KAHER Institute of Physiotherapy, Belagavi

Anand Heggannavar[3], MPT Associate Professor, Department of Orthopedic Manual Therapy, KAHER Institute of Physiotherapy, Belagavi

Correspondence Author: Apeksha Hungund, BPTMPT (OMT) student, KAHER Institute of Physiotherapy, Belagavi

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Abstract

Background: In the modern society neck pain is a major problem, which frequently becomes chronic and/or recurring. According to a systemic review the overall prevalence of neck pain in general population ranged between 0.4% - 86.8%. To determine subject's ability to return their head to a predetermined position without visual cues after they have moved, the cervicocephalic kinesthetic sensibility test has been used.

Methodology: Twenty – nine subjects were screened aged 40 – 60 years. 26 subjects having chronic neck pain were recruited in the study. Neck range of motion and pain was assessed using universal goniometer and visual analog scale (VAS) respectively. Subjects were given Northwick Park neck pain questionnaire for perception of individual concerning pain and ability to manage in everyday life. The subjects were measured for repositioning error by the cervicocephalic kinesthetic sensibility test using beam of light and universal goniometer.

Results: Independent t test showed there is statistical difference in the male and female error with beam of light in case of cervical flexion (p=0.0019). The correlation between error with beam of light with left cervical lateral flexion scores in case of Northwick Park neck pain questionnaire is statistically significant (p=0.0313), But there was no statistical difference in male and female components.

Conclusion: There is no significant difference in cervicocephalic kinesthetic sensibility using beam of light and universal goniometer in subjects with chronic neck pain.

Keywords: chronic neck pain, cervicocephalic kinesthetic sensibility, proprioception.

Introduction

In the modern society neck pain is a major problem, which frequently becomes chronic and/or recurring. [1] The International Association for the Study of Pain defines pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage".[2]

According to a systemic review the overall prevalence of neck pain in general population ranged between 0.4% - 86.8%. The prevalence is higher in women, high – economic countries and urban areas compared with low – and middle – income countries and rural areas.[3] A study reported high (43.4%) one – year prevalence of neck pain

among group C desk job workers at tertiary care hospital in New Delhi. Software professionals in metro cities like Chennai, Hyderabad, Bangalore and Coimbatore reported higher prevalence of work related neck pain.[4]

To determine subject's ability to return their head to a predetermined position without visual cues after they have moved, the cervicocephalic kinesthetic sensibility test has been used.[1] There are limited information available about impaired cervicocephalic kinesthetic sensibility in middle – aged adults, despite the high prevalence of non – traumatic neck pain in middle – aged adults.[5]

There is uncertainty in the pathogenesis of chronic non – traumatic neck pain. There is no significant relationship between the degree of structural pathology and cervical neck pain as reported by several investigators. The proper function of the head – neck system depends on the proprioceptive information provided from receptors in the zygapophyseal joints and small intrinsic muscle has been illustrated. Through the activation of mechanoreceptors and muscle spindle system, proprioception, including joint positioning sense, protects the joint by regulating joint stiffness.[5]

Various studies have been done to evaluate the relation between neck pain and cervicocephalic kinesthetic sensibility.

Cervicocephalic kinesthetic sensibility in patients with chronic, non-traumatic cervical spine pain show little impairment of cervicocephalic kinesthetic sensibility. But results of the study were controversial with studies of chronic cervical pain patients. Also the origin of cervical pain in the study was not focused. [10]

Comparison was done between cervical spondylosis (with radiculopathy) subjects and normal individuals to check the proprioceptive reposition errors in Manipal, India which concluded cervical proprioceptive reposition errors are increased in subjects with cervical spondylosis in comparison with age and gender matched normal subjects.[11]

There are limited information available about impaired cervicocephalic kinesthetic sensibility in middle – aged adults, despite the high prevalence of non – traumatic neck pain in middle – aged adults.

There is a paucity of evidence in Indian population on cervicocephalic kinesthetic sensibility in chronic cervical pain subjects, and hence the need to do this study.

Methodology

The data for the present study was collected from tertiary health care hospital, Belagavi, Karnataka, India. This study was a cross – sectional study. The data was collected for a duration of 3 months. 26 subjects were recruited in this study. The inclusion criteria was subjects with age group of 40 – 60 years having chronic neck pain more than 3 months. Subjects were excluded from the study for any of the following reasons: if the onset of pain was after an episode of trauma or history of any cervical injury, subjects with congenital, malignancy, autoimmune and neurological conditions involving cervical spine and any vestibular impairment demonstrated by vertigo, dizziness, or motor imbalance. The outcome measures used in this study were Visual analog scale (VAS), Range of motion using universal goniometer, Northwick Park neck pain questionnaire and cervicocephalic kinesthetic sensibility using beam of light and goniometer. Ethical clearance was obtained from the Institutional Ethical committee. Subjects were screened based on the inclusion and exclusion criteria prior to their enrollment to the study and Informed consent was taken before considering the subjects into the study. The study protocol was explained to the subjects in their vernacular language. Demographic details of each subjects were recorded. Neck range of motion was assessed using universal goniometer and pain was assessed using visual analogue scale (VAS). Subjects

were given Northwick Park neck pain questionnaire for perception of individual concerning pain and ability to manage in everyday life.

Cervicocephalic kinesthetic sensibility using beam of light

The subjects were asked to sit upright in a chair with a backrest, instructed to face the target straight ahead. Vision was occluded by blind fold. Subjects first hold the head in neutral head position. A beam of light was adjusted on subject's head and the subject were asked to do movements in sagittal, transverse and frontal plane. The head was maintained at target position for 3 second and again asked to held in neutral head position for 3 seconds. Average of 3 readings will be taken in each plane.

Cervicocephalic kinesthetic sensibility using universal goniometer

The subjects were asked to sit upright on a chair with a backrest, vision was occluded by blind fold. A universal goniometer was adjusted on subject's head. Head to neutral head position and head to target repositioning test was measured in degrees. For cervical rotation, subjects were lying on the plinth. Vision was occluded by blind fold. A universal goniometer was adjusted on subject's head. Head to neutral head position and head to target repositioning test was measured in degrees.

Results

Statistical analysis of the present study was done using Statistical Package for the Social Sciences (SPSS) version 21 to verify the results obtained. Independent t test was used for comparison between male and female and Karl Pearson's correlation coefficient method was used to check the correlation between the parameters.

There was no statistical difference in the male and female mean age and body mass index (BMI) scores (p=0.7697, p=0.3274) according to the independent t test.

Acccording to the independent t test, there is a statistical difference in the male and female error with beam of light (p=0.0019) in case of cervical flexion variable in which males have shown more error. (Table 1)

Table 1: Comparison of male and females with mean of Error with beam of light (in cms) scores by independent t test.

Variable	Male (Mean±SD)	Female (Mean±SD)	t-value	p-value
Cervical flexion	17.40±1.53	15.24±1.62	3.4818	0.0019*
Cervical extension	16.43±2.24	15.30±3.39	1.0068	0.3241
Right cervical rotation	17.17±1.49	16.72±1.28	0.8225	0.4189
Left cervical rotation	16.51±2.53	15.67±3.46	0.7087	0.4853
Right cervical lateral flexion	13.93±2.10	12.80±2.17	1.3481	0.1902
Left cervical lateral flexion	13.77±1.92	13.07±2.81	0.7442	0.4640

The correlation between error with beam of light with left cervical lateral flexion scores using Karl Pearson's correlation coefficient method in case of Northwick Park neck pain questionnaire is statistically significant (p=0.0313). (Table 2)

Table 2: Correlation between Northwick park neck pain with other parameters scores by Karl Pearson's correlation coefficient method

Variables	Components	Correlation between Northwick park neck pain with		
		r-value	t-value	p-value
Range of motion (in degrees)	Cervical flexion	0.2900	1.4843	0.1507
	Cervical extension	0.1909	0.9526	0.3503
	Right cervical rotation	0.1339	0.6617	0.5144
	Left cervical rotation	-0.1320	-0.6523	0.5204
	Right cervical lateral flexion	0.0928	0.4567	0.6520
	Left cervical lateral flexion	-0.0609	-0.2989	0.7676
Error with beam of light (in cms)	Cervical flexion	-0.1057	-0.5207	0.6074
	Cervical extension	0.1264	0.6241	0.5385
	Right cervical rotation	-0.2266	-1.1399	0.2656
	Left cervical rotation	0.0221	0.1082	0.9148
	Right cervical lateral flexion	-0.0526	-0.2578	0.7988
	Left cervical lateral flexion	0.4231	2.2878	0.0313*

Correlation between range of motion with error with beam of light score was done using Karl Pearson's correlation coefficient method which suggested that there is partial correlation between cervical flexion and cervical extension (r=0.4132, r=0.4238). There is a strong

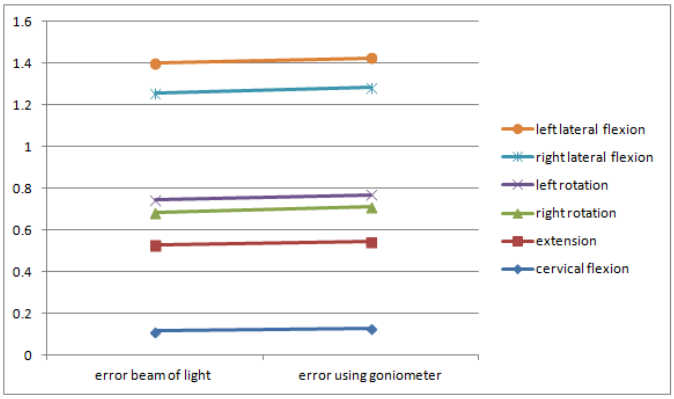
correlation between cervical rotation and lateral flexion (r=-0.6977, r=-0.7586). (Table 3)

Table 3: Correlation between Ranges of motion (in degrees) with Error with beam of light (in cms) scores by Karl Pearson's correlation coefficient method

Range of motion (in degrees)	Error with beam of light (in cms)					
	Cervical flexion	Cervical extension	Right cervical rotation	Left cervical rotation	Right cervical lateral flexion	Left cervical lateral flexion
Cervical flexion	r=0.1147	r=0.4132*	r=0.1563	r=0.0592	r=-0.5133	r=0.1424
Cervical extension	r=0.0140	r=-0.4238*	r=-0.1339	r=-0.6165*	r=0.0625	r=0.1300
Right cervical rotation	r=-0.2024	r=-0.1523	r=0.2151	r=-0.1776	r=-0.4636*	r=0.0799
Left cervical rotation	r=0.0075	r=-0.0924	r=0.5021*	r=-0.3520	r=-0.3217	r=-0.3095
Right cervical lateral flexion	r=-0.1225	r=-0.6102*	r=-0.2804	r=-0.6977*	r=0.2744	r=0.0337
Left cervical lateral flexion	r=-0.3426	r=-0.663*9	r=-0.0633	r=-0.7586*	r=0.0772	r=-0.2293

There was no statistical difference of male and female with mean age, BMI, visual analog score (VAS), range of motion (ROM), Northwick Park neck pain questionnaire.

Graph 1: Comparison between the two methods that is using n=beam of light and universal goniometer.



Discussion

The present study focused on cervicocephalic kinesthetic sensibility in chronic neck pain patients using beam of light and universal goniometer. The subjects were examined for their ability to return the head to a straight ahead position after an active movement away from that point. This method is used in various studies. The result from our study are comparable with a study involving chronic non – traumatic neck pain, we found a statistical difference in head repositioning error. [10]

The method we used to assess cervicocephalic kinesthetic sensibility was similar to a previous study where we asked the subjects to perform a maximum movement they can instead of maximal amplitude head movement and our results were similar to the previous study, the subjects experienced a sharp increase in pain at the end ROM.

The active movement components involved in the repositioning error requires the activation of dorsal and ventral neck muscles at various layers. The muscle spindle significantly contribute to the sense of body position, this study results probably indicate decrease of muscle spindle function as age increases in middle aged adults.[5,12,13]

The procedure involved head in space information from vestibular system and head on trunk proprioceptive information from the cervical spine mechanoreceptors. As no speed guidelines were given amid our testing technique, the likelihood exists we didn't locate any important distinction on the grounds that the active movements were led too quickly.[10]

There was a tendency for the subjects to overshoot the target position, as evidenced by greater positional errors during repositioning from both flexed and extended positions to neutral position. Thus, the overshooting phenomenon in present study indicates decreased proprioceptive afferent inputs.

Our study results are in accordance with C.C Teng *et al* where the repositioning error is greater in cervical flexion in middle – aged subjects.

Conclusion

There is no significant difference in cervicocephalic kinesthetic sensibility in subjects with chronic neck pain using beam of light and universal goniometer.

Limitation and Future scope

In the present study only chronic neck pain subjects were included irrespective of any other underlying pathologies

which could have affected the results. In future studies, different pathological neck pain can be considered and can be assessed and treated for the same.

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