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Original Research Article

THE EFFECT OF WEARING HEADSCARVES ON CERVICAL SPINE PROPRIOCEPTION

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ABSTRACT

Background: Proprioception plays an important role in sensorimotor control of posture and movement. Impairments in cervical proprioception have been demonstrated in subjects with whiplash-associated disorder, patients with age-related degeneration, and patients with articular diseases or spondylosis. The joint position error test is widely used to measure head repositioning accuracy.

Objective: The purpose of this pilot study was to compare cervical spine joint position error in females who routinely wear headscarves to females that do not wear headscarves.

Methods: Twelve females with mean age 27.5±4.0 years were divided into two groups: females who routinely wear headscarves (n=6), and females who never wear headscarves (n=6). Joint position error was measured using a head-mounted laser while subjects were seated. The tasks involved relocating the head to neutral after flexion, extension, right rotation, and left rotation. A total of six trials were done for each direction.

Results: The joint position error was higher in females wearing headscarves compared to females who do not wear them in the cumulative joint position error score (8.2±1.0 vs. 4.4±1.0, p=0.06) as well as during head rotation to the right (9.3±1.6 vs. 3.1±1.6, p=0.06).

Conclusion: Wearing headscarves may increase the cervical joint position error and can negatively impact postural control. However, further studies are needed to confirm this finding.

KEY WORDS: Cervical spine, Proprioception, Joint position error, Headscarves.

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INTRODUCTION

Proprioception plays an important role in sensorimotor control of posture and movement. There is a high density of muscle spindles in the cervical spine muscles serving as primary receptors of proprioception [1]. Moreover, there are higher densities of muscle spindles in the deeper neck muscles and upper cervical spine compared to the lower cervical spine [2]. Injuries to cervical spine soft tissue structures can compromise proprioception and contribute to deficits in head and neck position sense [3]. Impairments in cervical proprioception have been documented in subjects with whiplash-associated disorder (WAD), patients with age-related degeneration, and patients with articular diseases or spondylosis [4].

The joint position error (JPE) test was first introduced by Revel et al., 1991. It is widely used test to measure head repositioning accuracy [3,5,6,7,8]. The error is calculated by measuring the distance between the reference position and reproduced position then converting it to degrees [9]. The JPE has good test-retest and inter-tester reliability [10]. Several studies have reported that there is a greater JPE in patients with WAD compared to healthy controls [3,5,6,7,11].

Owens et al. (2007) measured JPE in healthy volunteers after recent muscle history contraction. Their results showed a significant undershooting after maximum voluntary contraction suggesting a possible mechanism of joint position error. Consequently, this may introduce a clinical measure for paraspinal muscle contribution to cervical pain and dysfunction [12].

A headscarf is operationally defined as a scarf that wraps up over the head and around the neck. Females in Islamic cultures are required to wear this scarf when out in public. Several Islamic countries mandate a dress code for women that involve wearing headscarves, while other countries have banned the wearing of headscarves. However, the majority of the countries around the world make the wearing of headscarves optional for women. According to Pew Research Center, from the one-million Muslim women in the United States, 43% wear headscarves. The influence of headscarves on cervical proprioception has not been determined. Therefore, the purpose of this pilot study was to investigate the impact of wearing headscarves on neck proprioception; and to compare cervical spine JPE in females who routinely wear scarves to females that do not wear scarves.

MATERIALS AND METHODS

Subjects: Twelve females with mean age 27.5± 4.0 years participated in the study. Subjects were divided into two groups. Group 1: six females who routinely wore headscarves; Group 2: six females who never wore headscarves. Subjects were excluded if they have had a recent episode of cervical pain or trauma, had tenderness or muscle spasm, or limited cervical range of motion. Subjects were recruited from Loma Linda University and signed a Loma Linda University Institution Review Board approved informed consent prior to participation.

Procedure: Joint position error was assessed using a head-mounted laser. The starting position for cervical JPE test was in upright sitting 90 centimeters (cm) away from the front of a wall with their feet resting on the floor and back against the back of a chair. Subjects assumed a neutral head position and were required to memorize this position as their perceived neutral position. Subjects were then asked to close their eyes and maximally rotate their head to the left, right, flexion, and extension. Immediately after each direction they were asked to return to their perceived neutral head position while keeping their eyes closed. When subjects indicated that they had returned to their perceived neutral position, the investigator marked the position with a marker. Each task was repeated 6 times. The difference between the beginning and ending position was calculated.

Statistical Analysis: The general characteristics of the subjects were summarized using means and standard deviations. The normality of the variables was examined using Kolmogorov-Smirnov test. The characteristics of subjects in the two groups were compared using an independent t-test or Mann-Whitney U test. The mean joint position error (JPE) was computed using the readings in the six trials in four directions. To control for the effects of age,

analysis of covariance (ANCOVA) was used to assess differences in mean JPE between the two groups. The inter-rater reliability of all the measures taken was examined using Pearson's Correlation. The mean JPE among females while wearing a scarf and when they took it off was compared using Wilcoxon signed rank test. The level of significance was set at ≤ 0.05.

Table 1: Mean (SD) of general characteristics (n=12).

	Scarf (n_1=6)	No Scarf (n_2=6)	p –value[a]
Age (years)[b]	30.7 (2.7)	24.3 (1.9)	0.001
Height (cm)	185.2 (4.1)	164.5 (4.5)	0.07
Weight (Kg)	70.5 (20.0)	60.8 (6.9)	0.39
BMI (kg/m^2)	28.2 (7.6)	22.5 (3.0)	0.12

SD: Standard Deviation; BMI: Body Mass Index
[a]Mann-Whitney U test
[b] Independent t test

RESULTS

Twelve females with a mean age of 27.5±4.0 years participated in the study. The distribution of age, height (cm), weight (kg) and JPE measurements in the different positions was approximately normal (p>0.05). There was no significant difference in mean height (cm), weight (kg) and body mass index (kg/m^2) between the two groups. However, there was a significant difference in mean age between females who wore headscarves and those who did not (30.7±2.7 vs. 24.3±1.9; p=0.001). Refer to Table 1.

Results of the ANCOVA showed that there was a borderline significant difference in mean± standard error (SE) joint position error in cumulative and when moving to the right side between the two groups (8.2± 1.0 vs. 4.4± 1.0, $F_{1,9,0.05}$=4.6;p=0.06), (9.3±1.6 vs. 3.1±1.6, $F_{1,9,0.05}$ =4.9; p=0.06) respectively. However, there was no significant difference in mean JPE when moving towards left, extension and flexion (p>0.05, refer to Table 2). Moreover, there was no significant difference in the mean JPE within females when they wore the scarf and when they took it off (p>0.05).

Table 2: Mean (SE) of Joint Position Error (JPE) in the four directions (n= 12).

	Scarf (n_1=6)	No Scarf (n_2=6)	p –value[a]
Cumulative JPE	8.22(1.01)	4.42(1.01)	0.06
JPE Right	9.27(1.60)	3.12(1.60)	0.06
JPE Left	9.74(2.13)	4.84(2.13)	0.22
JPE Extension	7.22(0.74)	5.36(0.74)	0.19
JPE Flexion	6.64(1.29)	4.35(1.29)	0.34

SE: Standard error of the mean. JPE: Joint Position Error.
[a] Analysis of covariance

DISCUSSION

Joint position error in females who wear headscarves was compared to those who do not wear headscarves. The results indicated that the joint position error was higher in females wearing headscarves compared to females who do not wear them. A borderline significance was found in the cumulative JPE score as well as when moving to right rotation. However, there was no significant difference in mean JPE within females when they wore the headscarf and when they took the headscarf off.

Neck proprioception plays an important role in postural control. Increased JPE has been reported in subjects with WAD [3,5,6,7,11]. Joint position error has also been reported in subjects with neck pain [9,10,13]. Deficits in cervical proprioception as indicated by higher JPE might be a predisposing factor for development of cervical pain and dysfunction [14,15]. In our study, subjects who wore headscarves showed to have higher JPE compared to those who did not wear them when moving their head in all directions (Table 2). Although this increase in JPE had a borderline significance, this difference may contribute to maintenance of joint stability and thus may increase the risk of injury.

Similar to this study, Sterling et al. (2003) [16] reported a significant difference in JPE between subjects with traumatic neck pain compared with healthy control in right rotation only. They concluded that the side of pain might contribute to this discrepancy because the majority of the subjects had bilateral involvement. Although, hand dominance was not considered in their study, they speculated that it might explain their finding [16].

Moreover, Treleaven et al. (2003) [3] demonstrated a significantly higher joint position error in subjects with WAD compared with healthy control in rotation and extension.

Their analysis revealed that WAD subjects with dizziness had significantly higher JPE in right rotation compared to WAD subjects without dizziness. Additionally, Kristjansson et al. (2003) [13] demonstrated a significantly higher joint position error in subjects with neck pain compared to healthy control in rotation.

In this study, subjects who wore headscarves were older than those who did not wear them, and it is well documented that neck proprioception tends to decline with age [17]. Although we statistically controlled for age in our sample, age difference might have an effect on JPE in subjects who wear headscarves. Hence, further studies are warranted to compare JPE in females who wear headscarves compared to age-matched controls.

There is a relationship between range of motion (ROM) and JPE [18]; however, in this study we did not measure ROM, which may contribute to the relocation accuracy. Wearing the headscarves over the neck might hinder full cervical ROM and might be the reason for impaired JPE. Further studies need to include ROM measurements and correlate them with JPE. Additionally, age is considered to be a factor causing a decline in repositioning accuracy; therefore, further studies need to correlate both variables. Also, although subjects performed the JPE test in alternating directions, some biofeedback may have occurred as subjects opened their eyes after relocating their head for each repetition. Future studies should blindfold subjects throughout the entire procedure to minimize potential biofeedback and learning effect as described in a previous study [9,10,11]. Finally, the JPE testing should also be performed in standing to determine the effect of cervical proprioception on postural control between women who wear headscarves and those who do not wear headscarves.

CONCLUSION

The findings of this pilot study suggest that wearing headscarves can potentially influence head repositioning accuracy. Future research is needed to confirm these findings and should include larger sample size, age-matched control, blindfolding to minimize biofeedback and inclusion of JPE with range of motion measurements as well in standing for postural control measurements.

Conflicts of interest: None

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