Original Article

Correlation Between the Simple Reaction Time and Cervical Proprioception in Asymptomatic Young Adults with Forward Head Posture (FHP): A Cross Sectional Study

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Abstract

Background: This study was designed to find the Correlation between the Simple Reaction Time and Cervical Proprioception in asymptomatic young adults with Forward Head Posture (FHP).

Purpose: To find the correlation between the Simple Reaction Time and Cervical Proprioception in asymptomatic young adults with Forward Head Posture (FHP).

Materials and Methods: Materials required for this study were Body markers, Tripod stand, Laptop, ON Protractor mobile application, Headband with laser beam device, Target with concentric circles, Deary-Liewald reaction time software. It was a cross-sectional observational study design. The sampling method used was Purposive sampling. One Sixty subjects with Forward head posture (CVA= $<49^0$) were included in this study. The written informed consent was taken. Informed consent document was signed, retained by the principal investigator and a copy was given to the participant. Deary-Liewald Time task and Cervicocephalic Relocation test was used to study the Simple Reaction Time and Cervical Proprioception respectively. All the data obtained was statistically analysed using proper tests.

Results: The results showed no significant (p value > 0.05) correlation of SRT with Cervical Rotation Proprioception, as the participants in our study were asymptomatic young adults with mean of 22.24±1.783years, had mild FHP and their scores on both the Simple Reaction Time and Cervical Proprioception tests were slightly above the normal range.

Conclusion: Our study concluded that there is no significant correlation of Cervical Proprioception with Simple Reaction Time in Asymptomatic Young Adults with Forward Head Posture.

Key Word: Forward Head Posture (FHP), Simple Reaction Time (SRT), Cervicocephalic Relocation Test (CRT), Craniovertebral Angle (CVA).

Introduction

Posture is defined as a musculoskeletal balance, resulting in minimal amount of stress and strain on the body. Forward head posture (FHP) is one of the most common type of poor head postures in the sagittal plane. Peterson-Kendall et al. defined FHP

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as 'a state in which the external auditory meatus is positioned anterior to the plumb line through the shoulder joint'.[1] Forward head posture (FHP) is commonly referred to as "text neck", "scholar's neck, "wearies neck", "hunch" or "reading neck".[2]It is caused by several factors which includes sleeping with the head elevated too high, extended use of computers, laptops & cell phones, lack of developed back muscle strength and nutritional deficiency such as calcium. Prolonged use of smart phones exposes individuals to cumulative trauma disorder caused by maintaining the same posture for long periods of time.

It is found that there is 73% prevalence of forward head posture in the age group of 18-30 years.[3]Craniovertebral Angle (CVA) is defined as the angle between the line passing through the C7 and the midpoint of the ear tragus with the horizontal line.[4] A young healthy adult exhibits an average Craniovertebral angle (CVA) within a 10° range from 49° to 59°. Therefore, subjects encountering angles less than 49° are considered as FHP.[5] FHP can be classified into: • mild CVA = 46.9-49.1 and • moderate to severe CVA = 40.7-43.2.[6] In FHP, the lower cervical spine goes into hyper flexion with the lordosis curve flattening out and the upper cervical spine goes into hyperextension with the lordosis curve becoming more pronounced. This causes the anterior shearing forces to increase than normal causing muscular imbalance, joint cervical position sense dysfunction and sensorimotor disturbance. As the head is held further forward the spinal canal lengthens through the neck, leading to an increased stretching and tension on the spinal cord and adjacent nerve roots. Common muscles that elongate and weaken due to forward head posture include: • Deep cervical flexors: such as longuscapitus and longuscolli, Erector spinae, middle trapezius and rhomboid muscles. Common muscles that shorten and tighten due to long-term forward head posture include •Sub occipital muscles, Levator scapulae muscle. The cervical spine plays a important role in providing proprioceptive input, which is evident through the abundance of cervical mechanoreceptors and their central and reflex connections to the vestibular, visual and central nervous systems.[7] It is known that altered sagittal cervical spine alignment potentially lead to altered sensorimotor integration through a modified afferent input from altered cervical spine kinematics.[5] Cervical proprioception plays a significant role in maintaining head on body stabilization, and there has been observed a close relationship between anatomical structures of the cervical spine in maintenance of this position sense and interaction with CNS. 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. Delay in appropriate and quick response can lead to injuries and fatality.[8]

AIM

To correlate the Simple Reaction Time and Cervical Proprioception in asymptomatic young adults with Forward Head Posture.

Material and Method

Materials required for this study were Body markers, Tripod stand, Laptop, ON Protractor mobile application, Headband with laser beam device, Target with concentric circles, Deary-Liewald reaction time software.It was a cross sectional observational study conducted on 160 subjects with Forward head postureUpper Trapezius Trigger Point, age between 18-30 years,was taken from Out patients department tertiary hospital and care centre. The method used in this study for sampling was Purposive sampling.

Inclusion criteria:

- Young adults: 18-30 years[3]
- Forward head posture (CVA= $<49^0$)[5]
- Both gender
- Normal corrected vision

Exclusion criteria:

History of any Musculoskeletal, Neurological and Cardiopulmonary conditions

- Cervical spine instability
- Trauma to cervical spine
- Cervical spine surgery
- Congenital spinal deformities
- Patients with impaired cognition
- Vertigo

- Impaired vision
- Individuals with neck pain

Outcome measures:

1. **Deary-Liewald Time Task:**

This software was designed by IJD and programmed by DL The software is used to assess the Simple Reaction time and Choice Reaction time. The programme is designed to run on all laptop and desktop computers and requires no special software. Participants are seated comfortably on a chair with a backrest in front of a laptop with the screen at—or slightly below—eye level, at least 20 inches (51 cm) from your eyes—about an arm's length distance. One white square is positioned in the centre of a laptop screen, set against a blue background which is shown to the participant. The stimulus refers to the appearance of a diagonal cross within the square. Each time a cross appears, participant responds by pressing a key with the index /middle finger with their preferred hand as quickly as possible after which it disappears and another cross appears shortly after. Twenty trials are performed. The Deary-Liewald reaction time task is a reliable and valid method for obtaining measurements. There are also instructions for downloading and using the new reaction time programme, and they encourage other researchers to use it. Its reliability is observed to be 0.94.[9]

Figure 1: Simple Reaction Time Task

2. **Cervicocephalic Relocation Test:**

Cervicocephalic relocation test (CRT) to the neutral head position (NHP),'' originally described by Revel, Andre´- Deshays, and Minguet (1991). Participants were blindfolded and had to sit as far back in the chair as possible with their arms hanging by their sides, keep the shoulders against the backrest, and place the rear of their heels on the floor facing a white, plain wall 90 cm apart, with their heads in a neutral position, a laser pointer was attached to the head and a button was given to the subject to turn the laser light on/off when necessary. Once the neutral head position was achieved and memorized, the subjects pressed the hand held button so that the laser light turned on and the mark left on the wall could be recorded. Then after actively rotating the head on the horizontal axis to both right and left sides in the comfortable end range of movement, the participants relocated their heads on the trunk to the beginning neutral position that they had memorized. After each relocation, the subject pressed the button once more. No feedbacks were given during the procedure. Six trials were carried out for each right and left head rotation.[4,10] If the mean value was higher than a threshold value of 7.1 cm or 4.5 degrees, the subject were considered as inaccurate. Target used to determine laser values (in degrees) of JPE based on the formula: Angle = tan -1 [error distance] [90 cm] its reliability is observed to be 0.81.[10]

Procedure

Approval from the Ethics Committee and MUHS was sought. Subjects were screened according to inclusion and exclusion criteria and only those eligible were included in the study (n=160). Asymptomatic young adults with forward head posture (CVA = $<49^0$). and age group of 18-30years were selected. Cervical proprioception and Simple Reaction time was recorded for each participant. The written informed consent was taken. Informed consent document was signed, retained by the principal investigator and a copy was given to the participant. Each participant participated in a single testing session and was given an information sheet to know the details of the study. The entire procedure was orally explained to the participant. Simple Reaction timeusing Deary-Liewald Time Task and Cervical proprioception using Cervicocephalic Relocation Test was recorded for each participant. The entire procedure took approximately 25-30 minutes. The Simple Reaction Time using Deary –Liewald time task was correlated with the Cervical Proprioception using Cervicocephalic Relocation Test scores. Data was analysed using Shapiro-wilk test. As data was not normally distributed, Spearman's correlation coefficient was used for correlation analysis of cervical rotation of left and right side with SRT.

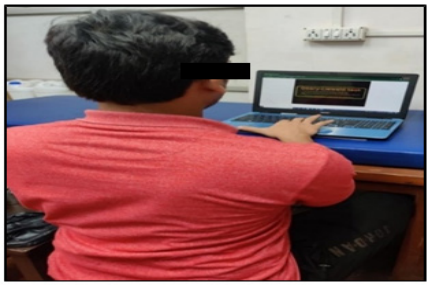

Figure 2: Participant performing SRT

Figure 3: Participant performing CRT

Data Analysis

- Data was analyse dusing Graph Pad Prism (Version9.4.0)

Table 1: Test for Normality

Test for Normality distribution	SHAPIRO-WILKTEST		
W	0.8772	0.9727	0.9869
P value	<0.0001	0.0029	0.1408
Passed normality Test (alpha=0.05)?	No	No	Yes
P value summary	****	**	Ns
Number of values	160	160	160

Table 2: Correlation analysis of simple reaction time with right cervicalrotation joint position sense

	S pearmanr
	SRT with Right side
R	0.1192
95% confidence interval	-0.04122 to 0.2737
P value	
P(two-tailed)	0.1332
P value summary	Ns
Exact or approximate P value?	Approximate
Significant?(alpha=0.05)	No
Number of XY Pairs	160

Table 3: Correlation analysis of simple reaction time with left cervical proprioception

	Spearmanr
	SRT with left side
R	0.06212
95% confidence interval	-0.09853 to 0.2196
P value	
P (two-tailed)	0.4352
P value summary	Ns
Exactor approximate P value?	Approximate
Significant? (alpha=0.05)	No
Number of XY Pairs	160

Result

- **Table 1,** shows, Shapiro-Wilk test for the normality of data with results.
- The data was tested for normality using Shapiro-wilk test considering the sample size (N=160). Simple Reaction Time and right side cervical rotation proprioception data did not pass the normality test while the left side cervical rotation proprioception data passed the normality test.
- Therefore, correlation was measured using non-parametric test, i.e., Spearman's correlation coefficient to find the relationship of Simple Reaction Time with right Cervical proprioception scores and Simple Reaction Time with left cervical proprioception scores.
- **Table 2:** Correlation of SRT with Right cervical rotation proprioception showing Spearman's correlation coefficient on the data, **(r=0.1192, N=160)** the results were found to be not significant **(p value>0.05).**
- This indicates that the rewash no correlation between SRT with Right cervical rotation proprioception.
- **Table 3:** Correlation of SRT with Left cervical rotation proprioception showing Spearman's correlation coefficient on the data, **(r=0.06212, N=160)** the results were found to be not significant **(p value>0.05).**
- This indicates that there was no correlation between SRT with Left cervical rotation proprioception.

Discussion

The prevalence of FHP is 73 percent amongst students, which may be a result of their habit of studying with their necks flexed, or from using laptops and cell phones more frequently, or from adopting specific positions or adopting improper posture for an extended period of time, which may result in muscular imbalance and be one of the causes of forward head posture.[3] Numerous research have shown that FHP can cause various abnormalities such as my of a scialtrigger points, cervicogenic headaches, neck pain, and are duction in lung capacity. Asa result, it's critical for the rapists to conduct a valid evaluation of FHP in order to gauge the effectiveness of the irtherapeutic interventions.[6]

This study was conducted on 160 asymptomatic young adults with forward head posture measuring CVA = $<49^0$ between the age of 18 to 30 years with a meanage of 22.24±1.783 Years. Participants in our study were screened for FHP by measuring Craniovertebral ANGLE using on protractor mobile application for assessing Forward head posture ICC=0.81[11]

Forward head posture can be classified based on the CVA scores as:

Slight FHP = 48.7±2.5

Moderate to severe FHP =41.9±3.9.[6]

In our study the Mean CVA score was 46.49±2.759 which corresponds to slight FHP with mean of 48.7±2.5, as the participants were asymptomatic and young (mean=22.24 years).

In their study, Zahra Salahzadeh et al. found that the Craniovertebral angle method is widely used to assess forward head posture (FHP) and involves evaluating the position of the head in relation to the seventh cervical vertebrae.

CORRELATION OFSRT WITH CERVICAL ROTATION PROPRIOCEPTION OF RIGHT AND LEFT SIDE:

The objective of our study was to find the relationship between Simple Reaction Time and Cervical Rotation Proprioception in Asymptomatic Young Adults with Forward Head Posture. The results showed no significant correlation of SRT with Cervical Rotation Proprioception for right and left side, as the participants in our study were asymptomatic young adults with mean of 22.24±1.783 years, had mild FHP and slightly higher Cervical Proprioception and Simple Reaction Time than normal.

It suggests that FHP along with degenerative changes due to aging or any musculoskeletal condition such as cervical spondylos is; trauma can be a risk factor affecting Cervical Proprioception and Simple Reaction Time.

In a study, Piotr Kocur et al. discovered that Age was negatively correlated with CVA values, which indicates a more anteriorly positioned head i.e., severity of FHP increases with age. Additionally, between the third and ninth decade of life, the SCM and UT muscles lose 1.5 percent of their elasticity each year and become stiffer.[12] numerous factors relating to the composition and operation of the connective tissue influence myotonometric assessments of the biomechanical characteristics of muscle. This tissue develops the deep and superficial fascial layer that envelops and penetrates muscle tissue. In reaction to external pressures, my of ascialt issue's structure and morphologyalter continuously and dynamically. Extracellular matrix morphology, or the amount of collagen and elastin 42, and especially collagen cross-linking 43, is known to have an impact on stiffness and elasticity. Therefore, we assume that the infiltration and degeneration of muscle connective tissue is the most likely

Cause of an increase in stiffness and loss inelasticity. The quantity of non-twitching connective or adipose tissue in skin and myofascial tissues rises with age, which affects both faster rates of ageing and higher rates of pain.

Conclusion

Our study concluded that there is no significant correlation of Cervical Proprioception with Simple Reaction Time in Asymptomatic Young Adults with Forward Head Posture.

Limitations

This study was conducted in a tertiary care hospital i.e., it was a unicentric study. Therefore, the results cannot be generalized to a larger population.

Ethical Clearance: Institutional ethical Committee, TNMC & BYL Nair College, Mumbai.

Conflict of Interest: Nil

Source of Funding: Self

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