VIMS Journal of Physical Therapy

[ORIGINAL ARTICLE]

Effect of Chin Tuck Exercise with Pectoralis Muscles Stretching Exercise Versus Chin Tuck Exercise with Scapular Retraction Strengthening Exercise on Cranio-Vertebral Angle, Shoulder Angle and Active Cervical Rom in Young Adult Patients in Text Neck Syndrome: A Randomized Clinical Trial

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Background: Text Neck Syndrome refers to repetitive stress injury, which occurs when an individual's head is hung forward while looking at a mobile device for a longer period of time. The most common symptoms of this syndrome are forward head posture, forward shoulder posture, and reduced active cervical ranges of motion.

Aim: To find the effect of chin tuck exercise with pectoralis muscles stretching exercise versus chin tuck exercise with scapular retraction strengthening exercise on cranio-vertebral angle, shoulder angle, and active cervical ROM in young adult patients in text neck syndrome.

Method: The study was conducted at the College of Physiotherapy, Wanless Hospital, and Miraj Medical Centre. It was a cross-over study conducted on college-going students using a simple random sampling method. Participants (n=48) who fulfilled inclusion criteria were included and were divided into two groups. The duration of the study was 6 months. Participants were assessed using SAS-SV for pre-assessment, a smartphone protractor application, and a Goniometer for both pre-and post-assessment. The participants in group A were given pectoralis muscle stretching exercises, and participants in group B were given scapular retraction strengthening exercises, including chin tuck exercises, for over 4 weeks. After this, the outcome measures, such as CVA, SA, and Active Cervical ROM, were assessed again.

Result: Statistical analysis was done using unpaired t-tests between the groups and paired t-tests among the groups. The within-group analysis of pre-and post-treatment measurement of the techniques showed clinical and statistical significance, whereas the between-group analysis showed no significant difference.

Conclusion: It can be concluded that chin tuck exercise with scapular retraction strengthening exercise is more effective than chin tuck exercise with pectoralis muscles stretching exercise in treating text neck syndrome.

Keywords: *text neck syndrome, CVA, SA, SAS-SV, ROM.*

Introduction

Text Neck is a term used to describe overuse and a repetitive stress injury caused by slumping your head forward and down when using a mobile electronic device for lengthy periods (US chiropractor Dr. Dean L. Fishman). According to studies, 79% of people between 18 and 44 spend 22 hours daily using their cell phones. About 40% of smartphone users fall within the 18 to 25 age range. According to the research, people put unnecessary stress on their spines, between 700 and 1,400 hours a year. The body's head, neck, and shoulders might suffer due to poor posture.[1]

The forward head posture appears as though the head is protruding out due to the continual forward head movement in a position where the ears are in front of the shoulder. As a result, muscles like the levator, rhomboid, trapezius, and pectoral lengthen and shorten. FHP is the structural modification of the head's alignment away from the body's centerline. Because of the structure, the cervical vertebrae's position changes, with the higher vertebrae extending and the lower vertebrae bending, increasing the head's weight over the neck. Due to

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this bending motion places additional strain on the muscles and joints surrounding the cervical vertebra. The upper cervical vertebrae extend forward with the facet facing upward due to the extension of the upper cervical joint and atlanto-occipital joint, correcting the postural deformity that alters the neck's curvature. This shift in curvature results in an imbalanced muscle pattern, the upper-cross syndrome, and finally, rounded shoulders.[3]

The prevalence of Text Neck Syndrome is 32% in young adults (18-25 years of age group). [4]

According to a previous study, 91% of people have flexed necks. In comparison to women, men were likely to have protracted shoulders. [5]

Previous studies show that subjects with a Cranial-vertebral angle (CVA) of less than 50 would be considered as having a forward head posture (FHP). CVA is a virtual line drawn between the midpoint of the tragus to the C7 spinous process and a horizontal line through the spinous process of the C7 vertebrae. [12]

According to the previous study, a shoulder angle (SA) of more than 52 indicated forward shoulder posture (FSP). SA is formed between the vertical line connecting the C7 marker and the acromion process marker. [13]

According to the previous study on co-morbid factors associated with Text Neck Syndrome among mobile phone users, 100% showed forward head posture. The study also proved that cervical ROM is more restricted than normal. [2]

The symptoms following Text Neck Syndrome are Forward Head Posture (FHP), Forward Shoulder Posture (FSP), and Restricted Cervical joint ROM (Flexion, extension, lateral Flexion of both sides). [2,3,5]

Technique information

Chin tuck exercise

Chin tuck is the most commonly prescribed exercise for correcting FHP and recruiting deep cervical flexors. [3]

It is a static exercise that increases the strength of cervical extensors and flexibility of cervical flexors and can increase the size of the muscle fibers to improve deep anterior neck muscle force and torque. [6]

Pectoralis Muscles Stretching Exercise

The stretching group performed muscular extension for both stretching the pectoralis major and the pectoralis minor. Self-stretching of the pectoralis muscles was effective in reducing FSP. [7]

Scapular retraction

Strengthening exercise

Retraction exercise that selectively strengthens the rhomboid and lower trapezius muscles may be appropriate for patients with forward scapular posture. [7]

The treatment consists of strengthening the posterior shoulder muscles (the middle trapezius, the lower trapezius, the rhomboids, and the serratus anterior). [7,13]

The study's main purpose is to treat text neck syndrome, which requires a specifically focused approach that can be done using techniques like chin tuck exercise, pectoralis muscles stretching exercise, and scapular retraction strengthening exercise. However, the effect of both these approaches has not been studied on text neck syndrome in the past. Establishing this evidence will help to structure a more targeted exercise program in subjects with text neck syndrome. Hence, this study is taken up to investigate the effect of chin tuck exercise with pectoralis muscles stretching exercise versus chin tuck exercise with scapular retraction strengthening exercise on cranio-vertebral angle, shoulder angle, and active cervical ROM in young adult patients in text neck syndrome to facilitate in choosing a better treatment option and hasten the functional recovery.

Methodology

The study was conducted at the College of Physiotherapy, Wanless Hospital, and Miraj Medical Centre. It was a cross-over study conducted on patients with text neck syndrome using a simple random sampling method. Forty-eight patients were included in the study. Both young adult male and female subjects diagnosed with text neck syndrome with Smartphone usage assessed on SAS-SV: >30 who had forward head posture (CVA less than 50 Degrees is FHP) and forward shoulder posture

(Shoulder angle more than more than 52 Degrees indicates FSP) with reduced active cervical ROM were included in the study. Subjects with a history of previous neck and upper limb surgery, neurological disorders-Neurogenic Headache, cervical trauma, malignancy, recent upper limb fracture and dislocations (less than 3 months), Migraine, Meningitis, Cervicogenic Headache were excluded from the study. Ethical clearance from the College of Physiotherapy, Wanless Hospital, Miraj, was taken. After getting informed consent from the patients, all the selected subjects underwent a pre-treatment assessment for Smartphone addiction, CVA, SA, and Active cervical ROM using SAS-SV, Smartphone protractor application, and goniometer. The subjects were randomly divided into two groups. Group A was given a chin tuck exercise 10 times with 10 seconds hold and 10 seconds break (Fig 1) along with pectoralis muscles stretching exercise for 3 movements in one set with a hold for 30 seconds; 6 sets were performed (Fig 2). Group B was given a chin tuck exercise 10 times with 10 seconds hold and 10 seconds break (Fig 1) along with a scapular retraction strengthening exercise for 10 movements, one set with 2 minutes rest; a total of 2 sets was performed (Fig 3). Finally, the comparison was made on which technique is more beneficial and effective. The study was conducted for 6 months, during which the outcome measure was a smartphone protractor application and a goniometer.

Fig 1: Chin tuck exercise

Fig 2: Pectoralis muscles stretching exercise

Fig 3 : Scapular retraction strengthening exercise

Statistical Analysis

Data analysis was done using unpaired t-tests between the groups and paired t-tests between the groups. For each study group, two-time points were used: intervention and post-intervention after 4 weeks. An unpaired t-test was used to compare the effect of both treatment protocols.

Result

A total of 48 subjects with text neck syndrome were involved in the study, including 14 males and 34 females. Patients involved in the study were divided into two groups. They went through treatment techniques like chin tuck exercise with pectoralis muscles stretching exercise and chin tuck with scapular retraction strengthening exercise in the treatment of text neck syndrome.

Table No. 1 Normality test using the Shapiro-Wilk test

The data set is not normally distributed as all the variables have not indicated a p-value of more than

5% in the observation. In the following sections, the researcher shall use non-parametric tests for data analysis purposes.

Variable	Time frame	Group A		Group B	
		z-value	p-value	z-value	p-value
CVA	Pre	0.830	0.001	0.811	0.001
	Post	0.942	0.183	0.939	0.156
SA	Pre	0.864	0.004	0.766	0.000
	Post	0.890	0.014	0.935	0.124
Flex	Pre	0.843	0.002	0.924	0.072
	Post	0.933	0.112	0.708	0.001
Ext	Pre	0.955	0.353	0.901	0.023
	Post	0.883	0.009	0.888	0.012
Lat Flex Rt	Pre	0.956	0.363	0.895	0.017
	Post	0.864	0.004	0.866	0.004
Lat Flex Lt	Pre	0.945	0.214	0.914	0.044
	Post	0.826	0.001	0.888	0.012

Table No.2 : Gender Distribution

Particular		Group		Total
		Grp-A	Grp-B	
Gender	Male	7	7	14
	Female	17	17	34
Total		24	24	48

Table No. 3 : Independent sample test
Comparison of Groups with Mann Whitney Independent samples test

Variable	Group	Mean	SD	z-value	p-value
Age	Grp A	22.38	1.53	0.961	0.337
	Grp B	21.96	1.43		
Height	Grp A	37.58	5.97	1.212	0.226
	Grp B	39.00	5.32		

Graph 1:

Within group Pre and Post-test for CVA

The mean values in groups A and B indicated changes post-treatment, and higher values are recorded for post-treatment outcomes. Also, the standard deviation shows consistency with the post-treatment value, which is less than the value. The effect size or Cohen's D for group A indicates a 1.90 value, and for group B, it indicates a 2.03 value, which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at a 5% significance level, there is a significant statistically reliable difference between the pre & post treatment values with a p-value less than the 5% significance level (i.e., $0.001 < 0.05$) in the study, and, therefore it justifies the improvements in health outcome post-intervention.

Table No. 4 : Comparison of pre-test and post-test scores of CVA in two Groups by Wilcoxon paired sample test

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Grp-A	Pre	45.92	3.20	7.25	3.81	1.90	4.295	0.001*
	Post	53.17	1.74					
Grp-B	Pre	47.29	1.90	7.29	3.59	2.03	4.294	0.001*
	Post	54.58	2.65					

Within group Pre and Post-test for SA

The mean values in groups A and B indicated treatment changes, and lower values were recorded for post-treatment outcomes. Also, the standard deviation shows limited consistency with the post-treatment value, which is more than the value. The effect size or Cohen's D for group A indicates a 1.77 value, and for group B indicates a 1.88 value, which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at a 5% significance level, there is a significant statistically reliable difference between the pre & post treatment values with a p-value less than the 5% significance level (i.e., 0.001 < 0.05) in the study, and, therefore it justifies the improvements in health outcome post-intervention.

Table No.5 : Comparison of pre-test and post-test scores of SA in two Groups by Wilcoxon paired sample test

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Grp-A	Pre	54.63	1.44	6.08	3.44	1.77	4.292	0.001*
	Post	48.54	3.02					
Grp-B	Pre	54.54	1.82	9.96	5.30	1.88	4.289	0.001*
	Post	44.58	4.32					

Within group Pre and Post-test Flexion

The mean values in group A and group B indicated changes post-treatment, and higher values are recorded for post-treatment outcomes. Also, the standard deviation shows consistency with the post-treatment value, which is less than the value. The effect size or Cohen's D for Group A indicates a 2.71 value, and for Group B indicates a 3.34 value, which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at a 5% significance level, there is a significant statistically reliable difference between the pre & post treatment values with a p-value less than the 5% significance level (i.e., 0.001 < 0.05) in the study, and, therefore it justifies the improvements in health outcome post-intervention.

Table No.6: Comparison of pre-test and post-test scores of Flexion in two Groups by Wilcoxon paired sample test

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Grp-A	Pre	36.83	4.40	10.67	3.93	2.71	4.291	0.001*
	Post	47.50	1.56					
Grp-B	Pre	36.96	3.86	12.42	3.72	3.34	4.295	0.001*
	Post	49.38	0.82					

Within group Pre and Post-test for Extension

The mean values in group A and group B indicated changes post-treatment, and higher values are recorded for post-treatment outcomes. Also, the standard deviation shows consistency with the post-treatment value, which is less than the value. The

effect size or Cohen's D for Group A indicates a 5.51 value, and for Group B indicates a 4.22 value, which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at a 5% significance level, there is a significant statistically reliable difference between the pre & post treatment values with a p-value less than the 5% significance level (i.e., 0.001 < 0.05) in the study, and, therefore it justifies the improvements in health outcome post-intervention.

Table No.7 : Comparison of pre-test and post-test scores of Ext in two Groups by Wilcoxon paired sample test

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Grp-A	Pre	37.08	5.10	28.88	5.24	5.51	4.29	0.001*
	Post	65.96	4.76					
Grp-B	Pre	36.63	4.51	32.96	7.82	4.22	4.287	0.001*
	Post	69.58	5.52					

Within group Pre and Post-test for Lateral Flexion Rt

The mean values in Group A and Group B indicated changes in treatment, and higher values were recorded for post-treatment outcomes. Also, the standard deviation shows consistency with the post-treatment value, which is less than the value. The effect size or Cohen's D for Group A indicates a 3.00 value, and for Group B, it indicates a 1.91 value, which is assumed to be very high in effect size per the standard reference parameters. Based on the results of the test analysis at a 5% significance level, there is a significant statistically reliable difference between the pre & post treatment values with a p-value less than the 5% significance level (i.e., 0.001 < 0.05) in the study, and, therefore it justifies the improvements in health outcome post-intervention.

Table No.8 : Comparison of pre-test and post-test scores of Lat Flex Rt in two Groups by Wilcoxon paired sample test

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Grp-A	Pre	28.79	5.93	18.13	6.05	3.00	4.291	0.001*
	Post	46.92	1.74					
Grp-B	Pre	35.58	5.95	12.21	6.38	1.91	4.289	0.001*
	Post	47.79	1.89					

Within group Pre and Post-test for Lateral Flexion, Lt

The mean values in Group A and Group B indicated changes post-treatment, and higher values were recorded for the post-treatment outcome. Also, the standard deviation shows consistency with the post-treatment value, which is less than the pre-value.

The effect size or Cohen's D for Group A indicates a 2.89 value, and for Group B indicates a 2.12 value, which is assumed to be very high in effect size per the standard reference parameters. Based on the results of the test analysis at a 5% significance level, there is a significant statistically reliable difference between the pre & post treatment values with a p-value less than the 5% significance level (i.e., 0.001 < 0.05) in the study, and, therefore it justifies the improvements in health outcome post-intervention.

Table No.9 : Comparison of pre-test and post-test scores of Lat Flex Lt in two Groups by Wilcoxon paired sample test

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Grp-A	Pre	28.88	6.42	18.13	6.26	2.89	4.289	0.001*
	Post	47.00	1.98					
Grp-B	Pre	34.46	5.96	13.79	6.49	2.12	4.292	0.001*
	Post	48.25	1.59					

Table No. 10 : Between groups independent test for Group Statistics using Mann Whitney independent samples test

From the above table it is observed that between groups analysis is not significant for CVA, SA and Active cervical ranges of motion pre time frame as the p-value is more than 5%. It shows non-significant differences between the groups. Whereas, it is significant for post time frame at 5% level significance as the p-value is less than 5%. It shows significant differences between the groups.

Variable	Time	Group	Mean	SD	z-value	p-value
CVA	Pre	Grp-A	45.92	3.20	1.734	0.083
		Grp-B	47.29	1.90		
	Post	Grp-A	53.17	1.74	1.740	0.082
		Grp-B	54.58	2.65		
SA	Pre	Grp-A	54.63	1.44	0.611	0.541
		Grp-B	54.54	1.82		
	Post	Grp-A	48.54	3.02	3.211	0.001
		Grp-B	44.58	4.32		
Flex	Pre	Grp-A	36.83	4.40	0.210	0.833
		Grp-B	36.96	3.86		
	Post	Grp-A	47.50	1.56	4.202	0.001
		Grp-B	49.38	0.82		
Ext	Pre	Grp-A	37.08	5.10	0.280	0.779
		Grp-B	36.63	4.51		
	Post	Grp-A	65.96	4.76	2.116	0.034
		Grp-B	69.58	5.52		
Lat Flex Rt	Pre	Grp-A	28.79	5.93	3.431	0.001
		Grp-B	35.58	5.95		
	Post	Grp-A	46.92	1.74	1.599	0.110
		Grp-B	47.79	1.89		
Lat Flex Lt	Pre	Grp-A	28.88	6.42	2.892	0.004
		Grp-B	34.46	5.96		
	Post	Grp-A	47.00	1.98	2.204	0.028
		Grp-B	48.25	1.59		

Discussion

The present study was conducted to find the effect of Chin Tuck Exercise with Pectoralis Muscles Stretching Exercise versus Chin Tuck Exercise with Scapular Retraction Strengthening Exercise in Text Neck Syndrome and compare its effects to fulfill the aim of the study. Forty-eight participants with forward head posture, forward shoulder posture, and decreased active cervical ROM were involved in this study, including 14 females and 34 males. Subjects involved in this study were divided into two groups. Group A- Chin tuck exercise with pectoralis muscles stretching exercise and Group B- Chin tuck exercise with scapular retraction strengthening exercise.

According to the smartphone protractor application and goniometry, there was a significant clinical difference in pre- and post-value of both the treatment techniques, improving cranio-vertebral angle, shoulder angle, and active cervical ranges of motion. Whereas, the results also showed that Chin Tuck Exercise with Scapular Retraction Strengthening Exercise is more effective than Chin Tuck Exercise with Pectoralis Muscle Stretching Exercise in improving Text Neck Syndrome.

This is relevant to the previous study done by M Anbupriya Sureshbabu et al. (December 2021) on the immediate effect of chin tuck exercises on a cranio-vertebral angle and shoulder angle among collegiates with forward head posture suggested that it corrects the FHP by altering the CV angle and not the rounded shoulders by increasing the CVA but has no effect in

Forward shoulder angle among subjects with FHP. Hence, exercise programs concentrating on CVA and SA could yield a better outcome. [3]

Won-Gyu Yoo (Jan 2018) conducted a study comparing the effects of pectoralis muscles stretching exercise and scapular retraction strengthening exercise on the forward shoulder; the forward shoulder posture of the group of the scapular retraction exercise was significantly decreased when compared to that of the group of the pectoralis muscles stretching ($p<0.05$).[7]

The study was done by Muhammad Nazim Farooq et al. (2016) on the reliability of the universal goniometer for assessing active cervical ROM in asymptomatic healthy persons. To determine within-rater and between-rater reliability of the universal goniometer (UG) for measuring active CROM in asymptomatic healthy subjects. It concluded that UG is a reliable tool for assessing ACROM in a clinical setting for healthy subjects.[9]

According to the study conducted by Jinal A. Mamania et al. (August 2017) on Validity and Reliability of 'ON PROTRACTOR' Smartphone Application for measurement of cranio-vertebral and cranio-horizontal Angle and to compare the joint angles measured and to investigate and set the inter-rater validity and reliability using 'ON Protractor mobile application' with joint angles measured using 'AutoCAD' software. It concluded that the smartphone mobile application ON Protractor is reliable for measuring cranio-vertebral and cranio-horizontal angles.[10]

The study was done by Aleksandra Nikiloc et al. (January 2022) on the validity and reliability of the Serbian Version of the Smartphone Addiction Scale-Short Version. The study aimed to test the reliability and validity of the Serbian version of the SAS-SV and estimate smartphone addiction prevalence among medical students. The study concluded that the Serbian version of the SAS-SV is a reliable and valid instrument for detecting smartphone addiction among university students.[8]

Conclusion

According to the result of the present study, the within-group analysis showed both group A-Chin Tuck Exercise with Pectoralis Muscle Stretching Exercise and group B-Chin Tuck Exercise with Scapular Retraction Strengthening Exercise are clinically and statistically significant in increasing Cranio-vertebral angle, decreasing Shoulder angle and hence increasing Active Cervical Range of Motion ($p=0.001$). But, according to the group analysis, Group B-Chin Tuck Exercise with Scapular Retraction Strengthening Exercise is more effective in increasing Cranio-vertebral angle, decreasing Shoulder angle, and hence increasing Active Cervical Range of Motion as compared to Group A-Chin Tuck Exercise with Pectoralis Muscle Stretching Exercise.

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