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Effectiveness of Neck Stretching and Modified Cervical Exercises with Neck Stretching and Postural Modifications in Smartphone Users with Forward Head Posture: A Comparative Study

Shreya Ahirrao[1], Sharath U.R[2], Somshekar[3], Pradeep Krishnareddy[4], Shridhar S[5]

[1]MPT, [2,4,5]MPT, Assistant Professor,
Kempegowda Institute of Physiotherapy, K.R. Road, V.V. Puram, Bangalore -560004
[3]Professor, Department of Orthopedics, Kempegowda Institute of Medical Science, K.R. Road, V.V. Puram, Bangalore -560004

Corresponding Author: Shreya Ahirrao

ABSTRACT

Introduction: Smartphone addiction has become an emerging social problem as an uncontrollable overuse of it and its interference with daily life. The persistent use of smartphones can cause greater repercussions on physical and mental health.
Aims: To compare the effectiveness of neck stretching and modified cervical exercises with neck stretching and postural modification in smartphone users with the forward head posture.
Methods: The subjects were assessed for inclusion and exclusion criteria. Samples were selected through a simple random sampling method. 90 subjects were recruited in the study. The age group was 15-30 years including both males and females. Subjects with smartphone addiction and forward head posture were assessed and included in the study. The outcome measures were the Visual analog Scale, universal goniometer, and the Neck Disability Index to check the pain, cervical Range Of Motion, and neck disability. Group A received neck stretching and modified cervical exercise, whereas Group B received neck stretching and postural modifications for five times a week for 4 weeks.
Results: Significant differences were observed in both groups A and B. Group A has shown a better percentage of improvement as compared to Group B against various measurements in reducing pain and disability and in improving cervical range of motion.
Conclusion: The present study stated that the Neck Stretching and modified cervical exercises were more effective than Neck stretching and postural modifications.

Keywords: Smartphone users, neck stretching, modified cervical exercise, postural modifications, neck disability index, forward head posture.

INTRODUCTION

Smartphone addiction is a growing concern in society, as the uncontrollable overuse and interference of it with daily life. At present, India has 300–400 million smartphone users [1].There were 291.6 million smartphone users in India in 2017. It is extrapolated that the number of smartphone users will reach 490.9 million by 2022 [2]. According to the Mobile Marketing Association in association with Kantar IMRB, the average consumer spends 3 hr. a day on their smartphones [3]. Despite its negative effects, Smartphone has become a prevailing social problem as it signifies the characteristics of addiction such as tolerance, withdrawal, the difficulty of performing daily activities, or impulse

control disorder as confirmed in previous studies [4].

The continuous use of smartphones in a stationary position with an unsupported arm could bring about an abnormal alignment of the neck as they have small monitors that are typically held downward, users must bend their heads to see the screens, increasing activity in the neck muscles. Overloading the neck and shoulders increase muscle fatigue, decreases work capacity, and affects the musculoskeletal system [5].

The problem of neck pain is common especially in young adults which is more than 30% of populations at least once in a week due to poor posture Neck pain has a broad range of differential diagnosis ranging from benign to live- threatening causes (e.g., trauma, infection, malignancy) and, many kinds of research have established a correlation between neck pain and the use of smart devices [6]. Pain in the neck is due to reduced cervical lordosis and the pain threshold of the muscles. There is also shortening of muscular fibers around the articulation points of atlanto-occipital and overstretching of muscles around the joints [7].

Range of motion losses can occur from inactivity and structural changes of the tissues and results in an increase in connective-tissue density, shortening of collagen tissue and muscle in the cervical region [8]. The center of gravity of the head in this posture is positioned at the front rather than the vertebral body weight [9]. The weight supported by the spine dramatically increases when the head is flexed forward at varying degrees [10]. Most of the neck muscles maintain at least 80% of their peak force-generating capacity throughout the cervical range. The length-tension relationship, combined with moment arm changes throughout the range and it alters a muscle's moment or torque producing ability. Muscle length is probably the main influencing factor in this relationship, suggesting that maintaining a neutral head position is vital in reducing the load on the cervical muscles. A change in posture alters the moment produced by the weight of the head by changing the location of the head's center of gravity with respect to the point of rotation in the cervical spine [11].

Postural misalignment of the head on the trunk (e.g., forward head posture) is related to complaints of pain in the neck but is also observed in asymptomatic individuals. Maintaining proper alignment change requires conscious attention, especially in the presence of a strength/ tightness imbalance [12], although improvement in postural alignment with exercises would be expected due to improvement in muscle length and/or strength. The influence of self-awareness of posture must also be taken into consideration. Wright, Domenech, and Fischer reported on a randomized, controlled study of a postural correction program for clients with pain. They reported that the exercise group experienced a significant improvement in symptoms (neck pain) [13].

Apart from the physical changes, studies in the past by Park (2015), JH Ha (2008) have also found out that excessive mobile usage has produced adverse effects on the human psychology Use of these devices has produced feelings of loneliness and isolation which is associated with interpersonal anxiety and obsession causing uncontrolled emotions which may even lead to serious incidents and fatalities [14]. In the present study, the researcher has planned to compare the effectiveness of stretching and modified cervical exercises with stretching and postural modifications in smartphone users with forward head posture.

MATERIALS AND METHODS

Study design and population

A comparative study was done using simple random sampling method. 90 participants were recruited. This study was approved by the institutional ethical committee (Ref no. KIPT/31/19-20).

Inclusion criteria

In this study 90 Subjects were taken who had forward head posture and smartphone addiction between 15-30 yrs. of age using smartphones more than 3-4hours each day,

Exclusion criteria

Recent neck, shoulder, arm and hand injury, Individuals having pre-existing mechanical and degenerative neck conditions, Neurological disorder, Congenital spinal deformity, Spinal or cervical trauma, Cervical radiculopathy, Vestibular system problem. Prior to data collection, all participants were explained the study purpose and procedures of the study, and written informed consent was obtained.

Methodology

Group A subjects were taught neck stretching exercises 5 sessions a week for 4 weeks followed by modified cervical exercise. Group B subjects were taught neck stretching exercises followed by postural modifications. Forward head posture was measured with the 'ON protractor' mobile phone application which is freely available in the Google app store. This application allows us to take a picture and draw an angle by touching the screen at the reference points on the markers and the image gets saved in the device [15]. Smartphone addiction was measured using the 'Smartphone addiction scale' (SAS) which is a reliable and valid measurement tool for evaluation of smartphone addiction [4]. The Outcome measures, Pain status, cervical range of motion, and disability were measured using Visual Analogue Scale, universal goniometer, and neck disability index on day 1 before starting treatment and at the end of 4th week.

Neck stretching exercise like Neck retraction; Head drop, Side bends, Rotation, Flexion were common for both the groups which were given for 5-10 repetitions, held for 10-30 sec [16]. Modified cervical exercises were performed in the following manner- first pull the subject's neck to the head, thereby attaching the chin to the neck; the subject's eyes should be looking directly forward; hold both hands on the back of the subject's head; ask the subject to push his/her head back against the hands; Ask for the hands to spread as wide as possible so pectoralis major can be stretched. Each group performed three sets of exercises, with one set as five circuits, 7 sec of exercises followed by 10 sec of rest [9].

The correct postural modifications while using there smartphones were taught to the subjects and shown in the figure 1 and 2.

In sitting posture-The neck should be in neutral position, shoulders should be relaxed and elbow should be supported and the subject should hold the phone at the eye level.

In supine posture-The neck should be relaxed on pillow in neutral position and elbow should be supported with the pillow and the subject should hold the phone at eye level [7].

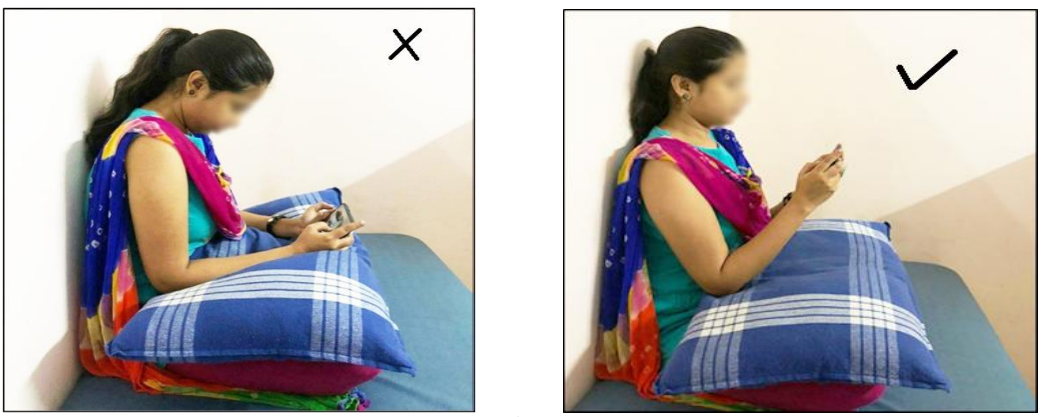


Figure 1 Postural modifications- sitting posture.

Figure 2 Postural modifications- supine posture

Statistical Analysis

Data was analyzed using the statistical package SPSS 22.0 (SPSS Inc., Chicago, IL) and level of significance was set at $p<0.05$.Normality of the data was assessed using Shapiro Wilk test. Descriptive statistics was performed to find out the mean and standard deviation and proportion of the respective groups. Inferential statistics was performed by Paired t test (within the group) and Independent t test (between the group) to find out the statistical significance. Chi square was used to analyze the association between categorical variables.

RESULT

The subject in Group A was given neck stretching and modified cervical exercise and the subjects in Group B were given neck stretching and taught postural modifications over a period of 4 weeks. The mean age and gender difference of Group A and Group B were shown in graphs 1 and 2 and the comparison of test scores of within and between the groups for cervical range of motion, pain intensity (VAS), and neck disability index for were shown in the table no. 1 and graph

Cervical flexion ROM

The mean difference and SD score of group A were 15.11±6.62 and group B were 11.44±4.21 and the Percentage-wise comparison of group A and Group B was 20.7% vs. 15.4%.

Cervical extension

The mean difference and SD score of group A 13.67±5.31 and for group B were 13.22±5.23 and the percentage-wise comparison of group A and Group B was 24.7% vs. 23.9%.

Lateral flexion

The mean difference and SD score of group A 11.55±5.03 and for group B 11.33±4.93 were and percentage-wise comparison of group A and Group B was 36.5% vs. 35.2% for right lateral flexion.

The mean difference and SD score of group A 11.56±5.25 and for group B were 11.55±5.31 and the percentage-wise comparison of group A and Group B was 36.1% vs. 35.9% for left lateral flexion.

Lateral rotation

The mean difference and SD score of group A 14.33±5.79 and for group B was 13.33±4.88 and percentage-wise comparison of group A and Group B was 20.1% vs. 18.7% right lateral rotation and left lateral rotation

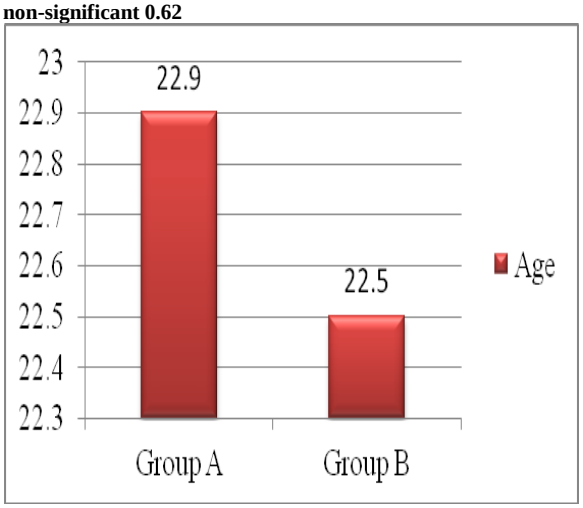
Visual analogue scale

The mean difference and SD score of group A 2.044±0.76 and for group B 2±0.67 was and percentage-wise comparison of group A and Group B was 48.9% vs. 47.9%

Neck disability index

The mean difference and SD score of group A 10.6±3.23 and for group B were 9.73±3.54 and the percentage-wise comparison of group A and Group B was 74.6% vs. 71.5%.

Graph 1: Age of the study participants
The groups are comparable with respect to age as they are non-significant 0.62



Graph 2: Gender distribution of the study participants
The groups are comparable with respect to Age as they are non-significant 0.73

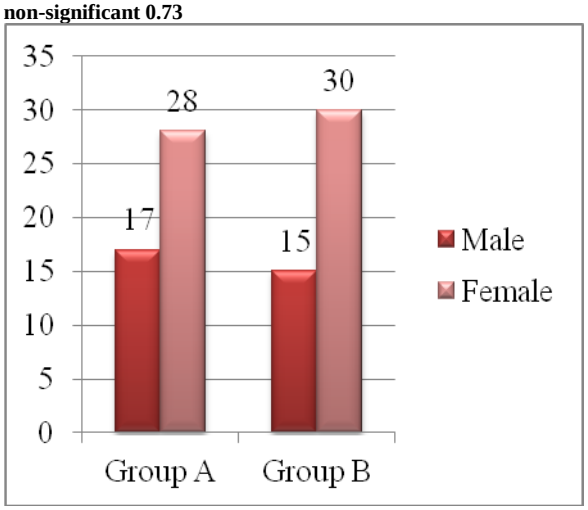
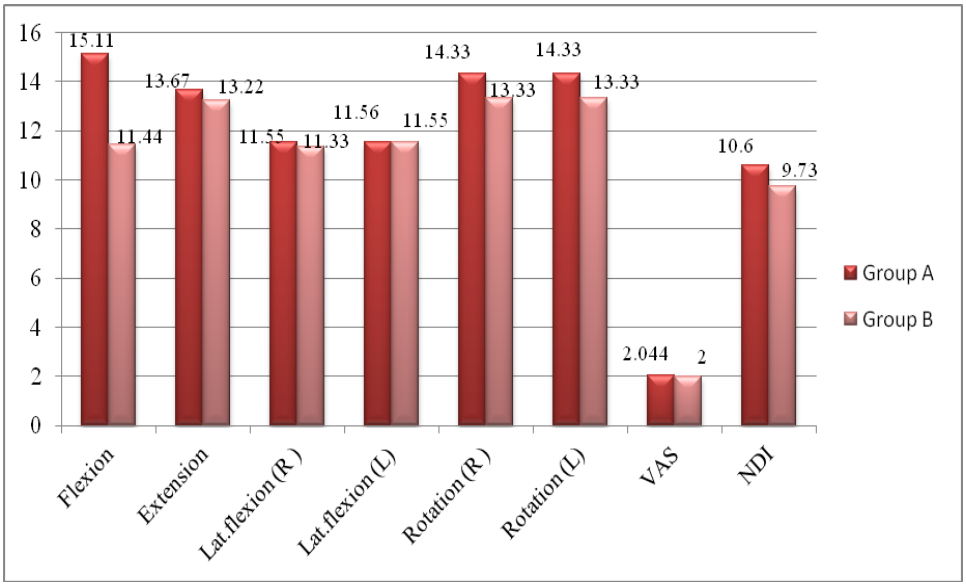


Table 1 : Comparison within &between the group A and group B

	Group A	Group B	p-value between group
ROM			
Flexion	15.11±6.62	11.44±4.21	0.002*
Extension	13.67±5.31	13.22±5.23	0.68
Lat.flexion (R)	11.55±5.03	11.33±4.93	0.85
Lat.flexion (L)	11.56±5.25	11.55±5.31	0.98
Rotation (R)	14.33±5.79	13.33±4.88	0.37
Rotation (L)	14.33±5.79	13.33±4.88	0.37
VAS	2.044±0.76	2±0.67	0.77
NDI	10.6±3.23	9.73±3.54	0.22
P-Value (within group)	0.0001*	0.0001*	

**P<0.05 is statistically significant*



Graph 3 Comparison within &between the group A and group B

DISCUSSION

The present study was done to compare the effects of stretching and modified cervical exercise with stretching and postural modifications to reduce pain and to improve cervical ROM in subjects with forward head posture. The outcomes of this study were aimed to measure pain using the Visual Analog Scale, cervical Range of motion using a universal goniometer, and checking the Neck disability. Both the groups showed significant improvement after 4 weeks of treatment but percentage-wise Group A explained a better performance with respect to Group B in terms of increasing cervical range of motion, reducing pain and neck disability. The cervical range of motion in smartphone-addicted people significantly declined in almost every direction. This finding recommended that smartphone addiction has a deleterious influence on craniocervical mobility.

Excessive use of the Smartphone can cause musculoskeletal symptoms like fatigue and decreased cervical range of motion. Fatigue in the cervical muscle is responsible for more flexed cervical posture and imbalanced tones between the cervical muscles after prolonged usage of a smartphone. This negative relationship between the time of smartphone use and neck flexion and extension could be due to the fact that the posture people adopt as they look at their smartphones raises the stress on the neck [5]. It may cause undue stress on the related structures that more the use of a smartphone, the less flexion-extension movements could occur and the reason behind reduction in Side flexion could be due to the fact that people are using their smartphones with one hand and often with tilted head due to the size of the equipment.

For the improvement of the cervical range of motion, this study offered modified cervical exercises that were a combination of the movements recommended by McKenzie and Kendall [9]. In addition, the modified cervical exercises proved effective in increasing the range of motion of those with forward head posture.

In the present study, the correlation of duration of smartphone use with Pain and NDI score of both groups is moderately positive. This indicated that if a subject had longer usage time with their smartphones, they tended to have worse pain, more difficulty in their neck-specific and functional activities. This may also be due to the poor posture adopted while using the smartphone, which causes excessive stress and induces pain in the neck. Due to this neck pain, there may be difficulty in performing functional activities. Neck pain became more prevalent with daily exposure to digital media for periods longer than 3-4 hours. While using a mobile phone there are repetitive thumb movements and excessive neck flexion [17]. If the neck is left untreated, then it can lead to some serious permanent damage, such as flattening of the spinal curve, early arthritis; spinal misalignment, spinal degeneration or disc compression, disc herniation, or nerve damage.

Limitations of the study

The sample size in the present study was less, Digital Photographic method or Radiographic techniques for measurement of forward head posture was not used in this study, There was no targeted VAS range to determine the specificity of pain.

Recommendation

Further study can be done by targeting or choosing a specific Cervical ROM (flexion or extension or lateral flexion or lateral rotation), specific VAS value (range: mild (1-3) or moderate (4-7) or severe (8-10) and the specific duration of neck pain (acute or chronic). Specific age groups can be included.

CONCLUSION

Significant differences were observed in both groups. Neck stretching with modified cervical exercise and neck stretching with postural modifications both the treatments were effective in the

smartphone users after 4 weeks of intervention. Subjects who were treated with neck stretching and modified cervical exercise (GROUP A) showed a better percentage of improvement than subjects who were treated with neck stretching and postural modifications (GROUP B) against various measurements such as Visual analogue scale, Range of motion, and Neck disability index.

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