ORIGINAL RESEARCH PAPER

Volume - 13 | Issue - 03 | March - 2024 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

A PROSPECTIVE STUDY TO EVALUATE THE EFFECT OF KENDALL EXERCISE AND RESPIRATORY EXERCISE ON NORMALIZED SCAPULAR ABDUCTION (NSA) RATIO AND CHEST EXPANSION AMONG ROUNDED SHOULDER POSTURE IN YOUNG FEMALE SMARTPHONE USERS.

Physiotherapy

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ABSTRACT

This experimental study aimed to assess the impact of Kendall and respiratory exercises on Normalized Scapular Abduction (NSA) ratio and chest expansion among young female smartphone users with rounded shoulder posture. Thirty subjects aged 18-25 years were enrolled after ethical approval. Kendall and diaphragmatic exercises were conducted over six weeks, four times per week. Baseline, pre-intervention, and post-intervention measurements were taken for NSA ratio and chest expansion using inch tape. Statistical analysis revealed a significant decrease in NSA ratio and increase in chest expansion post-intervention ($P<0.05$). The findings suggest that Kendall and diaphragmatic exercises are effective interventions for reducing rounded shoulder posture and improving chest expansion in individuals who excessively use smartphones.

KEYWORDS

RSP (Rounded Shoulder Posture), NSA – Normalized Scapular Abduction Ratio

INTRODUCTION

Smartphones are described as modern communication devices with diverse software applications and powerful computing capacity. They are used globally for communication. Smartphone usage has seen a dramatic increase in the 21st century.[1]

A new development in the field of interpersonal communication and information sharing has arisen as a result of the growing global usage of smartphones [36]. Almost one third of the world's population, or 6.5 billion people, used smartphones in 2020, up from 3.6 billion in 2016. This has made smartphone use one of the main worldwide health concerns of the twenty-first century.

Frequent smartphone use is suggested to be limited to no more than 4 hours per day. Increased smartphone usage is associated with the development of structural problems and musculoskeletal pain patterns. Specific issues mentioned include neck/shoulder pain and breathing dysfunction[2]

Smartphone usage and prolonged sitting contribute to rounded shoulder posture, which can lead to respiratory dysfunction. Studies indicate that poor posture can affect breathing patterns, with 83% of patients experiencing neck pain showing altered respiratory function. Rounded shoulder posture weakens deep neck flexors and certain back muscles while tightening others, including the pectoralis minor and sternocleidomastoid, reducing inspiratory capacity. Normalized scapular abduction (NSA) ratio and chest expansion measurements are reliable indicators of this condition. To address reduced inspiratory capacity, diaphragmatic exercises such as the Kendall exercise are recommended to stretch the pectoral muscles and strengthen deep cervical flexors and shoulder retraction muscles.[3,4,5,6,7,8]

Need Of The Study

- Many studies were reported on Kendall exercise in reducing neck pain but a very few has been conducted on effect of Kendall on Rounded shoulder posture.
- Previous studies were conducted for short duration and have not concentrated on chest expansion by doing the diaphragmatic exercise and its measurement by inch tape.
- Hence this study was chosen, the effect of Kendall exercise and respiratory exercise on Normalized scapular abduction (NSA) ratio and chest expansion among rounded shoulder posture in young female smartphone users.

Aim Of The Study

The aim of the study is to evaluate the Effect of Kendall and respiratory exercise on Normalized scapular abduction (NSA) ratio and chest expansion among rounded shoulder posture in young female smartphone users.

Objectives Of The Study

To evaluate the Normalized scapular abduction (NSA) ratio on rounded shoulder Posture among young female smartphone users.
To evaluate the chest expansion on rounded shoulder posture among young female smartphone users.

MATERIALS AND METHODOLOGY

Materials:

- Couch
- Measuring tape
- Postural grid
- Pen and paper
- Anthropometric measurement

1. Weight by weighing machine in kg
2. Height by using measuring tape

Methodology

- **Study Design:** Experimental (one group pre-test and post-test design)
- **Study Setting:** College of physiotherapy SVIMS University, Tirupati.
- **Study Duration:** 6 weeks
- **Sampling Method:** convenient sample
- **Sample Size:** 30

Inclusion Criteria

- Age: 18-25years.
- Gender: females.
- students who are using smartphone more than 4hours in a day.
- Students who maintain slumped sitting posture while using smartphone.
- Bilateral rounded shoulder posture

Exclusion Criteria

- Gender: Males.
- Recent injuries, Spine abnormalities.
- Unilateral rounded shoulder posture.
- Having any surgical history related to upper body.
- Age above 26 to 40years.

Outcome Measures

- To determine the effect of Rounded shoulder posture in young female smartphone users by NSA ratio with measuring tape.
- To determine the effect of Chest expansion in young female smartphone users by using measuring tape in centimeters (cm).

Study Protocol

Participants with bilateral Rounded Shoulder Posture (RSP) determined by visual estimation based on specific criteria were included. The criteria included:[11,12]
(1) non-parallel medial borders of the scapulae, or
(2) anterior positioning of the shoulder point in relation to the sternal notch or presence of chest hollowing.

Normalized Scapular Abduction (NSA) ratio, a reliable measure of scapular position[10], was collected. The mean NSA ratio of 1.60 in this group aligned closely with the population mean in the United States. Scapular alignment was measured bilaterally using a measuring tape in centimeters[13,14]. The NSA ratio was calculated by dividing the total scapular distance by the length of the scapula. Total scapular distance was measured as the linear distance from the third thoracic vertebra to the inferior angle of the acromion, while the length of the scapula was measured from the inferior angle of the acromion to the root of the spine of the scapula.

Participants were instructed to stand in a relaxed position during measurement.

Chest expansion was assessed using a cloth tape at two levels of the rib cage: Expansion in the upper thoracic region was evaluated at the third intercostal space, middle of the clavicular line, and spinous processes of the fifth thoracic vertebra, while expansion in the lower thoracic region was assessed at the xiphoid process and spinous processes of the 10th thoracic vertebra. Participants were instructed to inhale slowly through the nose to expand the lungs fully while pushing against the tape measure, followed by complete exhalation through the mouth. Measurements were taken at the end of both inspiration and expiration cycles. Measurements were conducted with participants in a standing or sitting position with back support, ensuring proper placement of the cloth tape on the designated vertebrae. The tape was held with an index finger to prevent deformation or cutaneous folds. Chest expansion values were calculated by subtracting the inspiratory diameter from the expiratory diameter.

Pre-test values were obtained by measuring the Normalized Scapular Abduction (NSA) ratio for Rounded Shoulder Posture (RSP) and chest expansion for thoracic girth. Participants were then encouraged to engage in Kendall exercises for posture and diaphragmatic exercises for thoracic girth from the first to the sixth week. Post-test values were measured after six weeks of intervention.

Kendall Exercises

1. Stretching pectoralis muscle
2. Strengthening shoulder retraction
3. Strengthening the deep cervical flexors
4. Stretching the cervical extensor

This exercise were repeated 15 times. All the exercises consist of total 25 mins a day and performed 4 session per week.

Respiratory Exercise
Diaphragmatic Exercise

Lie comfortably in a half-lying position with knees bent, using a pillow under the head and knees for support if needed.

Position one hand on the upper chest and the other beneath the rib cage, just above the belly. Inhale slowly through the nose, filling the lower belly with air while keeping the hand on the chest still.

Tighten the abdominal muscles and exhale slowly through pursed lips, allowing the belly to gently fall inward. The hand on the belly should return to its original position. This exercise can also be done while sitting in a chair with knees bent. Ensure relaxation of shoulders, head, and neck throughout.

Aim for five to ten minutes per session, or practice several times a day if possible.

DATA ANALYSIS & RESULTS

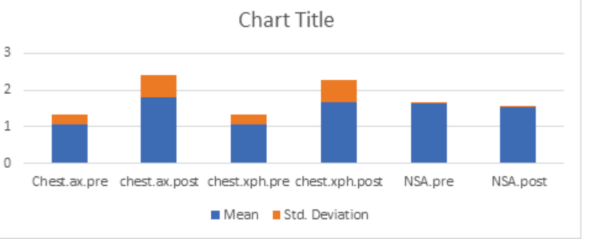
- Participant data were analysed by intension to treat. All continuous data will undergo assessment for normality. Continues data were described using mean (SD) if normally distributed and median (IQR) when the distribution is skewed.
- Differences in the outcomes were compared within the group.
- P value of <0.05 was considered statistical significant paired T-test

The results were anaylsed using SPSS 21 version for the statistical analysis for the study. The present study included 30 subjects who received Kendall exercises and diaphragmatic exercise for 6 weeks initiated from the day of screening.

Table-1: Representing The Pre And Post Values Of Chest Expansion At Axillary Level & Xiphiod Level And NSA Ratio .

Variables	Mean	Std. Deviation	95% Confidence Interval of the Difference		T value	Df	P Value
			Lower	Upper			
Chest.ax.pre - chest.ax.post	-0.73	0.58	-0.11	-0.52	-6.89	29	0.001
chest.xph.pre - chest.xph.post	-0.60	0.62	-0.11	-0.37	-5.29	29	0.001
NSA.pre - NSA.post	0.12	0.03	0.00	0.11	22.10	29	0.001

The above statistical data were explained about the comparison of the pre and post values with mean and standard deviation. Pre test value of chest expansion axillary level is mean standard deviation(1.07 0.25), post test value of chest expansion axillary level is meanstandard deviation(1.80 0.61). Pre test value of chest expansion xiphiod level is meanstandard deviation(1.07 0.25) and post test value of chest expansion xiphiod level is mean standard deviation(1.67 0.60). Pre test value of NSA ratio is meanstandard deviation(1. 65 0.03) and post test value of NSA ratio is mean standard deviation(1.55 0.01)



Figure–1 Graph Representing The Pre And Post Values Of Chest Expansion At Axillary Level & Xiphiod Level And NSA Ratio .

DISCUSSION

The present study was conducted to find out the effect of the effect of kendall exercise and respiratory exercise on normalized scapular abduction (NSA) ratio and chest expansion among rounded shoulder posture in young female smartphone users.

The study measured the Normalized scapular abduction ratio (NSA), chest expansion as parameters to demonstrate the effect of prolonged smart phone use on change in posture and respiratory function.

The study in finding out with short duration of treatment. There are limited studies on diaphragmatic breathing exercise given for reduced chest expansion in smart phone users.

In 2021, Qurat Ul Ain Gohar , Silwat Sultana, et. a cross sectional correlational analytical study, with total sample was 245 (64 males and 181 females) aged 18 to 40 years, who were recruited for this study, the aim of the researchers in this study is to know the Relationship among chest expansion and scapular index in smartphone users and they concluded that prolonged usage of smartphones affects scapular index and contributes to various musculoskeletal problems.[9]

In above study, they took large age group, short duration of the treatment period. So in this study I precised the age group and prolonged the treatment period and I concluded the study with significant p= 0.001.

Early researchers have shown, in a study by do youn lee, ms, pt, chan woo nam, conducted on 28 subjects were randomly assigned into the mckenzie exercise group (n=9), the self-stretch exercise group (n=10), and the kendall exercise group (n=9), they results that the three shows the observational data regarding cva and scapular index results within the groups is summarized in table 1. changes in the cva and the scapular index results between the groups before and after the intervention had no significant differences statistically (p>0.05). the post-test results using the lsd did have a significant difference between self-stretch exercise group and kendall exercise group statistically (p<0.05).[4]

In the above study each group contains a small sample size, so i conducted the study with better sample size to achieve better result and i concluded the positive improvement with significant value of p=0.001.

CONCLUSION

The study found that prolonged smartphone usage exceeding 4 hours contributes to rounded shoulder posture and reduced chest expansion in developed students. Statistical analysis revealed a significant difference between pre and post-treatment values ($p < 0.001$), leading to the acceptance of the alternate hypothesis and rejection of the null hypothesis. Based on these results, it can be concluded that Kendall exercises and diaphragmatic exercises effectively correct rounded shoulder posture and increase chest expansion, supporting the acceptance of the alternate hypothesis and rejection of the null hypothesis.

Limitations and Recommendations

- Sample size is very small and there was no long term follow up
- The absence of a control group is noted.
- Conducting the study with a large sample size is feasible.
- Future research endeavors could involve extending the duration of the treatment protocol. Further study can be done with different protocol comparison.
- The future research can also be carried out with any modalities of treatment protocol.

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