

Association between Rounded Shoulder Posture and Pulmonary Capacity among Undergraduate Doctor of Physical Therapy Students

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Abstract

Background: vital capacity and its relationship with posture has previously been studied. Variations in posture has an effect on the inspiratory and expiratory pressures. Spirometry is the preferred choice for measurement of vital capacities. Chronic deviations in posture could have long lasting effects on vital capacity. Physical therapists are prone to suffering long term musculoskeletal disorders, thus affirming the need to have screening protocols in place to prevent onset of such disorders.

Methods: two hundred undergraduate physical therapy students were included in the study. Rounded shoulder posture was assessed using vernier calipers (in supine, distance between tip of shoulder and table was measured). Forced vital capacity and forced expiratory volumes were assessed using spirometry.

Conclusions: significant differences were obtained in readings of forced vital capacity and forced expiratory volume between those with rounded shoulders and those without (p-value= 0.000 and 0.003 respectively). Postural changes affect vital capacities. Undergraduate students should be educated regarding proper postures, in order to prevent long term effects.

Key words: Forced vital capacity, posture, students, pulmonary ventilation

Introduction

The association of vital capacity with posture is one that is recognized and previously worked on.^{1,2,3} Respiratory muscles have functions associated with posture, thus any deviation from normal impedes the ability of these muscles to perform their function effectively.^{4,5} A small change in posture can affect lung capacities. Semi-upright sitting has large variations in

inspiratory and expiratory pressures as compared to upright sitting.^{6,7} Postural disorders begin in children from an early age,^{8,9} and a highly common factor in youth is excessive cell phone usage. The frequency of short term musculoskeletal disorders due to excessive phone usage is high; whereas long term effects are also noticed to some extent.¹⁰ In modern society, pain and associated musculoskeletal disorders are on the rise due to poor posture and excessive smart phone usage.¹¹ Texting posture has been shown to cause disorders in neck, and upper extremities.

Vital capacity is a preferred quantitative measure of respiration due to its ease of measurement.¹² Spirometer

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tests are routinely used in clinical settings to reveal impairment of respiratory organ performance and to look at changes like enhancements as a results of interventions. Measures of vital capacity include: Forced Vital Capacity (FVC), slow vital capacity, and inspiratory vital capacity.¹³ Spirometry measures airflow from fully inflated lungs. Muscular force is required in expansion of lungs and thorax, to completely inflate them. Lungs expand passively, and chest is stretched to maximum on full inhalation, following which, forced expiration is performed into a device which records air flow over time. Expiration is a combination of factors such as muscular work, elastic recoil of thoracic wall and lungs, and small and large airways function.¹⁴

Work related musculoskeletal disorders are prevalent in physical therapists (lifetime prevalence of 91%), and 1 in 6 left the profession due to these disorders.¹⁵ With a cacophony of factors, it is imperative that screening for undergraduate students be performed, in order to identify any effect poor posture, specifically rounded shoulders, may have on pulmonary function. Studies have not been conducted in Pakistan regarding effects of posture on vital capacities. Our study aimed to assess the effects that poor posture could have on university students who have rounded shoulders.

Materials and Methods

The study design was an observational study, carried out in public and private sector universities

in Karachi, Pakistan, in 2018. A sample of 200 students was calculated via OpenEpi v3.01, with non-probability, purposive sampling being used to recruit participants. Undergraduate students in various universities were approached, and briefed about the study. Those who signed consent forms were enrolled in the study. Approval for this study was given by Isra Institute of Rehabilitation Sciences.

History of orthopedic, respiratory, neuromuscular, cardiovascular issues were part of exclusion criteria of the study. Participants were divided into two groups; those with rounded shoulders, and those without. Vernier calipers were used to determine the presence of rounded shoulders. Subjects lay supine, and were asked to relax. The distance between the table and peak of the shoulder was recorded, and if it was found to be greater than 2.5 centimeter, they were considered as having rounded shoulders.

For the spirometry procedure, a nose clip was placed. Pulmonary capacity was measured by using portable (SP10) spirometer in sitting position. Pulmonary parameters recorded were FVC, Force Expiratory Volume in one second (FEV1) and Peak Expiratory Flow Rate (PEFR). After explanation of the procedure, participants were instructed to take a few normal breaths, inspire as much as possible, then exhale as hard as they could, until the lungs were completely empty. Three attempts were done, so as to familiarize participants with the procedure, with the third reading being considered for analysis.

Table 1: Assessment of participants without rounded shoulders compared to those with rounded shoulders

Without Rounded Shoulders				
Age	BMI	FEV1	FVC	PEFR
21.11±1.86	20.62±3.90	3.06±0.59	3.40±0.56	5.68±0.69
With Rounded Shoulders				
Age	BMI	FEV1	FVC	PEFR
21.48±2.01	20.78±4.19	3.26±0.29	3.74±0.36	6.57±0.66

Results and Discussion

Out of 200 participants, 64 were male and 136 were female. 24 males and 76 females did not have rounded shoulders. 40 males and 60 females had rounded shoulders. Values for age, BMI, FEV1, FVC and PEFr are outlined in Table 1. Significant difference was obtained between groups for FEV1 (p value=0.003), and difference between FVC and PEFr values for rounded shoulders and those without rounded shoulders was highly statistically significant (p value=0.000 for both). Majority of research has been conducted regarding forward head posture and its effects on pulmonary capacity.^{16,17, 18}This study aimed to assess the association of rounded shoulders and pulmonary capacities. All three measures assessed in this study were shown to have significant correlation with rounded shoulder posture. Those with rounded shoulders had lower values as compared to those without rounded shoulders. Lin et alⁱⁱⁱ found that slumped posture has a significant effect on lung capacity, and expiratory flow in healthy participants. Excessive usage of smartphones was also linked to rounded shoulders, thus affecting pulmonary capacities, as observed in a study conducted by Kang et al.¹⁹There are differences in lung capacities found between genders, however, our study did not assess this component.^{20, 21}Further, activity levels may play an important part in pulmonary capacities. A longitudinal study found that increased activity levels had a beneficial effect on respiratory functions. Smoking cessation, or not being a smoker, was found to have a similar effect.²²

Limitations of this study were that digital assessment was not performed for identification of rounded shoulder posture. Activity levels of participants were not taken into consideration when assessing pulmonary function. Majority of the population consisted of female participants. A stratified sample, along with adequate testing protocols

is recommended to further explore the relationship between rounded shoulders and pulmonary capacities.

Conclusion

Our study concludes that rounded shoulders can cause differences in pulmonary capacities. Undergraduate students should be advised on ideal sitting postures, as well as reduction of smart phone usage; which will help reduce incidence of musculoskeletal disorders, as well as avoid any negative effects on pulmonary capacities.

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Ethical Clearance: Taken from Isra Institute of Rehabilitation Sciences ethical committee.

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