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# Frequency of Protracted Shoulders and its Relationship with Inter scapular Distance and Thoracic Expansion in Healthy Young Adults: A Cross-Sectional Study

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**Author`s Contribution**

[2,3,5] Substantial contributions to the conception or design of the work for the acquisition, analysis or interpretation of data for the work, [1,4] Drafting the work or reviewing it critically for important intellectual content, [1-6] Final approval of the version to be published, Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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**A B S T R A C T**

Background: Protracted shoulders are common musculoskeletal condition in young population which has impact on thoracic expansion and interscapular distance. The main contributors to protracted shoulders are poor ergonomics, sedentary lifestyle and excessive use of gadgets. In this study frequency of protracted shoulders and its relationship with interscapular distance and thoracic expansion has been evaluated.

Objective: To determine the frequency of protracted shoulders in healthy young adults and its relationship with interscapular distance and thoracic expansion at axillary and T4 level.

Methodology: The study design was a cross-sectional analytical study, conducted among students from Foundation University Islamabad. A total of 357 subjects were selected using convenience sampling based on inclusion and exclusion criteria, and all participants provided written informed consent. Outcome Measures: Plumb line was used to access protracted shoulders and measuring tape was used to measure interscapular distance and thoracic expansion at axillary and T4 level.

Results: The study showed that there is moderately positive correlation between protracted shoulders (PS) and Interscapular Distance. (p=0.436, rs = 0.41). Furthermore, the correlation between PS and Thoracic expansion at axillary level was strongly positive (p=0.162, rs = 0.74) while a strongly negative correlation (p=0.225, rs = - 0.64) was observed at T4 level. 2

Conclusion: The study's findings concluded that the frequency of protracted shoulders is high among healthy young adults. The study showed that there's a relationship of protracted shoulders with thoracic expansion at the axillary level while no relationship established at T4 level and with interscapular distance among healthy young adults.

Keywords: Posture, Protracted Shoulder, Thoracic expansion

## Introduction

The term "posture" refers to the body's position in space. Protracted shoulders are common musculoskeletal condition that affects a significant proportion of the young population. Protracted shoulder posture is defined as abduction, the elevation of the scapula, and forward positioning of the shoulders.[1,2] In individuals with protracted shoulder posture, the shoulder blades are often positioned farther apart than they would be in individuals with a neutral posture. This can result in an increase in interscapular distance, which refers to the horizontal distance between the

T3 spinous process and the vertebral limits of both scapular bones.[3] Protracted shoulder posture can have a significant impact on chest expansion. When the shoulders are protracted, the chest becomes compressed and the rib cage is pulled downwards and inwards, reducing the amount of space available for the lungs to expand during breathing.[4] Protracted shoulder impairs the mobility and function of diaphragm causing insufficient contraction of abdominal muscles thus decreasing chest expansion.[5] In the present era postural syndromes are very prevalent among young individuals. Protracted shoulders pull the scapula forward that causes increased inter scapular distance which may adversely affect thoracic expansion and cause respiratory complications later. Despite its high prevalence and significant impact on individuals' health and well- being, the etiology and management of protracted shoulder posture remain poorly understood. Therefore, this thesis highlights the effect of protracted shoulder posture on chest expansion and inter scapular distance, two key indicators of respiratory function. By examining the relationship between posture and respiratory function, we aimed to shed light on the potential long-term consequences of poor posture. It is important to address protracted shoulder posture through appropriate exercise and postural correction techniques to prevent these issues from 3 occurring. While protracted shoulders may not always cause symptoms or functional limitations, they can increase the risk of developing shoulder pain and other musculoskeletal issues over time. Therefore, addressing protracted shoulder posture is important for maintaining healthy chest expansion and respiratory function. Despite the studies mentioned above as far as we know, no such study has been conducted that has evaluated the relationship of protracted shoulder posture with Thoracic expansion and inter scapular distance. This study in future will highlight the importance of correct posture at young age that can prevent complications later.

The study was to measure the effect of Forward shoulder posture on Forced vital capacity. The study concluded that in patients with forward shoulder posture there was an increase interscapular distance which results in decrease forced vital capacity.[6] In a study by Hussain et all San observational study published in 2022. The purpose of the study was to assess the effect of poor posture on pulmonary capacities. The parameters were Forced Expiratory Volume in one second (FEV1) Forced vital capacity (FVC) and Peak expiratory flow rate (PEFR). Results revealed that there was a significant effect of poor posture on pulmonary capacities that is individuals with rounded shoulders had lower pulmonary capacities than those without rounded shoulders.[7] Paresa Nejati et al conducted a study to find out the relationship of forward head posture and rounded shoulder with neck pain in office workers. A cross-sectional study. The main purpose of this study was to assess the relationship of neck pain with faulty posture. As office workers spend long working hours in front of computers, which may result in poor posture and ultimately neck pain. The result of the study showed that among 203 office workers prevalence of neck pain and shoulder pain was 36.7% and 9.3%respectively.[8]

The study hence proven that neck pain is common among office workers but there is no relationship between neck pain and forward shoulder posture.[9] K. Kotteeswaran conducted a study in 2012, determining the Effect of Stretching and 4 Strengthening Shoulder Muscles in Protracted Shoulder in Healthy Individuals they examined the individual with protracted shoulders by using pectoralis minor test. They concluded that stretching of the tight muscle and strengthening of the antagonist muscle helped in correcting protracted shoulder posture.[1]

## Methodology

The study design was a cross-sectional analytical study, conducted among students from Foundation University Islamabad. Ethical approval for the study was obtained under reference number **FF/FUCP/932-9/DPTF1808**. The inclusion criteria for the study are as follows: participants of both genders, healthy young adults aged between 18 and 25 years. The exclusion criteria specify that individuals who smoke or have cardiopulmonary or neuromuscular diseases will not be considered for participation in the study.

Method for Plumb line-assessment for protracted shoulders: A plumb line was hung 3 feet in front of a wall, with the plumb bob roughly a quarter inch off the floor anterior to the lateral malleolus. This location was used as a reference point for judging posture from the side. The subjects stood between the wall and the plumb line in bare feet, wearing attire that enables for visual inspection of body landmarks. The external auditory meatus of the subjects was exposed. A skin marker or color tape was used to indicate the tip of the acromion process. A scale was used to measure the distance between the tip of the shoulder (acromion processes, also known as the "landmark") and the plumb line. Protracted shoulders were assessed as normal or mild, which is deemed to be within normal limits (WNL) or grade 1. They were measured from the center of the landmark in line with or upto 1 cm anterior to the plumb line, from the posterior border of the landmark in line with or displaced up to 1 cm anterior to the plumb line, and from the posterior border of the bony landmark displaced more than 1 cm beyond the plumb line.[5]

Method for measuring Inter-scapular distance: Participants were instructed to stand in comfortable and relaxed upright position with their back straight and arms relaxed at their sides. After that, the T3 level was palpated from both sides and horizontal distance between the two spines of scapula was measured. The distance was measured using measuring tape. The normal range of 7-10 cm is seen.

Method for measuring Thoracic expansion: Thoracic expansion was measured using measuring tape. At axillary level and at nipple level, the tape was encircled around the chest and measurements were taken at the end of deep inspiration and expiration. Normally 5-12 cm of chest expansion is observed.

## Results

The participants included in research were 357, males 86 (24%) and females 271 (75.9%), mean age in years was 21.12+- 1.67 and their BMI (kg/m2) was 22.12+4. 07. Using the Kolmogorov -Smirnov test in SPSS, it was revealed that the data of the research was non-normally distributed ($p<0.05$). Due to non-normal distribution of variables, Spearman's rank correlation was used to assess relationships between protracted shoulders, inter-scapular distance, and thoracic expansion. There was high frequency of protracted shoulders (86.8%), measured by plumb-line among healthy young adults Using Spearman's rank correlation, the correlation co efficient value of protracted shoulders with thoracic expansion at axillary level rs=0.74 and p-value=0.162 suggesting a strong positive correlation between protracted shoulders and thoracic expansion at axillary level, at T4 level rs= -0.64 and p-value= 0.225 described strong negative correlation between protracted shoulders and thoracic expansion at T4 level. The correlation coefficient rs= 0.41 and p-value= 0.436 described a moderately positive correlation of protracted shoulders with inter-scapular distance as shown in (Table 1)

**Table 1: Correlation of Protracted shoulder with variables**

| Variables | Mean± SD | Protracted shoulders (cm) Mean± SD | Co-relation co-efficient r value | p-value |
|---|---|---|---|---|
| **Inter scapular distance(cm)** | 10.47+1.95 | 1.47+0.38 | 0.41 | 0.436 |
| **Chest expansion at axillary level (cm)** | 3.75+1.09 | | 0.74 | 0.162 |
| **Chest expansion at T4 level (cm)** | 3.61+1.06 | | - 0.64 | 0.225 |

## Discussion

The main aim of current study was to identify the frequency of protracted shoulder posture with Interscapular distance, thoracic expansion at T4 level and axillary level in healthy young population. Results showed moderately positive correlation between protracted shoulders and inter-scapular distance whereas, strong negative correlation between protracted shoulders and chest expansion at T4 level but positive correlation at axillary level. A study conducted in 2011 by Ravi Savadatti et al, which describes the impact of forward shoulder position on forced vital capacity while measuring forced vital capacity using spirometer in the elderly population. The study also described the relationship of forward shoulder posture with inter-scapular distance and revealed a strong, meaningful correlation between ISD and plumb line measurements. The study's conclusion highlights an elevation in ISD and plumb line measurements among FSP individuals. The correlation coefficient (rs) for inter-scapular distance showed 0.9332* and p-value<0.001. [6] While mentioning the results of current study correlation co-efficient value for inter-scapular distance rs= 0.41 and p-value=0.436 that showed weak relationship of protracted shoulders with inter-scapular distance. The difference in results were due to variance in population as current study included young healthy individuals of age (18-25) while the previously mentioned study included elderly population of age (28-48). In contrast to current study, research was conducted by Ali Ghanbari ET al.in 2008 in which the posture and the angle made by the line linking C7 to the acromion were measured using a device with camera. They measured the relationship of FSP with forced vital capacities and Variables Mean+-St.Deviation Age 21.12+1.67 BMI 22.12+4.07 Protracted shoulders(cm) 1.47+0.38 Inter scapular distance(cm) 10.47+1.95 Chest expansion at axillary level (cm) 3.75+1.09 Chest expansion at T4 level 3.61+1.06 7 there was a significant correlation between FSP and respiratory values while the current study measured the relationship of protracted shoulder with chest expansion that showed a strongly negative correlation with chest expansion.[9] In contrast to the current study, research was conducted in 2022 by Hussain SA which used vernier calipers to measure the protracted shoulder posture. This method measures the distance between the tip of the shoulder and the table. Vernier caliper causes potential measurement errors, such as variation in pressure applied.[7] For this reason, the current study assessed the young adults' rounded shoulder posture using the plumb line method due to its simplicity, cost-effectiveness, and widespread use in clinical practice. The plumb line method allowed for a quick

and easy evaluation of postural alignment, providing a comprehensive assessment of the shoulder position relative to the vertical reference line. Current study has limitations like data has only collected from single setting, male to female disproportion and lack of generalizability.

## Conclusion

The results of the study concluded that the frequency of protracted shoulders is high (86.8%) among healthy young adults. The study showed that there's a relationship of protracted shoulders with thoracic expansion at the axillary level while no relationship established at T4 level and with interscapular distance among healthy young adults

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