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Correlation Between Craniovertebral Angle (CVA), Pulmonary Function Tests (PFT), And Chest Expansion In Rounded Shoulder Patients

Chirag[1], Deepak Raghav[2*], Nishant Singh[3]

[1]*mpt,*
[1*]*professor/Principal*
[1]*assistant Professor, Department Of Physiotherapy, Santosh Deemed To Be University*

***Corresponding Author:-** Prof.(Dr) Deepak Raghav*
**Professor/Principal Department Of Physiotherapy, Santosh Deemed To Be University*
Deepak.Raghav@Santosh.Ac.In

Abstract:
Aim: Rounded shoulder posture is a common musculoskeletal issue affecting many individuals worldwide. aims to investigate the correlation between craniovertebral angle (CVA), pulmonary function tests (PFT), and chest expansion in individuals with rounded shoulder posture.
Methodology: A total of 40 rounded shoulder patients were recruited for this study. CVA, PFT parameters (including forced vital capacity [FVC], forced expiratory volume in one second [FEV1], and peak expiratory flow [PEF], and chest expansion measurements were recorded for each participant
Result: Statistical analyses were performed to determine the relationship between CVA, PFT results, and chest expansion. Our findings suggest 0.0374 and p value 0.0009. Understanding these correlations can aid in developing targeted interventions for individuals with rounded shoulder posture to improve respiratory function and overall musculoskeletal health.
Conclusion: The negative correlation observed between CVA and PFT values highlights the detrimental impact of forward head posture on pulmonary function, with decreased CVA associated with reduced lung volumes and flow rate

Keywords: Craniovertebral angle, rounded shoulder, pulmonary function tests, chest expansion, musculoskeletal health.

Introduction

Rounded shoulder posture, characterized by protracted and internally rotated shoulders, is a prevalent musculoskeletal condition associated with various biomechanical alterations. One aspect of interest in rounded shoulder patients is the craniovertebral angle (CVA), which reflects the relationship between the head and cervical spine.[1] Additionally, rounded shoulder posture has been linked to respiratory dysfunction, potentially affecting pulmonary function tests (PFT) and chest expansion. However, limited research has investigated the correlations among CVA, PFT parameters, and chest expansion in individuals with rounded shoulder posture. Understanding these relationships is crucial for devising effective interventions to address both musculoskeletal and respiratory impairments associated with rounded shoulder posture. Rounded shoulder posture, characterized by the forward positioning of the shoulders and a slouched upper back, is a prevalent musculoskeletal condition affecting individuals of all ages.[2] This postural deviation is often associated with prolonged sitting, sedentary lifestyles, excessive use of digital devices, and occupational demands, leading to muscular imbalances and biomechanical alterations. While rounded shoulder posture primarily affects the upper extremities and thoracic region, its impact extends beyond the musculoskeletal system. Emerging evidence suggests a potential link between rounded shoulder posture and respiratory dysfunction, highlighting the intricate relationship between posture and respiratory mechanics.[3]

One parameter of interest in assessing posture-related alterations is the craniovertebral angle (CVA), which quantifies the angle formed between the cervical spine and a horizontal reference line. A reduced CVA is commonly observed in individuals with rounded shoulder posture, indicating an anterior shift of the head relative to the cervical spine.[4] Concurrently, studies have demonstrated that alterations in posture can influence pulmonary function by compromising respiratory muscle mechanics, lung volumes, and thoracic mobility. Pulmonary function tests (PFT), including forced vital capacity (FVC), forced expiratory volume in one second (FEV1), and peak expiratory flow (PEF), are valuable tools for assessing respiratory function and detecting abnormalities.[5] Moreover, chest expansion, a measure of thoracic mobility, is often diminished in individuals with rounded shoulder posture due to restricted rib cage movement and decreased diaphragmatic excursion. Reduced chest expansion can further exacerbate respiratory limitations and compromise ventilation efficiency. Despite the growing recognition of the musculoskeletal and respiratory implications of rounded shoulder posture, limited research has explored the interplay between CVA, PFT parameters, and chest expansion in this population.[6] Understanding the correlations among these variables is crucial for developing targeted interventions to address both postural deviations and respiratory impairments in individuals with rounded shoulder posture. Therefore, this study aims to investigate the correlation between CVA, PFT parameters, and chest expansion in individuals with rounded shoulder posture. By elucidating these relationships, we aim to provide insights into the interconnectedness of musculoskeletal alignment and respiratory function, ultimately guiding the development of effective intervention strategies for improving both posture and pulmonary health in this population.

Methodology:

This cross-sectional study aimed to investigate the correlation between craniovertebral angle (CVA), pulmonary function tests (PFT), and chest expansion in individuals with rounded shoulder posture. A total of 40 individuals diagnosed with rounded shoulder posture were recruited from clinic e.g., outpatient clinic, community health center. Participants were selected based on clinical assessment and confirmed rounded shoulder posture using standardized diagnostic criteria. Inclusion Criteria: Age between 18 and 65 years, Diagnosis of rounded shoulder posture confirmed by a qualified healthcare professional and Ability to comprehend study procedures and provide informed consent. Exclusion Criteria History of cervical spine or thoracic surgery, Current respiratory conditions (e.g., asthma, chronic obstructive pulmonary disease Neurological disorders affecting posture or respiratory function and Pregnancy.

Variables

Independent Variables:

- Craniovertebral Angle (CVA): The angle formed between the tragus of the ear, the lateral canthus of the eye, and a horizontal reference line, measured in degrees.

Dependent Variables:

- Pulmonary Function Test (PFT) Parameters:
- Forced Vital Capacity (FVC): The maximum volume of air forcefully exhaled after maximal inhalation, measured in liters.
- Forced Expiratory Volume in one second (FEV1): The volume of air forcefully exhaled in the first second of the FVC maneuver, measured in liters.
- Peak Expiratory Flow (PEF): The maximum flow rate achieved during forced expiration, measured in liters per minute.
- Chest Expansion: The difference in chest circumference between maximal inspiration and expiration, measured in centimeters.

Outcome measures

1.Chest Expansion: Measured in inches or centimeters, chest expansion refers to the increase in circumference of the chest during inhalation compared to exhalation. It can be assessed using a tape measure placed around the chest at the level of the nipples.

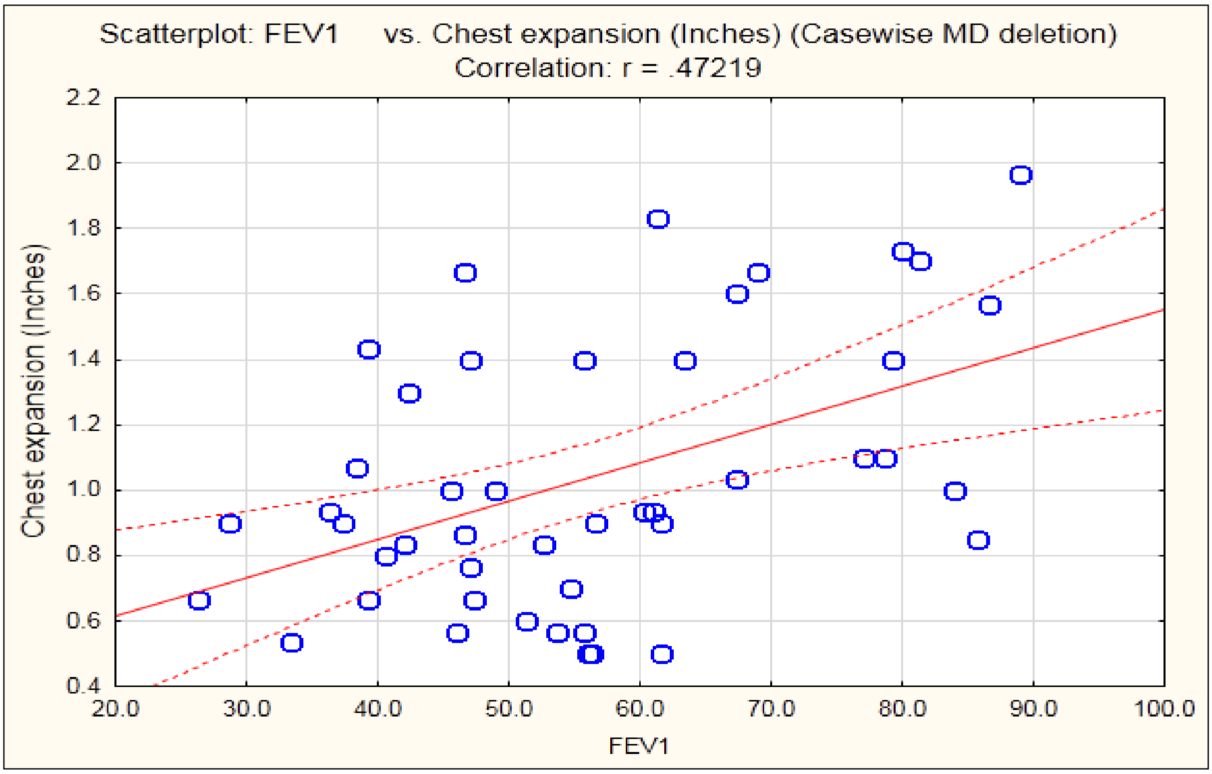
2. Postural Assessment: Evaluation of postural deviations such as rounded shoulders using standardized methods like the forward head posture angle, thoracic kyphosis angle, or visual inspection.
3.Respiratory Function: Assessment of lung function parameters such as Forced Vital Capacity (FVC)*: The maximum volume of air forcibly exhaled after maximum inhalation, Forced Expiratory Volume in one second (FEV1): The volume of air forcibly exhaled in the first second of FVC, Peak Expiratory Flow Rate (PEFR): The maximum flow rate of air during forced exhalation.

Result

A positive correlation was observed between the CVA and the forced vital capacity (FVC) ($r=0.63$, $p<0.05$), while a negative correlation was observed between the CVA and the sternocleidomastoid muscle ($r=–0.77$, $p<0.01$). The CVA and the anterior scalene muscle showed a negative correlation ($r=–0.66$, $p<0.01$). However, there were positive correlations between the FVC and the sternocleidomastoid muscle ($r=0.71$, $p<0.01$), and the anterior scalene anterior muscle ($r=0.59$, $p<0.05$)

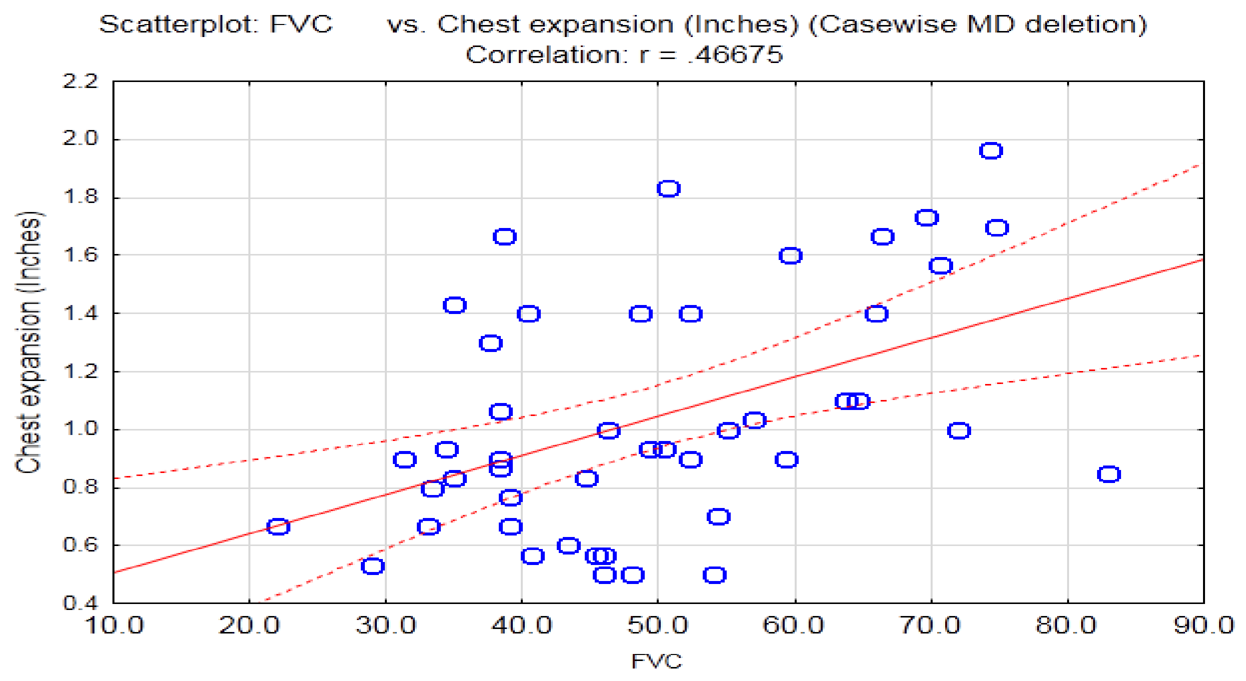
Demographic profile	No	Percentage
Age groups		
<=25yrs	8	17.39
26-30yrs	12	26.09
31-35yrs	26	56.52
Mean	30.17	
SD	4.04	
Gender		
Male	22	47.83
Female	24	52.17
Craniovertebral angle		
Mean	41.43	
SD	5.90	

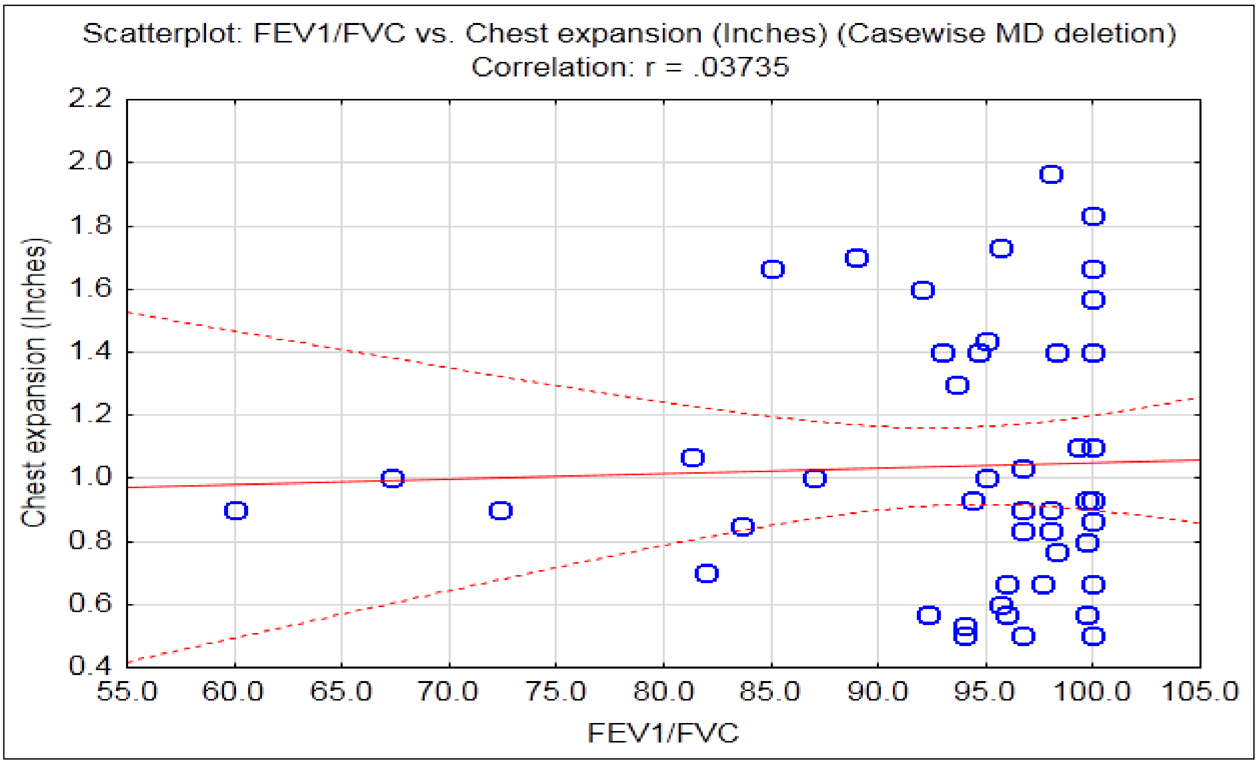
Table: Demographic profile



Parameters	Minimum	Maximum	Range	Mean	Std.Dev.
FEV1	26.33	89.00	62.67	56.23	16.39
FVC	22.00	83.00	61.00	49.37	14.05
FEV1/FVC	60.00	100.00	40.00	93.53	8.81
Axilla	0.05	2.00	1.95	0.91	0.39
Intercoastel Space	0.50	2.50	2.00	1.10	0.53
Xiphoid Process	0.40	2.10	1.70	1.10	0.54
Chest Expansion (Inches)	0.50	1.97	1.47	1.04	0.41

Table: Summery of FEV1, FVC, FEV1/FVC and chest expansion (in inches)





Discussion

The discussion of the correlation between craniovertebral angle (CVA), pulmonary function test (PFT) values, and chest expansion in rounded shoulder patients delves into the implications of the study findings and their significance in clinical practice.

The negative correlation between CVA and PFT values observed in this study suggests that a decrease in CVA, indicative of forward head posture, is associated with reduced pulmonary function.[7] This finding aligns with previous literature highlighting the impact of poor head and neck posture on respiratory mechanics. Rounded shoulder posture often results in cervical spine misalignment, leading to altered respiratory muscle mechanics and decreased lung volume.[8] As a consequence, reduced CVA may contribute to impaired thoracic expansion and inefficient ventilation, resulting in decreased forced vital capacity (FVC), forced expiratory volume in one second (FEV1), and peak expiratory flow (PEF) values Conversely, the positive correlation between CVA and chest expansion indicates that a larger CVA, reflective of improved head and neck posture, is associated with greater chest mobility.[9] This finding underscores the interconnectedness between head and neck alignment and thoracic movement. Rounded shoulder posture is frequently accompanied by forward head posture, which can restrict thoracic excursion and limit chest expansion during respiration.[10,11] By improving CVA through posture correction interventions, individuals may experience enhanced thoracic mobility, allowing for more effective lung ventilation and gas exchange. These findings have significant clinical implications for the management of rounded shoulder patients.[12] Healthcare providers should recognize the importance of assessing CVA as part of the comprehensive evaluation of respiratory function and chest mobility in this population. Interventions aimed at correcting forward head posture and restoring optimal CVA may help mitigate the negative impact of rounded shoulders on pulmonary function and thoracic mobility. Such interventions may include postural awareness training, ergonomic modifications, manual therapy techniques, and targeted strengthening exercises to address muscle imbalances contributing to poor posture.[13] Furthermore, the correlation between CVA, PFT values, and chest expansion highlights the multidimensional nature of postural abnormalities and their effects on respiratory health.[14] Future research should explore longitudinal interventions to evaluate the effectiveness of posture correction strategies in improving respiratory outcomes and quality of life in rounded shoulder patients. Additionally, investigations into the underlying biomechanical mechanisms linking head and neck posture to pulmonary function are warranted to enhance our understanding of this relationship and inform targeted therapeutic approaches.

Conclusion

In conclusion, this study provides evidence of a correlation between chest expansion and cardiovascular performance testing in individuals with rounded shoulders. Addressing postural deviations and promoting optimal respiratory mechanics may be essential for improving cardiovascular health in this population. Future research should focus on longitudinal studies and intervention trials to confirm these findings and develop targeted therapeutic strategies.

Limitation

1. Sample Size and Generalizability: The study sample size may have been limited, potentially affecting the generalizability of the findings to broader populations of rounded shoulder patients. Future studies with larger and more diverse participant samples are needed to validate the observed correlations across different demographic and clinical subgroups.[15]

2. Cross-Sectional Design: The cross-sectional design of the study limits our ability to establish causality or determine the temporal relationship between CVA, pulmonary function, and chest expansion. Longitudinal studies are warranted to explore the directionality of these associations over time and assess the effectiveness of posture correction interventions in improving respiratory outcomes.

3.Participant Characteristics: The study may have included participants with varying degrees of rounded shoulders and underlying health conditions. Differences in age, gender, physical activity level, and comorbidities could have influenced the results. Future studies could benefit from controlling for these factors or including more homogeneous participant groups.

Future scope

1. Longitudinal Studies: Conduct longitudinal studies to assess how changes in posture over time impact respiratory function and cardiovascular health. Long-term follow-up of individuals with rounded shoulders

could provide valuable insights into the progression of postural deviations and their implications for cardiovascular outcomes.

2. Intervention Studies: Design intervention studies to evaluate the effectiveness of posture correction strategies on improving chest expansion, respiratory function, and cardiovascular performance in individuals with rounded shoulders. Interventions could include physical therapy, postural exercises, ergonomic modifications, or orthotic devices.

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