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PREVALENCE OF UPPER CROSS SYNDROME DUE TO PROLONGED SITTING AMONG FEMALE MADRASSA STUDENTS.

Original Research (ID: 1692)

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ABSTRACT

Background: Upper Cross Syndrome is a common postural imbalance characterized by forward head posture, rounded shoulders, and altered cervical and scapular alignment. Students who remain seated for prolonged periods, especially in non-ergonomic positions, may be at increased risk of developing postural deviations and related musculoskeletal problems.

Objective: To determine the prevalence of Upper Cross Syndrome (UCS) and its association with prolonged sitting among female madrassa students.

Methodology: A cross-sectional observational study was conducted among 314 female madrassa students aged 15–22 years in Sialkot, Pakistan. Participants were assessed using the REEDCO Posture Assessment Scale, Craniovertebral Angle (CVA) measurement, Pectoralis Major Tightness Test (PMTT), and Wall Push-Up Test (WPT). Data were analysed using SPSS version 27. Descriptive statistics were used to determine prevalence, while Spearman correlation and Kruskal-Wallis tests were applied to evaluate associations between variables.

Results: The prevalence of UCS was 15.9% (n=50). The mean REEDCO score was 5.72 ± 1.98, indicating generally normal posture among participants. The mean CVA score was 1.15 ± 0.44. Pectoralis major tightness was observed in 10.8% of participants, while scapular dyskinesis was present in 8.6%. No statistically significant association was found between prolonged sitting duration and UCS ($p > 0.05$). However, a strong positive correlation was observed between CVA and REEDCO scores ($Rs = 0.846$, $p < 0.001$), suggesting that forward head posture contributes substantially to postural deviations associated with UCS.

Conclusion: The prevalence of UCS among female madrassa students was relatively low but clinically significant. Although prolonged sitting duration was not significantly associated with UCS, postural deviations, particularly forward head posture, showed a strong relationship with the syndrome. Early screening and posture correction programs may help prevent future musculoskeletal complications in this population.

Keywords: Upper Cross Syndrome (UCS), Pectoralis Major Tightness Test (PMTT), Wall Push-Up Test (WPT), Craniovertebral Angle (CVA), REEDCO Posture Assessment Scale, Spearman Correlation Coefficient (Rs).

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INTRODUCTION

Upper Cross Syndrome (UCS) is a musculoskeletal postural disorder caused by an imbalance between shortened, overactive muscles and weakened antagonistic muscles, a concept first described by Janda (1). It is characterized by tightness of the upper trapezius, levator scapulae, sternocleidomastoid, and pectoral muscles, along with weakness of the deep cervical flexors, lower trapezius, rhomboids, and serratus anterior, resulting in forward head posture, rounded shoulders, elevated scapulae, and increased thoracic kyphosis (1, 2). These postural alterations affect both static and dynamic cervical and shoulder girdle mechanics, causing abnormal loading of joints, ligaments, and soft tissues, which may lead to chronic muscular strain, joint dysfunction, neck and shoulder pain, stiffness, reduced range of motion, fatigue, tension headaches, and occasionally upper limb paraesthesia due to thoracic outlet compression (1, 3-5). UCS develops through multiple factors, including prolonged poor posture, sedentary lifestyles, extensive academic and occupational activities, smartphone and laptop use associated with "text neck," repetitive sports or vocational tasks, inadequate ergonomic awareness, and psychological stress that increases upper trapezius and levator scapulae activity (1, 6, 7). Clinically, individuals with UCS demonstrate reduced craniovertebral angle, rounded shoulders, scapular winging, pectoral and cervical muscle tightness, weakness of cervical and scapular stabilizers, altered scapulothoracic rhythm, and compensatory activation of accessory muscles, contributing to ongoing dysfunction (1, 2, 4). Research has also identified impaired proprioception, balance, and sensorimotor control in affected individuals, which can compromise upper limb function, stability, and safety during daily activities (2). The syndrome significantly affects quality of life, with studies reporting associations with difficulty lifting objects (OR 2.23), performing self-care activities (OR 2.30), and disturbed sleep (OR 1.76), while chest and cervical muscle tightness may further impair respiratory mechanics and increase fatigue(4, 7).

Environmental and lifestyle factors such as prolonged non-ergonomic sitting, lack of posture breaks, poor workstation design, physical inactivity, and sustained anterior chain activity contribute substantially to its development, whereas physically active individuals appear less susceptible (6, 7). Epidemiological studies report varying prevalence rates, including 10.97% among middle-school students in Delhi (1), 31.3% among Pakistani undergraduate students (6), and 6.1% among working women in Karachi (7), indicating that risk differs across populations and environments(8). Diagnosis typically involves assessment of craniovertebral angle, pectoralis minor length, cervical flexor endurance, scapular stability through the wall push-up test, manual muscle testing, posture analysis tools, and balance or proprioception evaluations (1, 9). Management focuses on stretching shortened muscles, strengthening weakened stabilizers, implementing posture correction exercises, improving ergonomics, encouraging physical activity, and adopting a multidisciplinary approach involving physiotherapy and occupational health interventions (1, 6, 7) female students may be particularly vulnerable to UCS because they spend prolonged periods sitting on the floor in flexed postures without ergonomic support and often have limited opportunities for physical activity; however, no previous research has investigated UCS prevalence in this population. Given the established relationship between prolonged sitting, poor ergonomics, and postural dysfunction, studying UCS among female madrassa students is important for developing targeted preventive and corrective strategies to improve their musculoskeletal health and overall well-being (4, 6, 7).

METHODS

This study was conducted using an observational cross-sectional design to assess postural deviations and associated factors among female madrassa students. A non-probability convenient sampling technique was applied to recruit participants based on accessibility and willingness. The sample size was calculated using Rao Soft software, considering a 95% confidence level, a population size of 1713, and a response distribution of 50%. The recommended sample size obtained was 314 participants. The study was completed over a period of six months after obtaining formal approval from the research committee. During this duration, all phases of the research, including proposal approval, data collection, data entry, analysis, and report writing, were systematically carried out(10, 11). The study setting included various madrassas in Sialkot, from where data were collected. Participants were selected based on predefined inclusion and exclusion criteria. Inclusion criteria included female madrassa students aged 15–22 years, those who sat continuously for at least four hours daily for religious studies, and those willing to participate by providing informed consent(3). Exclusion criteria included individuals with a history of recent upper body trauma, acute musculoskeletal conditions, congenital postural or structural deformities, or any recent treatment, spinal surgery, or use of painkillers(12, 13).

Data collection involved demographic information and multiple assessment tools. The REEDCO Posture Assessment Scale was used to evaluate posture. This standardized tool assesses postural traits from sagittal and coronal views. However, only five relevant traits (neck, upper back, head, shoulders, and spine) were considered in this study due to their association with upper cross syndrome. Each trait was scored as 10 (good), 5 (fair), or 0 (poor), indicating the level of postural deviation. The tool has demonstrated strong reliability and

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validity in previous studies.(14) The Pectoralis Major Tightness Test was performed in a supine position, where participants placed their hands behind the head and lowered their elbows toward the table as shown in figure 1. Failure of the elbows to touch the surface indicated muscle tightness, which was recorded either positive or negative.(1)

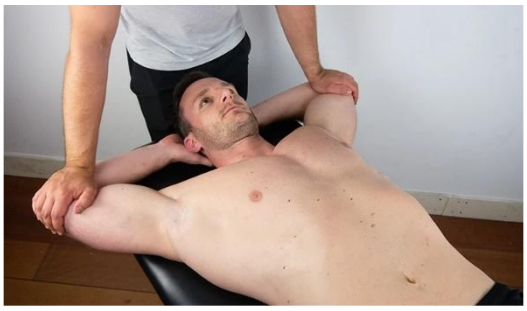

Figure 1: Pectoralis Major Test

The craniovertebral angle (CVA) was measured using a goniometer to assess forward head posture. The angle was determined by marking the C7 spinous process and the tragus of the ear, with the goniometer aligned accordingly. A normal CVA is approximately 49.9°, and smaller angles indicate increased forward head posture severity.(15) Additionally, the wall push-up test was used to assess scapular dyskinesis. Participants performed wall push-ups while maintaining proper posture, and scapular movement was observed. The result was recorded as either present or absent, indicating abnormal scapular motion(6, 16). For data collection, informed consent was obtained prior to assessment. All participants were evaluated using the selected tools, and demographic data were recorded. Data were entered and analyzed using SPSS version 27. Descriptive statistics such as mean, standard deviation, and frequency distribution were calculated, while appropriate inferential tests spearman correlation and Mann–Whitney U test were applied to determine associations between variables and to evaluates whether there is a significant difference in the distribution of scores between the groups. Ethical considerations were strictly followed. Participants were informed about the purpose, procedures, risks, and benefits of the study before obtaining consent. Confidentiality of participant data was maintained throughout the research(17).

RESULTS

A total of 314 female madrassa students were included in the analysis. The participants were aged 15–22 years, with the largest proportion belonging to the 20–22 years age group (n = 119, 37.9%), followed by 15–17 years (n = 111, 35.4%) and 18–19 years (n = 84, 26.8%). Regarding daily sitting duration, 166 participants (52.9%) reported sitting for more than five hours, while 148 participants (47.1%) reported sitting for four to five hours. Postural assessment showed that normal alignment was observed in most participants across all assessed domains. Head posture was normal in 284 participants (90.4%), while mild and severe deviations were present in 20 (6.4%) and 10 (3.2%) participants, respectively. Shoulder posture was normal in 282 participants (89.8%), with mild deviation in 20 (6.4%) and severe deviation in 12 (3.8%). Neck posture was normal in 275 participants (87.6%), whereas mild and severe deviations were found in 31 (9.9%) and 8 (2.5%) participants, respectively. Upper back posture was normal in 280 participants (89.2%), with mild deviation in 25 (8.0%) and severe deviation in 9 (2.9%). Spinal alignment was normal in 275 participants (87.6%), while mild and severe deviations were observed in 27 (8.6%) and 12 (3.8%) participants, respectively. Craniovertebral angle assessment showed normal findings in 278 participants (88.5%), while reduced craniovertebral angle was present in 36 participants (11.5%), including 26 (8.3%) with mild and 10 (3.2%) with severe abnormality.

Clinical assessment findings showed that pectoralis major tightness was present in 34 participants (10.8%) and absent in 280 participants (89.2%). Scapular dyskinesis, assessed through the Wall Push-Up Test, was observed in 27 participants (8.6%), while 287 participants (91.4%) had negative findings. Overall, Upper Cross Syndrome was identified in 50 participants, giving a prevalence of 15.9% among the study population. Among affected participants, 30 (9.6%) had mild Upper Cross Syndrome and 20 (6.3%) had severe Upper Cross Syndrome, while 264 participants (84.1%) had no evidence of the syndrome. The composite postural scores showed a mean REEDCO total score of 5.72 ± 1.98, with scores ranging from 5 to 15. The mean craniovertebral angle score was 1.15 ± 0.44, with scores ranging from 1 to 3. Spearman correlation analysis showed no statistically significant association between daily sitting duration and REEDCO total score ($R_s = 0.055$, $p = 0.328$), craniovertebral angle score ($R_s = 0.018$, $p = 0.750$), or Upper Cross Syndrome classification ($R_s = 0.062$, $p = 0.272$). Age was also not significantly correlated with REEDCO total score ($R_s = 0.102$, $p = 0.071$), craniovertebral angle score ($R_s = 0.107$, $p = 0.057$), or Upper Cross Syndrome classification ($R_s = 0.097$, $p = 0.087$). A statistically significant positive correlation was observed between craniovertebral angle score and REEDCO total score ($R_s = 0.846$, $p < 0.001$), showing that higher craniovertebral angle abnormality scores were associated with higher overall postural deviation scores.

Comparison between participants with and without Upper Cross Syndrome showed that the mean REEDCO total score was higher among participants with Upper Cross Syndrome than those without the syndrome (9.50 ± 2.76 vs. 5.00 ± 0.00; $U = 13200.0$, $p < 0.001$). Similarly, the mean craniovertebral angle score was higher among participants with Upper Cross Syndrome than those without the syndrome (1.92 ± 0.70 vs. 1.00 ± 0.00; $U = 11352.0$, $p < 0.001$). The effect size was large for both REEDCO total score ($r = 1.000$) and craniovertebral angle score ($r = 0.720$). When Upper Cross Syndrome was compared across sitting-duration categories, the prevalence was higher among students who sat for more than five hours daily than among those who sat for four to five hours daily (18.1% vs. 13.5%). However, this difference was not statistically significant (OR = 1.41, 95% CI: 0.76–2.61; $p = 0.270$).

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Table 1. Demographic Characteristics and Sitting Duration of Participants

Variable	Category	Frequency (n)	Percentage (%)
Age group	15–17 years	111	35.4
	18–19 years	84	26.8
	20–22 years	119	37.9
Daily sitting duration	4–5 hours	148	47.1
	More than 5 hours	166	52.9
Total		314	100.0

Table 2. Postural and Clinical Assessment Findings

Assessment item	Normal/Negative n (%)	Mild n (%)	Severe n (%)	Positive/Abnormal n (%)
Head posture	284 (90.4)	20 (6.4)	10 (3.2)	30 (9.6)
Shoulder posture	282 (89.8)	20 (6.4)	12 (3.8)	32 (10.2)
Neck posture	275 (87.6)	31 (9.9)	8 (2.5)	39 (12.4)
Upper back posture	280 (89.2)	25 (8.0)	9 (2.9)	34 (10.8)
Spine posture	275 (87.6)	27 (8.6)	12 (3.8)	39 (12.4)
Craniovertebral angle	278 (88.5)	26 (8.3)	10 (3.2)	36 (11.5)
Pectoralis Major Tightness Test	280 (89.2)	—	—	34 (10.8)
Wall Push-Up Test	287 (91.4)	—	—	27 (8.6)

Table 3. UCS Prevalence and Association Analysis

Variable/Analysis	Frequency / Statistic	Percentage / p-value
No UCS	264	84.1%
Mild UCS	30	9.6%
Severe UCS	20	6.3%
Total UCS prevalence	50	15.9%
Sitting hours vs REEDCO total score	Rs = 0.055	p = 0.328
Sitting hours vs CVA score	Rs = 0.018	p = 0.750
Sitting hours vs UCS classification	Rs = 0.062	p = 0.272
CVA score vs REEDCO total score	Rs = 0.846	p < 0.001

Table 4: Association Between Daily Sitting Duration and Upper Cross Syndrome

Daily sitting duration	UCS present n (%)	UCS absent n (%)	Total n (%)	Odds ratio (95% CI)	p-value
4–5 hours	20 (13.5)	128 (86.5)	148 (100.0)	Reference	—
More than 5 hours	30 (18.1)	136 (81.9)	166 (100.0)	1.41 (0.76–2.61)	0.270
Total	**50 (15.9)**	**264 (84.1)**	**314 (100.0)**	—	—

Test applied: Pearson chi-square test.

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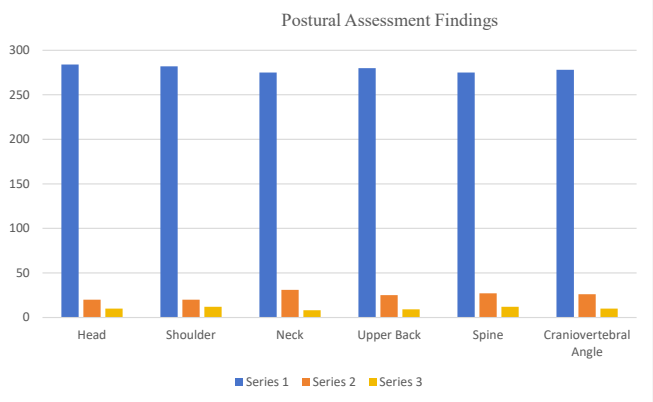

Figure 2: REEDCO Posture Score

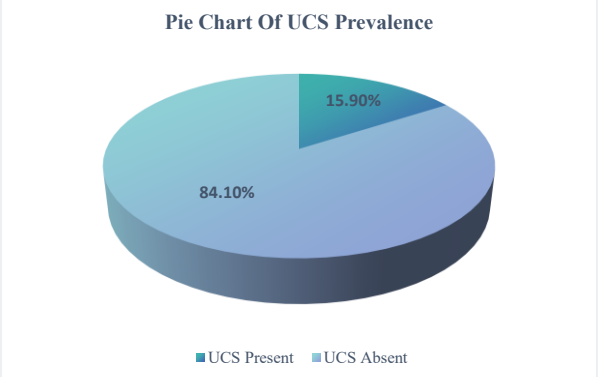

Figure 3. Pie Chart of UCS Prevalence

DISCUSSION

The present study assessed the prevalence of Upper Cross Syndrome (UCS) among 314 female madrassa students and found an overall prevalence of 15.9%, with 9.6% mild and 6.4% severe cases. This prevalence indicates that although the majority of participants demonstrated normal posture, a clinically important proportion exhibited postural deviations associated with UCS. These findings are comparable to those reported by Tomar et al. (10.97%)(1) and Pathan et al. (9%)(18), but lower than the prevalence reported among undergraduate students by Khan et al. (31.3%)(6), suggesting that differences in lifestyle, physical activity, and study environments may influence UCS occurrence. Analysis of postural components showed that deviations were most common in the neck and spine, while rounded shoulders and forward head posture were also observed. Approximately 11.5% of participants demonstrated reduced craniovertebral angles, indicating forward head posture. These findings support previous research by Khosravi et. al (2) showing that prolonged forward-flexed positions contribute to postural imbalance and the development of UCS(19).

The study found no significant association between daily sitting duration and UCS. Participants who sat for longer periods did not demonstrate significantly greater postural deviations than those sitting for fewer hours. This may be explained by the relatively homogeneous nature of the sample, as all participants were exposed to prolonged sitting for at least four hours daily. Therefore, postural quality and biomechanical factors appear to be more influential than sitting duration alone in determining UCS risk. These findings differ from studies by Khawar et al.(3) and Khan et al., (6)which reported a significant relationship between prolonged sitting and postural dysfunction. A major finding of this study was the strong positive correlation between craniovertebral angle (CVA) and REEDCO posture scores ($Rs = 0.846$, $p < 0.001$), indicating that forward head posture is closely associated with overall postural deviation. These findings align with Khosravi et al.(2) who linked reduced CVA to impaired sensorimotor control, and Ghous et al.(20), who reported a significant association between forward head posture and cervicogenic headache.

Clinical assessment also revealed pectoralis major tightness in 10.8% of participants and scapular dyskinesis in 8.6%, supporting the classic muscle imbalance pattern characteristic of UCS, where anterior muscles become tight while posterior stabilizers weaken. Similar findings have been reported in previous studies by Tomar et.al.(1) and Mubashir (7), reinforcing the importance of addressing muscle imbalance through corrective exercise programs. Overall, the findings indicate that forward head posture and muscle imbalance are more important determinants of UCS than sitting duration alone. Early postural screening, ergonomic awareness, stretching of tight muscles, and strengthening of weakened postural muscles should be encouraged among female madrassa students to prevent progression of postural dysfunction and future musculoskeletal complications(21).

However, these findings should be interpreted in light of certain limitations. The cross-sectional design of the study does not allow causal relationships to be established, and the sample was limited to female madrassa students from Sialkot, which may restrict the generalizability of the results to other populations. In addition, sitting duration was assessed through self-report, which may have introduced recall bias, and ergonomic characteristics of the study environment were not evaluated(22). The absence of long-term follow-up also limits understanding of the progression of postural changes over time. Future research should therefore employ longitudinal designs, include participants from diverse regions and educational settings, and incorporate both male and female students to provide broader evidence regarding UCS prevalence and risk factors. Furthermore, the implementation of posture education programs, ergonomic sitting arrangements with appropriate back support and desks, and regular stretching breaks may help reduce the risk of postural dysfunction. Routine screening initiatives conducted by physiotherapists could also facilitate early identification and management of UCS, thereby promoting better musculoskeletal health among students.

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CONCLUSION

The study concluded that Upper Cross Syndrome was present in a moderate proportion (15.9%) of female madrassa students. Although prolonged sitting duration was not significantly associated with UCS, forward head posture and muscle imbalances were key contributing factors. Early identification and correction of postural deviations are essential to prevent future musculoskeletal complications.

AUTHOR CONTRIBUTION

Author Name	Role
Husna*	Project Administration, Investigation, Data Curation, Formal Analysis, Visualization, Writing – Original Draft, Writing – Review & Editing
Dr. Sadaf Waris	Methodology, Validation, Supervision, Visualization, Writing – Review & Editing
Hadia Jabbar	Conceptualization, Methodology, Software, Data Curation, Investigation, Writing – Review & Editing
Areej Jahanzaib	Methodology, Investigation, Resources, Writing – Review & Editing
Mubeen Shabbir	Investigation, Methodology, Data Curation
Alishba Tanveer	Conceptualization, Methodology, Resources, Investigation
Dr. Raveena Rajpoot	Resources, Project Administration, Validation

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