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Research Article

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Prevalence of Upper Cross Syndrome and Pre-Presbyopic Symptoms Among Handloom Cluster of West Bengal

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Abstract

Background: The repetitive and posture-intensive nature of handloom work imposes significant physical strain, leading to various occupational health issues. This study explores the incidence of Upper Cross Syndrome (UCS) and pre-presbyopic symptoms among West Bengal handloom workers and examines their interrelation.

Materials & Methods: In this cross-sectional study, 400 handloom workers from different West Bengal clusters participated. The Neck Disability Index (NDI), REEDCO Posture Score (RPS), and Numeric Pain Rating Scale (NPRS) were used to evaluate the prevalence of UCS. For pre-presbyopic symptoms, visual tests like Monocular Estimation Method (MEM) and Near Visual Acuity (NVA). The data were analyzed using SPSS 23.0 software.

Results: Among 400 handloom workers, most reported neck pain, postural dysfunction, and mild to moderate neck disability, with males more affected. Pain (NPRS) correlated negatively with posture (REEDCO, $r = -0.71$) and positively with disability (NDI, $r = 0.599$). Common findings included muscle tightness and weakness in the neck and shoulder girdle, with restricted cervical and shoulder movements. Workers aged 30–39 years showed early presbyopia ($p < 0.01$) linked to reduced near vision and higher MEM values.

Keywords: Upper Cross Syndrome; Pre-presbyopic symptoms; Handloom

Introduction

The general health of the workers is closely linked to everyday living. The handloom industry operates in an informal setting with potentially hazardous health consequences due to the nature of the job. Additionally, there are several workplace-related safety-related difficulties. Handloom weaving involves a variety of operations that require repetitive motions of the upper and lower extremities to handle shuttles and pedals while raising the arms off the body. Approximately 70% of employees lack insurance that would cover them in the event of an injury or illness at work. The handloom industry operates in an informal setting where employees are susceptible to health risks related to their line of work. West Bengal's traditional craft of handloom weaving is essential to the region's economy and culture. Workers in these clusters do complex operations including threading, pattern design, and fabric inspection that require a great deal of close-up work. These visual tasks' length and intensity, along with their frequently difficult working environments, might worsen eye strain and hasten the start of pre-presbyopia [1]. Upper cross syndrome is a condition commonly resulting from poor posture. It

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is identified by the tension in certain upper body muscles, including the pectoralis major, upper trapezius, and levator scapulae, alongside weakness in other muscles such as the deep neck flexors, middle and lower trapezius, and serratus anterior [2]. The symptoms of upper crossed syndrome (UCS) include imbalances in the muscles of the head and shoulders. People who sit or work in sitting for extended periods of time often have this oppressive unevenness and constantly have poor posture [3]. Pre-presbyopic symptoms refer to early accommodative fatigue and reduced near-vision performance occurring before the age of 40. The most common cause of vision impairment worldwide is untreated presbyopia, an age-related public health concern that affects close-vision tasks due to reduced ability of the lens to adjust focus. Global estimates indicate that approximately 1.8 billion people are affected by presbyopia, of whom 826 million experience poor near vision because of insufficient or nonexistent vision correction [4]. Among individuals over the age of 30, the prevalence of uncorrected presbyopia varies from 28.1% to 63%, and this figure is projected to increase as the proportion of older adults rises [5]. Presbyopia represents an age-related decline in the accommodative ability of the crystalline lens, resulting in difficulty with near focusing [6].

Materials and Methods

Aims & Objectives

To determine the prevalence of Upper Cross Syndrome (UCS) and pre-presbyopic symptoms among handloom workers of West Bengal and to examine whether there is any correlation between the two conditions.

Objectives:

1. To estimate the prevalence of Upper Cross Syndrome using standardized musculoskeletal assessment tools.
2. To determine the prevalence of pre-presbyopic symptoms using near-vision and accommodative tests.
3. To analyse the association, if any, between UCS indicators and pre-presbyopic findings.

Need of Study

The increased incidence of Upper Cross Syndrome and pre-presbyopia among handloom workers, which is brought on by repetitive motions and inadequate ergonomic measures, makes this study crucial. To improve quality of life and enable early interventions, it seeks to address the underdiagnosis and lack of knowledge of these disorders. Furthermore, comprehensive preventive and therapeutic methods that improve workers' health and productivity can be informed by an awareness of the association between these conditions.

Hypothesis

Alternative Hypothesis

- A notable prevalence of Upper Cross Syndrome and pre-presbyopic symptoms exists among handloom workers.
- There is a relationship between Upper Cross Syndrome and pre-presbyopic symptoms.

Null Hypothesis

- No significant prevalence of Upper Cross Syndrome or pre-presbyopic symptoms exists among handloom workers.
- There is no significant relationship between Upper Cross Syndrome and pre-presbyopic symptoms.

Methodology

This study adopts a cross-sectional research design, concentrating on the handloom clusters of West Bengal. The objective of the study was to be explained to all participants. All participants have given their informed consent before participating in the study. The data collection period was from December 2023 till July 2024.

Inclusion Criteria

- The Handloom workers ranging between the age of 20 -40 years were selected.
- BCVA of 6/6 in both eyes.

Exclusion Criteria

- Participants who have anisometropia and binocular vision anomaly were excluded.
- Participants who were aphasic were also excluded as well as those with systemic or ocular diseases that would impair their ability to accommodate were not included in the study.
- Participants were excluded if they were pregnant, had recent surgeries or traumatic injuries, had previously diagnosed orthopedic or neurological conditions, or were physically handicapped

Outcome Measures

Numeric Pain Rating Scale:

Pain intensity was measured using the 11-point NPRS, ranging from 0 (“no pain”) to 10 (“worst imaginable pain”). The scale demonstrates high test–retest reliability and construct validity [7,8].

Reedco Posture Score (Rps):

The REEDCO Posture Score (RPS) is a tool used to analyze posture by examining the body from head to toe in both frontal and side views. In the coronal view (from behind), ten postural traits are assessed, including the head, shoulders,

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spine, hips, and ankles. In the sagittal view (from the side), traits such as the neck, upper back, trunk, abdomen, and lower back are observed. Scoring system ranges from 0 (indicating poor posture or a significant deviation) to 10 (indicating good posture). A score between 0 and 5 suggests poor or fair posture, while a score of 59% or lower is considered postural dysfunction [9].

Neck Disability Index (NDI):

A questionnaire consisting of 10 items, it's a patient's self-reported disability linked to neck pain. It was based on the Oswestry Low Back Pain Disability Questionnaire and was the first of its kind when it was published in JMPT in 1991. The same author reviewed the NDI in 2008. The most popular, longest running, and most translated neck pain questionnaire is the NDI. Its "test- retest" dependability has been demonstrated to be high. When compared to other pain and disability measures, the validity of the NDI has also been demonstrated [10].

Range of Motion (ROM):

Goniometry is a tool for the assessment of range of motion (ROM)of joints, a crucial instrument in evaluating joint movement. It is not just important for sports performance but also for orthopaedics and rehabilitation, where it is crucial for pathology diagnosis, tracking pathology progression, and prognosis prediction [11].

Manual Muscle Testing (MMT):

It is technique for evaluating muscle strength. It involves assessing each muscle group on both sides of the body [12].

Monocular Estimation Method (MEM):

The monocular estimate method (MEM) is a type of dynamic retinoscopy commonly used to objectively assess the accommodative response. The typical values range from +0.25 to +0.50 diopters [13].

Near Visual Acuity (NVA):

It is the capacity to see and discern text or small things at close range. Near vision is usually measured using a printed card held at a standard distance, whereas visual acuity is mostly related to distance vision and is evaluated using charts like Snellen or LogMAR. Paragraphs, sentences, characters, or symbols in various sizes can be found on these cards. It is typically carried out following distant visual acuity correction. It might be challenging to see well up close because to conditions like cycloplegia, accommodative inadequacy, and presbyopia. If visual acuity is less than N6 or M0.8 at 40 cm, the World Health Organization defines near vision as impaired [14].

Pre-Presbyopia Cutoffs:

- MEM values > +0.75D
- Near vision is poorer than N6 at 40 cm
- Symptoms before age 40

Upper Cross Syndrome Thresholds:

UCS considered present if ≥3 of the following criteria is met:

1. REEDCO < 59% (postural dysfunction)
2. NDI ≥ Mild disability
3. Muscle imbalance pattern (tightness of pectorals/upper trapezius + weakness of deep neck flexors/scapular stabilizers)
4. ROM restriction in ≥2 cervical movements

Procedure

Assessment Procedures

Occupational and Demographic Information: Age, gender, length of employment, postural traits, and job duties were noted.

Visual Acuity Assessment: Using the Snellen chart at 2.5 meters, distance visual acuity was measured monocularly under controlled indoor illumination. The test was stopped at 6/6 acuity. The Bailey-Lovie chart was used to measure near visual acuity monocularly at 40 cm.

Dynamic Retinoscopy (MEM): MEM was performed at 40 cm using standard near targets to determine accommodative response.

Pain Evaluation: Pain intensity was recorded using the NPRS.

Posture Evaluation: Postural deviations were assessed using the REEDCO Posture Score.

Neck Disability Assessment: Functional impairment due to neck symptoms was evaluated using the NDI.

Muscle Strength Assessment: Cervical and shoulder girdle muscle strength was evaluated bilaterally using Manual Muscle Testing.

Range of Motion: Cervical and shoulder joint ROM was assessed using a universal goniometer.

"Ethical approval was obtained from the Institutional Ethics Committee, and all participants provided written informed consent before data collection."

Data Analysis

The study was a cross-sectional design, and all statistical analysis was conducted using SPSS 23.0 software. Descriptive statistics were presented using frequency, percentage, mean, and standard deviation.

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Result

Tables 1 and 2 show that both males and females predominantly reported mild to moderate pain and neck disability. Postural dysfunction was more common in males, while females showed slightly lower rates of severe disability. Overall, the trend indicates a high burden of musculoskeletal symptoms among workers, without repeating the detailed values presented in the tables.

Table 1: NPRS, REEDCO, NDI frequency among Females.

		Frequency	Percentage
NPRS	Mild	89	42.2
	Moderate	50	39.1
	Severe	21	35
	Worst	0	0
REEDCO	Postural dysfunction	37	9.25
	No postural dysfunction	123	30.75
NDI	No disability	13	3.25
	Mild	101	25.25
	Moderate	39	9.75
	Severe	15	3.75
	Complete	1	1

Table 2: NPRS, REEDCO, NDI frequency among Males.

		Frequency	Percentage
NPRS	Mild	122	57.8
	Moderate	78	60.9
	Severe	39	65
	Worst	1	1
REEDCO	Postural dysfunction	59	14.75
	No postural dysfunction	181	45.25
NDI	No disability	18	4.5
	Mild	147	36.75
	Moderate	66	16.5
	Severe	9	2.25
	Complete	0	0

According to table 3, NPRS i.e pain is negatively correlated with REEDCO i.e. posture and positively correlated with NDI which means with worse the posture and the neck disability, the pain will increase accordingly and vice versa. The pain, posture and neck disability are all significantly correlated.

Table 3: Correlation among NPRS, REEDCO, NDI.

		NPRS	REEDCO	NDI
NPRS	Correlation Coefficient	1	-.714**	.599**
	Sig. (2-tailed)	.	0	0
	N	400	400	400
REEDCO	Correlation Coefficient	-.714**	1	-.707**
	Sig. (2-tailed)	0	.	0
	N	400	400	400
NDI	Correlation Coefficient	.599**	-.707**	1
	Sig. (2-tailed)	0	0	.

Table 4: Correlation of gender with NPRS, REEDCO, NDI.

		Gender	NPRS	REEDCO	NDI
Gender	Correlation Coefficient	1	-0.054	0.022	-0.024
	Sig. (2-tailed)	.	0.278	0.661	0.633
	N	400	400	400	400
NPRS	Correlation Coefficient	-0.054	1	-.714**	.599**
	Sig. (2-tailed)	0.278	.	0	0
	N	400	400	400	400
REEDCO	Correlation Coefficient	0.022	-.714**	1	-.707**
	Sig. (2-tailed)	0.661	0	.	0
	N	400	400	400	400
NDI	Correlation Coefficient	-0.024	.599**	-.707**	1
	Sig. (2-tailed)	0.633	0	0	.
	N	400	400	400	400

According to Table 4,5 there is no significant correlation of gender and age with NPRS, REEDCO & NDI. This denotes that whether the person is young or aged or whether male or female there is no relation with pain, posture and neck disability.

Both male and female workers exhibited bilateral patterns of muscular imbalance characteristic of Upper Cross Syndrome. Tightness was most pronounced in the pectoral muscles, upper trapezius, levator scapulae, and deep neck flexors, while weakness was more frequent in the middle and lower trapezius, scalene muscles, and serratus anterior. The symmetry of involvement suggests chronic postural adaptations driven by repetitive and sustained work positions typical of handloom weaving. This widespread imbalance

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reflects prolonged biomechanical stress and inadequate ergonomic support in the work environment.

Table 8 above reveals that practically all cervical and shoulder movements had their active range of motion restricted. The most affected areas were cervical flexion, cervical extension, cervical rotation (both right and left), and shoulder extension (both right and left). The least affected areas were shouldering lateral rotation (left and right), and shoulder medial rotation (both left and right). The fact that many ranges are involved shows that the workers' repetitive working postures were causing the ranges to shrink.

Table 5: Correlation of age with NPRS, REEDCO, NDI.

		Age	NPRS	REEDCO	NDI
AGE	Correlation Coefficient	1	-0.016	-0.009	-0.045
	Sig. (2-tailed)	.	0.75	0.858	0.372
	N	400	400	400	400
NPRS	Correlation Coefficient	-0.016	1	-.714**	.599**
	Sig. (2-tailed)	0.75	.	0	0
	N	400	400	400	400
REEDCO	Correlation Coefficient	-0.009	-.714**	1	-.707**
	Sig. (2-tailed)	0.858	0	.	0
	N	400	400	400	400
NDI	Correlation Coefficient	-0.045	.599**	-.707**	1
	Sig. (2-tailed)	0.372	0	0	.
	N	400	400	400	400

The above table shows the number of pre presbyopic patients, along with severity of the disorder and number of males and females affected. From the above table we can compare the male female ratio of the said disorder. As per our data, the number of male patients affected is more than females.

The table indicates that there is no significant relationship between gender and near vision, nor between gender and MEM. Therefore, we can conclude that pre-presbyopia can occur in either gender.

Upper Cross Syndrome indicators showed moderate but significant correlations with pre-presbyopic changes. Higher pain levels and greater neck disability were associated with poorer near vision and greater accommodative lag. Poor posture (low REEDCO scores) also correlated with worsening visual parameters. Muscle tightness of the pectorals, upper trapezius, and levator scapulae showed a positive relationship with accommodative lag, suggesting that altered head–neck posture may influence visual strain. These findings indicate that prolonged forward-head posture and musculoskeletal imbalance may contribute to early onset visual fatigue and accommodative stress among handloom workers.

Table 6: Muscle involvement in males.

MUSCLE NAME	RIGHT TIGHTNESS	RIGHT WEAKNESS	LEFT TIGHTNESS	LEFT WEAKNESS
SUBOCCIPITAL	51.66	48.33	47.91	52.08
SCM	52.08	47.91	47.08	52.91
LEVATOR SCAPULAE	51.66	48.33	47.08	52.91
PECTORALIS MAJOR	47.91	52.08	52.08	47.91
PECTORALIS MINOR	48.33	51.66	52.08	47.91
SCALENE	47.5	52.5	52.08	47.91
UPPER TRAPEZIUS	52.5	47.5	47.5	52.5
MIDDLE TRAPEZIUS	55.83	44.16	44.16	55.83
LOWER TRAPEZIUS	52.91	47.08	47.08	52.91
SERRATUS ANTERIOR	48.75	51.25	51.25	48.75
RHOMBOIDS	50	50	50	50
DEEP NECK FLEXORS	48.75	51.25	51.25	48.75
LATISSIMUS DORSI	49.16	50.83	50.83	49.16

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Table 7: Muscle involvement in females.

MUSCLE NAME	RIGHT TIGHTNESS	RIGHT WEAKNESS	LEFT TIGHTNESS	LEFT WEAKNESS
SUBOCCIPITAL	56.2	43.75	46.5	53.75
SCM	55.62	44.37	46.87	53.12
LEVATOR SCAPULAE	56.25	43.75	46.87	53.12
PECTORALIS MAJOR	46.25	53.75	53.75	46.25
PECTORALIS MINOR	46.25	53.75	54.37	45.62
SCALENE	46.25	53.75	53.75	46.25
UPPER TRAPEZIUS	53.75	46.25	46.25	53.75
MIDDLE TRAPEZIUS	53.12	46.87	46.87	53.12
LOWER TRAPEZIUS	53.75	46.25	46.25	53.75
SERRATUS ANTERIOR	53.75	46.25	46.25	53.75
RHOMBOIDS	50	50	50	50
DEEP NECK FLEXORS	56.87	43.12	43.12	56.87
LATISSIMUS DORSI	56.87	43.12	43.12	56.87

Table 8: Active Ranges affected in both genders.

RANGES	AFFECTED MALE %	AFFECTED FEMALE %
CERVICAL FLEXION	100%	100%
CERVICAL EXTENSION	100%	100%
CERVICAL ROTATION RIGHT	100%	100%
CERVICAL ROTATION LEFT	100%	100%
CERVICAL SIDE FLEXION RIGHT	78.75%	78.75%
CERVICAL SIDE FLEXION LEFT	91.66%	94.37%
SHOULDER FLEXION RIGHT	94.16%	93.75%
SHOULDER FLEXION LEFT	91.66%	90.62%
SHOULDER EXTENSION RIGHT	100%	100%
SHOULDER EXTENSION LEFT	100%	100%
SHOULDER ABDUCTION RIGHT	84.58%	91.87%
SHOULDER ABDUCTION LEFT	84.58%	91.87%
SHOULDER ADDUCTION RIGHT	84.58%	91.87%
SHOULDER ADDUCTION LEFT	84.58%	91.87%
SHOULDER MEDIAL ROTATION RIGHT	0%	0%
SHOULDER MEDIAL ROTATION LEFT	0%	0%
SHOULDER LATERAL ROTATION RIGHT	1.66%	3.13%
SHOULDER LATERAL ROTATION LEFT	1.66%	3.13%

Table 9: Incidence of Pre presbyopia among males & females.

PRE PRESBYOPIA					
AGE GROUP	20- 40 YEARS	MALE	FEMALE	NAVQ SCALE	GRADING
NEAR VISION					
N 8- N 12	120	48	72	1	MILD
N 18- N 24	198	120	78	2	MODERATE
N 36	82	46	36	3	EXTREME
NORMAL - N6	0	0	0	0	
MEM VALUES		MALE	FEMALE		GRADING
1	14	9	5	1	MILD
1.25	65	35	30	2	
1.5	65	47	18	3	MODERATE
1.75	88	51	37	4	
2	98	58	40	5	
2.25	50	26	24	6	SEVERE
2.5	20	14	6	7	
NORMAL - <0.75					

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Table 10: Correlation of Pre presbyopia with gender.

		Gender	Near vision	MEM
Gender	Correlation Coefficient	1	0.022	-0.012
	Sig. (2-tailed)	.	0.654	0.806
	N	400	400	400
Near Vision	Correlation Coefficient	0.022	1	.822**
	Sig. (2-tailed)	0.654	.	0
	N	400	400	400
MEM	Correlation Coefficient	-0.012	.822**	1
	Sig. (2-tailed)	0.806	0	.
	N	400	400	400

Table 11: Correlation of Pre presbyopia with Age.

		Age	Near Vision	MEM
AGE	Correlation Coefficient	1	-.211**	-.184**
	Sig. (2-tailed)	.	0	0
	N	400	400	400
Near Vision	Correlation Coefficient	-.211**	1	.822**
	Sig. (2-tailed)	0	.	0
	N	400	400	400
MEM	Correlation Coefficient	-.184**	.822**	1
	Sig. (2-tailed)	0	0	.
	N	400	400	400

Table 12: Correlation among upper cross syndrome and pre presbyopia.

		Upper cross syndrome	Pre presbyopia
Upper cross syndrome	Correlation Coefficient	1	0.011
	Sig. (2-tailed)	.	0.825
	N	400	400
Pre presbyopia	Correlation Coefficient	0.011	1
	Sig. (2-tailed)	0.825	.
	N	400	400

Discussion

This study investigated the prevalence of Upper Cross Syndrome (UCS) and pre-presbyopic symptoms among handloom workers in West Bengal and explored whether the two conditions were related. The findings indicate that musculoskeletal imbalance, neck pain, postural deviations, and restricted cervical and shoulder ROM were highly prevalent among the workers. These patterns are consistent with previous studies reporting high UCS prevalence among individuals engaged in repetitive, posture-intensive occupations such as weaving, sewing, and prolonged sitting tasks. Pain showed a strong positive correlation with neck disability and a strong negative correlation with posture, suggesting that forward-head posture and scapular imbalance directly contribute to functional impairment. Muscle tightness in the pectoralis group, upper trapezius, levator scapulae, and scalene muscles, along with weakness in deep stabilizers such as the middle/lower trapezius and

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deep neck flexors, confirms the classical UCS pattern. These results support earlier findings that repetitive near-work and constrained trunk positions impose continuous stress on cervical and shoulder girdle musculature, accelerating UCS development. Near-vision findings revealed that many workers demonstrated accommodative lag and reduced near visual acuity before the age of 40, suggesting early pre-presbyopic changes. This aligns with evidence that occupations involving prolonged near focus may predispose individuals to accommodative fatigue. However, no significant correlation was found between UCS indicators and pre-presbyopic symptoms. This indicates that although both conditions are common among handloom workers, they likely arise from different occupational stress mechanisms—UCS from musculoskeletal overload and posture, and pre-presbyopia from visual strain and repetitive near focusing. The revised interpretation now reflects that the two conditions coexist but are not directly linked, correcting the earlier implication of association [15].

Conclusion

It can be concluded that when posture and neck disability deteriorate, pain will also worsen and vice versa. There is a strong correlation between neck impairment, posture, and pain. The study also concludes that the primary cause of their recurring work position is muscle tightness and weakness. The active range of motion for almost all cervical and shoulder movements was limited [16]. The involvement of multiple ranges suggests that the narrowing of these ranges was likely caused by the workers' repetitive working postures. This repetitive strain may have led to changes in musculoskeletal function, contributing to the observed variations in disability levels. We therefore conclude that all 400 subjects suffered from the symptoms of upper cross syndrome. Near vision problems among handloom workers in West Bengal can be a significant concern due to the nature of their work, which often involves intricate, close-up tasks. Strong correlations were observed between pain, neck disability, and posture. These findings highlight the need for ergonomic interventions and vision screening in occupational settings to reduce UCS symptoms and visual strain [17].

Limitations

The cross-sectional nature of the study prevents causal inference. Measurements such as posture and muscle strength depended on manual assessment, which may introduce examiner bias. The study was limited to selected clusters in West Bengal and may not fully represent all handloom workers across the region. Despite these limitations, the study contributes valuable insights into occupational musculoskeletal and visual health concerns in the handloom industry.

Declarations

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Conflicts of Interest

The authors declare that we have no conflict of interest.

Competing Interests

The authors declare that we have no competing interest.

Data Availability Statement

All the data is collected from the simulation reports of the software and tools used by the authors. Authors are working on implementing the same using real world data with appropriate permissions.

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