

“POSTURAL CHANGES AMONG SEWING MACHINE OPERATORS DUE TO NON-SPECIFIC NECK PAIN: AN OBSERVATIONAL STUDY”

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ABSTRACT

Background & Objectives: Musculoskeletal complaints regarding neck region are extensively present in sewing machine workers. As this profession involves highly monotonous, repetitive work in sitting position with bent neck and upper part of back curved on the sewing machine for longer duration. There are several methods to assess the postural deviations. But very few had assessed the quantitative postural deviations by plumb line method. So the objective of the study is to evaluate the postural changes among sewing machine operators due to non-specific neck pain.

Methods: 100 subjects who were fulfilling the inclusion and exclusion criteria were purposefully selected for the study. The postural assessment was measured by plumb line method in lateral and posterior view from C7 vertebrae and Vertex in sitting position.

Result: The result of study showed postural deviations in lateral view at vertex, with mean deviation 2.55cm, at C7 measurement mean deviation is 3.7cm and in posterior view mean deviation at vertex is 0.53cm and 0.42cm right and left side respectively.

Conclusion: The study conclude that long hours of sitting in one posture can leads to adaptation of Forward Head Posture which may cause the Upper Cross Syndrome vice versa. These will cause pain in the neck region. These findings also give idea of how and why these deviations develop. Future prevention and rehabilitation programs should be taken into account, in order to avoid their structural problems that can prevent upper cross syndrome and forward head posture.

Key words: Plumb line, Forward head posture, Upper cross syndrome

INTRODUCTION: “Posture, which is the relative disposition of body at any one moment, is a composite of the positions of the different joints of the body at that time.” Classically, ideal static postural alignment (viewed from the side) is defined as a straight line (line of gravity) that passes through the earlobe, the bodies of the cervical vertebrae, the tip of the shoulder, midway through the thorax, through the bodies of the lumbar vertebrae, slightly posterior to the hip joint, slightly anterior to the axis of the knee joint, and just anterior to the lateral malleolus.^[4]

Adequate posture occurs when the body is kept in balance with the least expenditure of energy possible. Inadequate posture consists of poor interrelations between parts of the body. These imperfect interrelations cause muscle tension and shortening, which makes appropriate joint movement more difficult to achieve. Incorrect movements cause injuries to the musculoskeletal system and limit the ability to perform daily activities. The prevalence of postural problem is associated with pain.^[5] Abnormal posture may cause pain and discomfort in the particular area where the deviations take places. There are deviations in cervical spine

due to many reasons like work positions, mobile device usage for prolonged periods of time, neck pain, computer device usage etc.

The Cervical Spine forms the skeleton of the neck. It consists of 7 vertebrae, which are grouped into the sub occipital cervical spine, and the lower cervical spine. The sub occipital spine is made up of the C1 or Atlas vertebrae, and the C2 or Axis vertebrae. These two vertebrae are shaped differently and perform a different function to the rest of the cervical vertebrae. The lower cervical spine is made up of the C3-C7 vertebrae's. All of these 5 vertebrae have the same characteristics. [29]

Neck pain is described as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage” in the neck region, which starts at the superior nuchal line and continues down to the level of the scapular spine. [1] Neck pain may arise due to muscular tightness in both the neck and upper back, and pinching of the nerves emanating from the cervical spine. Non-specific neck pain is the most common one. This is also known as ‘simple’ or ‘mechanical’ neck pain. The causes may be minor strains and sprains to muscles or ligaments in the neck. Bad posture seems to be the major contributing factor in many cases. [32]

Neck pain is more common in people who spend most of their day working at desk, in front of the computer with a ‘bent-forward’ posture or ‘forward head carriage’ posture. Non-specific neck pain is most often caused by continuous forward head carrying posture leading to sub-occipital muscle tightness, decreased cervical mobility and obliterated cervical spine curvature. [32] In a clinical practice, neck pain is everyday experiencing problem. In general population the prevalence of neck ache percentage is larger in females than males, 13% and 9% respectively. [2] Neck pain is very common in occupations like computer users, mobile device users, sewing machine operators, type writers etc. Prevalence of neck pain in these occupations is different. Scholars from different countries had reported prevalence of WMSDs among sewing machine operators. Afonso et al. estimated 76% prevalent rate of WMSDs among sewing machine operators in Portugal. Wrist/hand (42%), neck (32%) low back (30%) and shoulders (23%) were the most affected body parts. The prevalence of moderate to severe musculoskeletal pain in the neck/shoulder region and distal upper extremity were 24% and 16% respectively among sewing machine operators in Los Angeles. [3]

Musculoskeletal complaints regarding neck region are extensively present in sewing machine workers. As this profession involves highly monotonous, repetitive work in sitting position with bent neck and upper part of back curved on the sewing machine for longer duration. This kind of effort requires greater concentration and precision. Working in the profession of stitching for the time duration of greater than eight years possibly have some cumulative damaging effects on the neck area. [2] Sewing machine operation includes jobs that involve operating power sewing machines to sew, alter or repair wearing apparel, linens, blankets, and other fabric articles. This includes operation of automatic sewing machines when the operator must know how to thread the machine, wind bobbins, adjust tension, and oil parts. Sewing machine operators use hands to handle, control, or feel objects, and tools; sit for long periods of time, and repeat the same motions (Kaergaard and Andersen, 2000; Wang et al., 2007). For this reason, a high prevalence of musculoskeletal symptoms of neck, shoulder, back, hand/fingers and lower extremities have been found in studies of female SMOs. [7]

Occupation related musculoskeletal system disorders are highly prevalent in the persons associated with the profession of stitching. Prolonged working extent, working at lower levels of table, accurate hand work, these are all the risk factors causing neck aching in stitching machine workers. [2] The commonest risk factors among sewing machine operators are adaptation of awkward posture due to poorly designed seating devices that lack adjustable seat heights and back rests, and repetitive nature of sewing machine operators' tasks such as pedalling, and extreme flexion of the trunk and neck. [3] Psychological factors are also related like emotional stress and anxiety, headache, neck bending, cervical lordosis causes neck pain. [2] And due to neck pain, the posture of an individual may vary from normal anatomical posture.

So, the purpose of our study is to investigate the deviation of posture of such sewing machine operators due to neck pain. Observational analysis of posture involves locating body segments in relation to the LoG, which is represented by a **Plumb line** (a line with a weight on one end). The line is dropped from the ceiling and can be used to assess a person's posture from either the lateral aspect or from the anterior or posterior aspect.^[8] A plumb line is often used as a reference of alignment for the body when examining posture. A plumb line is a string suspended overhead with a small weight, or plumb bob, attached at the end near the floor.^[6] A plumb line test is used to determine whether the points of reference of the individual being tested are in the same alignment as are the corresponding points in the standard posture. The deviations of the various points of reference from the plumb line reveal the extent to which the subject's alignment is faulty.^[9]

METHODOLOGY

STUDY POPULATION: Sewing machine operators

SOURCES OF DATA: 100 sewing machine operators from Vadodara city.

STUDY DESIGN: Purposive Sampling Method

SAMPLE SIZE: In this study 100 (n =100) sewing machine operators are taken.

CRITERIA FOR SELECTION

INCLUSION CRITERIA

- Who has neck pain since ≥ 6 months,
- VAS ≥ 4 ,
- >1 Year of Work experience.

EXCLUSION CRITERIA

- Sewing machine operators who had any cervical fracture, pathology, any cervical surgery, neurological condition and congenital pathology.
- Working <8 hours/day

Method: selection of particular sewing machine operators was based on convenience sampling. All participants were informed about the objectives of study, and consent taken from them before their participation. A plumb line was used as the survey instrument.

Procedure:

A questionnaire with personal information such as name, age, gender, address, contact number, weight, height etc was completed. The assessment was conducted by observation, and the data for each subject were recorded on standardized assessment forms. Posture assessment was performed in the lateral and posterior view with theoretical guideline from Kendall. According to this authors, in the side view the plumb line projection represents the gravity line in the frontal plane. The assessment was taken in sitting position of subject in lateral and posterior view.

The subject was made to sit on table and hang the plumb line on the roof. In lateral view, measurement from vertex to the plumb line and from spine of C7 vertebrae to plumb line in sagittal plane was taken. In posterior view, from the vertex to the plumb line and from spine of C7 vertebrae to the plumb line in frontal plane. The presence of postural deviations was determined according to the positioning of the mentioned structures in relation to the plumb line.



Fig-1 vertex measurement (Post. View)

STATISTICAL ANALYSIS: Statistical analysis was done by using Microsoft Excel 2010. Outcome measurement was measured using Plumb Line and presented as mean \pm SD. Microsoft Word 2010 and Microsoft Excel 2010 were used to generate graphs and tables.

RESULT: Based on the Kendall and McCreary's criteria for normal posture, we check the posture up to C7 vertebrae and we observe the postural deviations like forward head posture and tilting of head in left or right side. Outcome measurements were measured using plumb line method and presented as mean \pm SD.

Table no.1 Vertex Measurement (Lat. View)

LAT. VIEW VERTEX MEASUREMENT	NO. OF SUBJECT	MEAN DEVIATION
0-0.5 cm	10	2.55 cm
1-1.5 cm	10	
2-2.5 cm	35	
3-3.5 cm	29	
4-4.5 cm	15	
5-5.5 cm	1	

Table no. 1 shows postural deviations in lateral view from vertex from both right and left side. The mean deviations from vertex is 2.5cm (SD 1.19). The vertex displaced 2.55 \pm 1.19 forward from normal alignment according to plumb line.

Table no. 2 C7 measurement (Lat. View)

LAT. VIEW C7 MEASUREMENT	NO. OF SUBJECTS	MEAN DEVIATION
2.5 cm	2	3.7 cm
3 cm	8	
3.5 cm	33	
4 cm	57	

Table no. 2 shows postural deviations in lateral view from C7 vertebrae from both right and left side. The mean deviations from C7 vertebrae is 3.7cm (SD 0.50).

Table no. 3 Vertex Measurement (Rt side, Post. View)

POST. VIEW VERTEX MEASUREMENT (RT)	NO. OF SUBJECTS	MEAN DEVIATION
0-0.5 cm	70	0.53 cm
1-1.5 cm	16	
2-2.5 cm	11	
3-3.5 cm	3	

Table no. 4 Vertex Measurement (Lt side, Post. View)

POST. VIEW VERTEX MEASUREMENT (LT)	NO. OF SUBJECTS	MEAN DEVIATION
0-0.5 cm	76	0.42 cm
1-1.5 cm	14	
2-2.5 cm	6	
3-3.5 cm	4	

Table no 3 & 4 shows head tilting in posterior view from vertex either left or right side. The mean deviations from the vertex in right side is 0.53cm and in left side is 0.42cm (SD 0.89, SD 0.81 respectively). The vertex displaced 0.53 ± 0.89 in right side or 0.42 ± 0.81 in left side from normal alignment according to plumb line.

DISCUSSION: According to Pilot study of 10 healthy young individuals, at Vertex measurement ranging from 0.5-1 cm, where at C7 vertebrae ranging from 2-2.5 cm. With reference to this present study aimed to assess the postural deviations in sewing machine operators who is having non-specific neck pain. The result indicated that the high prevalence of postural deviations among sewing machine operators, especially forward head posture, head tilting and protracted or retracted mandible up to C7 vertebrae. Postural changes may occur in sewing machine operators due to working >8 hours per day, highly monotonous, repetitive work in sitting position with bent neck and upper part of back curved on the sewing machine for longer duration. Working for extended period with bad posture results in health related issues. Gradually posture may deviate from ideal posture or plumb line due to adaptation of the incorrect posture and altered the biomechanics, which in turn causes various muscular issues like pain in the neck region.

When there are deviations from the ideal posture or plumb-line, these are known as misalignments, which can be present in one or more areas of the body. In the case of a misaligned posture, it generally happens that there are a number of chronically tight muscles around certain joints, As well as chronically stretched muscles around that same joint. This will put a lot of unwanted stress on the body, which will have adverse effects. ^[29]

Forward Head Posture, which is also known as Upper Crossed Syndrome or Proximal or Shoulder Crossed Syndrome, is characterised by a forward placed head anteriorly to the plumb-line, with rounded shoulders and a kyphotic thoracic spine. Ideally, the cervical spine should have a lordotic or concave curvature, but with a FHP the curvature of the cervical spine can disappear completely, affecting the flexibility of the spine. For the diagnosis of cross syndrome, we have to check manual muscle testing and tightness of certain group of muscle.

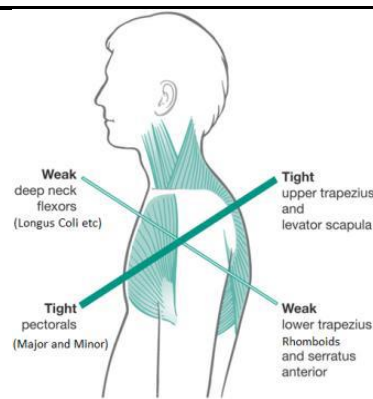


Fig-2 Upper Cross Syndrome

In forward head posture, there will be flexion in lower cervical region and extension in upper cervical region. The rotatory motion of C1 and C2 is coupled to a vertical translation of the same two vertebra. The head is supported by the lower neck and upper back, and it is these areas that commonly cause neck pain. The first three joints in the neck allow for most movement of the neck and head. The lower joints in the neck and those of the upper back create a supportive structure for the head to sit on. If this support system is affected, then the muscle in the area will become tight, causing neck pain. [32]

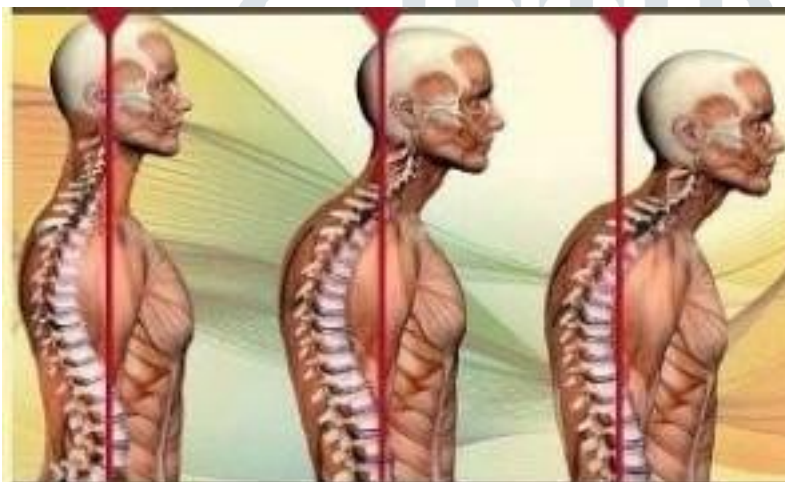


Fig-3 Ideal Posture VS Forward Head Posture

As seen in figure 3, every 2.5 cm's that the head is placed past the plumb-line, the weight of the head increases by 4.5 kg's. Even a slight shift forward can cause compression and strain on the bones, muscles, ligaments and other tissues in the neck, upper back, and shoulders and beyond. As per our results, we got the mean deviation is 2.5 ± 1.19 , so head increases 4.59 ± 2.15 kg of the body weight.

The plumb line test is used to determine whether the points of reference of the individual being tested are in the same alignment as are the corresponding points in the standard posture. The deviations of the various points of reference from the plumb line reveal the extent to which the subject's alignment is faulty. In routine examinations, it is not practical to try to determine exactly how much each point of reference deviate from the plumb line. [9] When the standard plumb line method used to assess posture is regarded as inaccurate, it is by implication invalid and unreliable and caution is recommended when using the plumb line method for the assessment of posture. [31]

CONCLUSION: The study conclude that long hours of sitting in one posture can leads to adaptation of Forward Head Posture which may cause the Upper Cross Syndrome vice versa. These will cause pain in the neck region. These findings also give idea of how and why these deviations develop. The analysed factors such as BMI, their work posture and work place can be modified as per the implementation of preventive and rehabilitation programs. Future prevention and rehabilitation programs should be taken into account, in order to avoid their structural problems that can prevent upper cross syndrome and forward head posture.

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