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Effect of Work Related and Non-Work Related, Individual, and Psychosocial, Risk Factors on Neck Pain Among Office Computer Workers: A Cross Sectional study.

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ABSTRACT

Neck pain as a work related musculoskeletal disorders in computer workers is a high prevalent disability with varying clinical signs and symptoms. Individuals present with neck signs and symptoms to the physical therapist and get treated. Though the treatment is done, chances of recurring of the pain is high. Hence assessment of work place, physical load of work and psychosocial stress an individual is going through must also be assessed to get the clarity of musculoskeletal disorder relating to neck pain and reduce its prevalence. 125 individuals suffering from neck pain were screened for BMI, pain score, psychological stress score. The result of the present study was analyzed for individual, physical, psychosocial, work related risk factors. Raw data was subjected to analysis likelihood analysis x^2 analyses and t tests, age difference in the variables of interest were tested. Results were assessed for monotonous work, physical tiredness at the end of the day, mental tiredness at the end of the day, break during work, neck position while working on computer, duration of constant sitting. Spermann's rank correlation coefficient was found significant for all the factors with respect to both outcome tools used, except monotonous work risk factor. Physical tiredness, mental tiredness at the end of the day, break during work, recreational activity at the end of the day, neck position while working on computer were significant factors causing neck pain.

Keywords: Work and non-work related, Individual, Psychosocial risk factors, neck pain, computer workers.

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INTRODUCTION

Population based studies showed that a lifetime prevalence of neck pain was 70% and a point prevalence was between 12-34%.[1] Skov et al found that the 1-year prevalence of neck symptoms to be 54%in men and 76% in women in sales people.(N=134). Neck pain can range from a stiff neck to a more serious condition. Neck pain is often a cause of strain or spasm of the neck muscles or inflammation of the neck joints. Neck pain is the common problem in the developed countries.[1] Increase in computer use has been associated with an increased prevalence of disorders in the neck and upper extremity.[2-4] Work related musculoskeletal disorders are injuries or disorders of musculoskeletal tissues caused by work place risk factors including cumulative trauma disorders, repetitive strain injuries,[5] and overuse injuries[6] . For people who spend most of their work time on computers, WRMDs of neck are common problems[7].

Types of neck pain in general:

- Acute neck pain vs Chronic neck pain
- Specific vs non-specific neck pain
- Traumatic neck pain vs Pathological neck pain.

Depending on anatomical structures neck pain can be classified as;

- Muscle strain
- Ligament sprains
- Arthritis
- Pinched nerves.

Pain may spread to the shoulders, upper back, or arm or it may cause a headaches radiating from the neck. The healthy neck allows all movements, stresses and strains of the head and body. If parts of the neck are injured, or repeated overuse is carried out of a particular movement, neck starts to degenerate, and can become a source of neck pain, shoulder stiffness, forward head posture, and arm pain.

Neck pain in this article is topographically defined as the pain experienced in the area from the base of skull to the upper part of back and extending laterally to the outer and superior bounds of shoulder blade.[7]Neck pain is assumed to be multi-factorial disorder which means it has several risk factors contributing to it. The risk factors can be divided into following groups,[8]

I. Physical
II. Psychosocial
III. Individual
IV. Work station

Work related risk factors which cause non-specific neck pain have been reported in few case studies. In office computer workers poor posture during usage of computer, improper arm position, sitting for prolonged time, short periods of movement with neck, working in the same posture for prolonged time, no breaks between work, mental tiredness contribute greatly to work related neck pain thus decreasing the quality of work. Identifying risk factors that predispose individuals to persistent neck pain may contribute to primary or secondary prevention.[1] This study comprises of identifying the potential risk factors causing the neck pain in the office workers as there is paucity of literature. This study may help in early detection of risk factors which are associated with frequency of neck pain in an Indian office setting. These risk factors may form the base of longitudinal epidemiologic condition hence this study may prove to increase a positive work environment by early identifying and avoiding the avoidable risk factors.

MATERIALS AND METHOD

Study design:

This study was a cross sectional study design. conducted on 125 patients through non-probability sampling for a period of 3 months. The study was conducted at Bharath Sanchar Nigam Limited office, Belagavi and approval of the study was obtained by KLE University ethical committee. Data was collected between October 2016 to January 2017.

Participants:

125 subjects were recruited in this study comprising of Males and females working on computers for 4 to 8hrs per day on computer where included in the study. Subjects with neck fractures, history of road traffic accident, whiplash injury, tumors, were excluded from the study. Inclusion criteria and exclusion criteria were as follows:

Inclusion Criteria	Exclusion criteria
Computer workers	Neck fractures
Duration of computer work minimum 4hrs.	History of head injury
Pain in the area specified	Whiplash injury
Neck pain between their jobs	Tumors
Male and female with age of 30-60yrs	Cervical radiculopathy

Sample size calculation:

The sample size and power calculations were performed with a local software. The calculations were based on prevalence(p) to be 45%, hence q=100-p=55%, and error(d) =9. These assumptions generated a sample size of at least 125. Samples in this study were obtained by non-probability method.

Procedure:

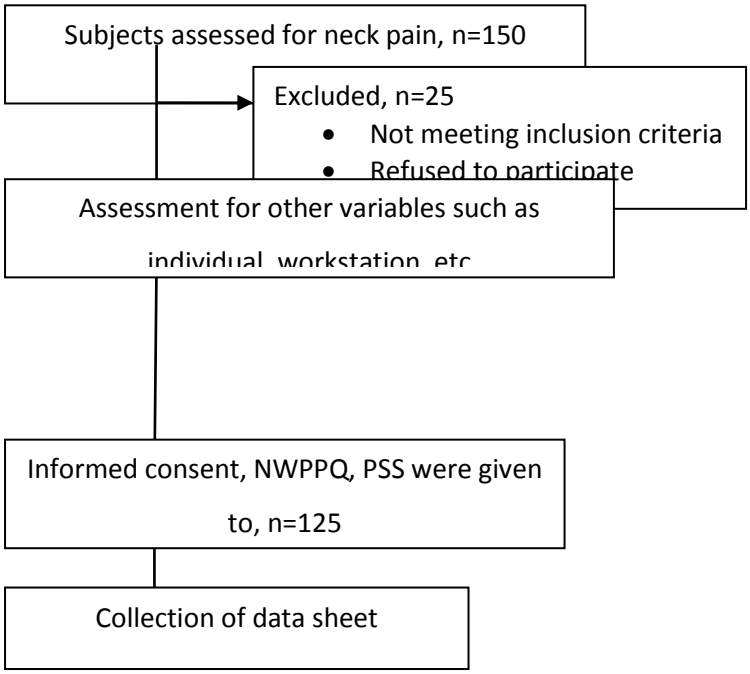
An approval for the study was obtained from an institutional ethical committee. The purpose of the study was explained and written informed consent was taken from each subject. All the subjects were screened for inclusion and exclusion criteria before enrollment in the study. Demographic data were noted down including age, gender, address, duration of employment, body mass index. Data was collected over a period of three months. Statistical analysis was done and results were obtained.

Outcome measures:

Northwick park pain questionnaire: Northwick park pain questionnaire measures the neck pain and the disabilities caused due to neck pain. Provides an objective measure and evaluate outcome of symptoms of neck pain over time[9].

Perceived Stress scale: A psychological instrument known as "Perceived Stress Scale (PSS)" developed by Sheldon Cohen and colleagues measures the perception of stress, that is it measures degree to which situation in one's life are appraised as stressful. The scale predicts both objective biological markers of stress and increased risk of disease among persons with higher perceived stress levels.[10]

Flow chart 1. Procedure flowchart.



Statistical analysis:

Data analysis was done using SPSS version 16.0. Descriptive statistics including mean, standard deviation were used to analyze the data. ANOVA was used to compare means of all groups. Sperman's rank correlation coefficient was used to find the strength of association between numerical variables (i.e. monotonus work, physical tiredness, mental tiredness at the

end of the day, break during work, stressful lifestyle, recreation activity, neck position while working on computer.)

RESULTS AND DISCUSSION

The study was divided into subjects with neck pain and without neck pain. The result was analyzed for gender, body mass index, duration of employment, duration of constant sitting (Table no. 1,2,3). No significant difference was found between neck pain and age, gender, BMI, duration of employment and duration of constant sitting.

Table 1: Distribution of male and female patients according to age groups

Age groups	Male	%	Female	%	Total	%
30-40yrs	25	34.29	18	28.93	40	22.36
40-50yrs	24	31.57	29	50.72	55	40.29
50+yrs	21	31.14	7	20.26	29	29.35
Total	70	103.00	54	100.00	124	100.00
Mean Age	46.17		43.81		45.15	
SD Age	9.49		9.02		9.32	

Table 2: Comparison of male and female patients with BMI scores by t test

Neck position	Male	%	Female	%	Total	%
Neutral	17	24.29	18	33.33	35	28.23
Slightly flexed	25	35.71	16	29.63	41	33.06
Flexed	28	40.00	20	37.04	48	38.71
Total	70	100.00	54	100.00	124	100.00
Chi-square= 1.2362 P = 0.5392						

Table 3: Comparison of male and female patients with duration of employment (yrs.) and duration of constant sitting scores by t test

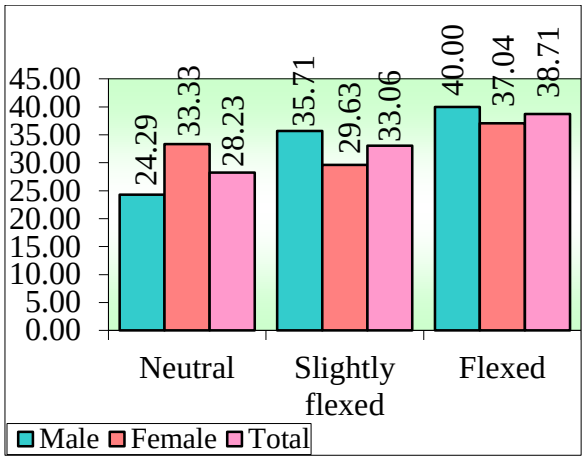
Variables		Male	Female	Total	t-value	p-value
Height	Mean	161.33	157.76	159.77	4.0391	0.0001*
	SD	5.43	4.06	5.18		
Weight	Mean	63.81	59.60	61.98	3.3551	0.0011*
	SD	7.60	5.94	7.21		
BMI	Mean	24.32	23.56	23.99	1.6104	0.1099
	SD	2.71	2.50	2.64		

*p<0.05

Table 4: Comparison of male and female patients with respect to status of neck position while using computer

Variables		Male	Female	Total	t-value	p-value
Duration of employment (yrs)	Mean	23.77	21.11	22.61	1.4486	0.1500
	SD	10.42	9.76	10.19		
Duration of constant sitting (%)	Mean	62.14	65.28	63.51	-1.3888	0.1674
	SD	12.59	12.30	12.51		

(Table 4)Non-parametric test was used to assess association between neck position and gender and age of the subjects. the statistical test was set as Chi square test. Calculated p value was 0.532, which is greater than 0.05, and hence no association was found. Graph 1, represent this association test.



Numbers on the left side of the graphs denote the percentage

Graph 1: Comparison of male and female patients with respect to status of neck position while using computer

Outcome measures

Table 5: Comparison of risk factors with Northwick park pain questionnaire:

Factors	Mean NPP	SD NPP	SE NPP	t-value	p-value
Monotonous work					
Yes	20.20	12.32	1.37	1.6113	0.1097
No	16.14	15.11	2.30		
Physical tiredness at the end					
Yes	25.63	8.38	0.90	13.2799	0.0001*
No	3.32	9.17	1.49		
Mental tiredness at the end					
Yes	25.57	8.47	0.90	14.3309	0.0001*
No	2.22	7.62	1.27		
Break during work					
Yes	0.63	2.46	0.43	-14.7652	0.0001*
No	25.11	9.24	0.96		
Stressful lifestyle					
Yes	25.71	8.89	1.05	8.4682	0.0001*
No	9.21	12.81	1.78		
Recreation activity					
Yes	7.26	12.80	1.95	-8.9167	0.0001*
No	24.91	9.05	1.01		
Neck pain					
Yes	26.18	7.52	0.80	20.5394	0.0001*
No	0.00	0.00	0.00		
Total	18.79	13.43	1.21		

***p<0.05**

Outcome measures:

Comparison of variables on assessment with respect to Northwick park pain questionnaire scores was statistically tabulated and calculated by t test and p value was set as 0.05. Any value below it would be considered statistically significant. Variables like physical tiredness,

mental tiredness at the end of the day, break during work, stressful lifestyle, recreational activity and presence of neck pain were very highly significant with calculated p value 0.0001. (table: 5)

Table 6: Comparison of risk factors with perceived stress scale:

Factors	Mean stress	SD stress	SE stress	t-value	p-value
Monotonous work					
Yes	22.27	8.46	0.94	2.0216	0.0454*
No	18.95	9.14	1.39		
Physical tiredness at the end					
Yes	25.35	6.08	0.66	11.6296	0.0001*
No	11.55	6.11	0.99		
Mental tiredness at the end					
Yes	25.85	5.37	0.57	17.3310	0.0001*
No	9.56	2.63	0.44		
Break during work					
Yes	11.44	5.54	0.98	-9.4743	0.0001*
No	24.49	7.07	0.74		
Stressful lifestyle					
Yes	24.42	6.76	0.80	5.4441	0.0001*
No	16.56	9.32	1.29		
Recreation activity					
Yes	13.60	7.48	1.14	-8.8276	0.0001*
No	25.11	6.59	0.73		
Neck pain					
Yes	25.20	6.19	0.66	12.2227	0.0001*
No	10.74	5.19	0.88		
Total	21.12	8.81	0.79		

*p<0.05

Table 7: Comparison of Neck positions of patients with respect to Northwick park pain questionnaire scores by one way ANOVA test

Neck position	Means	SD	SE
Neutral	0.00	0.00	0.00
Slightly flexed	19.95	6.95	1.08
Flexed	31.50	1.46	0.21
Total	18.79	13.43	1.21
F-value	601.0545		
P-value	0.0001*		
Pair wise comparisons by Tukeys multiple posthoc procedures			
Neck position vs Slightly flexed	P=0.0001*		
Neck position vs Flexed	P=0.0001*		
Slightly flexed vs Flexed	P=0.0001*		

Comparison of variables on assessment with respect to Perceived Stress Scale scores was statistically tabulated and calculated by t test and p value was set as 0.05. Any value below it would be considered statistically significant. All the variables i.e. Monotonous work (with p=0.04) physical tiredness, mental tiredness at the end of the day, break during work, stressful lifestyle, recreational activity and presence of neck pain were very highly significant with calculated p value 0.0001. (table No:6)

Pair wise comparisons of different neck position with respect to Northwick Park Pain Questionnaire by Tukeys multiple posthoc procedures with three groups being neutral vs slight flexed, neutral vs flexed and slightly flexed vs flexed, calculated p value of all 3 groups was very highly significant. (Table 7), where as on comparison with Perceived stress scale, the values of first two groups were statistically significant where as the third group was not. (Table:8)

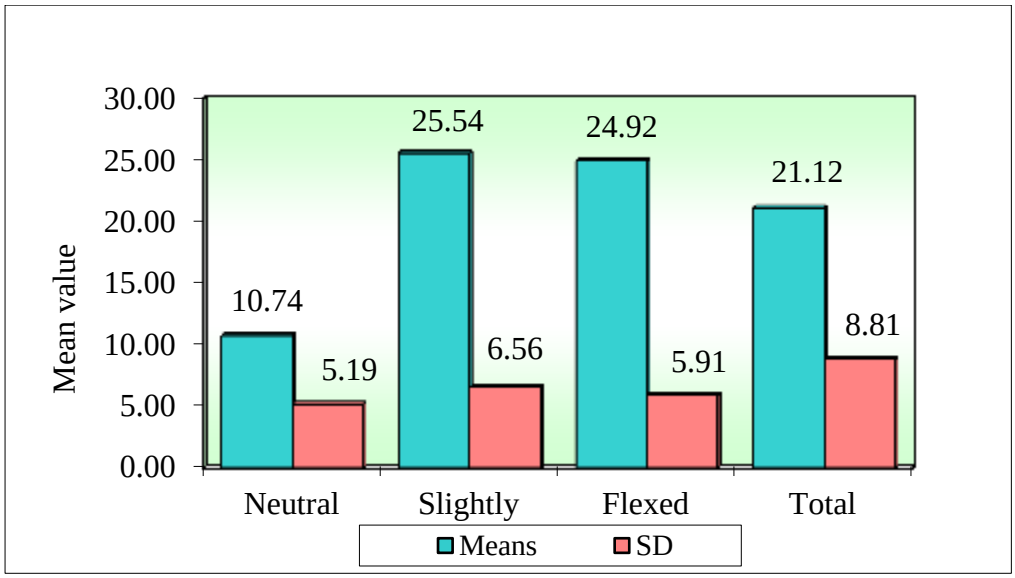
Table 8: Comparison of Neck positions of patients with respect to Perceived Stress scores by one way ANOVA test

Neck position	Means	SD	SE
Neutral	10.74	5.19	0.88
Slightly flexed	25.54	6.56	1.02
Flexed	24.92	5.91	0.85
Total	21.12	8.81	0.79
F-value	74.3523		
P-value	0.0001*		
Pair wise comparisons by Tukeys multiple posthoc procedures			
Neck position vs Slightly flexed	P=0.0001*		
Neck position vs Flexed	P=0.0001*		
Slightly flexed vs Flexed	P=8760		

On comparison of gender with respect of mean years of neck pain by student's t test no statistical significance was found. (table 9 and graph 2)

Table 9: Comparison of male and females with respect to mean years of patients if Neck pain presents by t test

Gender	Mean years	SD years
Male	1.54	2.22
Female	1.33	1.69
Total	1.46	2.01
t-value	0.4927	
p-value	0.6235	



Graph 2: Representation of comparison of male and female with respect to mean years of patients with neck pain by t test

Correlation between Northwick park pain questionnaire scores with presence and absence of monotonous work, physical tiredness at the end, mental tiredness at the end, break during work, stressful lifestyle, recreation activity and neck pain with respect to by Spearman's rank correlation coefficient method when calculated was seen that except monotonous work every other variable were statistically highly significant. (table 10). When these variables were correlated with respect to PSS, by Spearman's rank correlation coefficient same results were found (table: 11).

Table 10: Correlation between Northwick park pain questionnaire scores with presence and absence of monotonous work, physical tiredness at the end, mental tiredness at the end, break during work, stressful lifestyle, recreation activity and neck pain with respect to by Spearman's rank correlation coefficient method

Variables	Correlation between Northwick park pain questionnaire scores with			
	N	Spearman R	t-value	p-level
Monotonous work	124	0.0889	0.9854	0.3264
Physical tiredness at the end	124	0.7002	10.8331	0.0001*
Mental tiredness at the end	124	0.7273	11.7035	0.0001*
Break during work	124	-0.7324	-11.8827	0.0001*
Stressful lifestyle	124	0.5678	7.6184	0.0001*
Recreation activity	124	-0.5638	-7.5407	0.0001*
Neck pain	124	0.8019	14.8248	0.0001*
Neck position	124	0.9444	31.7212	0.0001*

***p<0.05**

At the end, when correlation between Northwick park pain questionnaire scores and Perceived stress scores by Karl Pearson's correlation coefficient method was calculated

statistically, it was seen that calculated p value was 0.0001 which was highly significant. (table No: 12)

Table 11: Correlation between Perceived stress scores with presence and absence of monotonous work, physical tiredness at the end, mental tiredness at the end, break during work, stressful lifestyle, recreation activity and neck pain with respect to by Spearman's rank correlation coefficient method

Variables	Correlation between Perceived stress scores with			
	N	Spearman R	t-value	p-level
Monotonous work	124	0.1326	1.4774	0.1421
Physical tiredness at the end	124	0.6686	9.9317	0.0001*
Mental tiredness at the end	124	0.7800	13.7669	0.0001*
Break during work	124	-0.5970	-8.2186	0.0001*
Stressful lifestyle	124	0.4166	5.0617	0.0001*
Recreation activity	124	-0.5854	-7.9756	0.0001*
Neck pain	124	0.6831	10.3309	0.0001*
Neck position	124	0.5644	7.5526	0.0001*

*p<0.05

Table 12: Correlation between Northwick park pain questionnaire scores and Perceived stress scores by Karl Pearson's correlation coefficient method

Variables	Correlation between Northwick park pain questionnaire scores with			
	N	r-value	t-value	p-level
Perceived stress scores	124	0.6327	9.0254	0.0001*

*p<0.05

DISCUSSION:

The study was conducted on a sample size of 125 individuals, working with computers in BSNL office setting, it was found that neck pain was associated with individual, psychosocial and work related risk factors. Different studies have taken these factors related to the neck pain, although variables significantly associated with neck pain were different between studies.

Neck complaints:

In this cross-sectional study, we found that neck pain assessed by Northwick Park Pain Questionnaire, showed p value significance of 0.0001 which is consistent with previous studies[1,3,11, 12, 13, 14, 15, 16, 17]. The response rate was higher since the questionnaire was distributed only once in person and collected the same moment. Selection bias of healthy individual cannot be excluded from the study as the study is purely observational. Another possibility is that selection bias who could not participate in study due to some reason and who also had neck pain were left out. Though these selection bias could not be evaluated age of the subject was between the range of 30-60 years which suggests that the study was

conducted in a reasonably stable population. Hence, it is expected that selection bias will not have any influence on the result to a greater extent.

Subjects with neck pain at that moment might rate their neck pain higher than those who were not feeling at that moment. This is especially true when using self reported neck pain scale[17].

Association between independent variables and neck pain:

Individual factors:

The prevalence of neck pain was substantially higher in men (75%) and female (66.67%), which is not in relation with study by B. Cagnie et al[1] which suggests that women had almost twofold risk compared to male. The result may be varying because of selection bias due to approaching time limit in the office to the subjects. The result showed p=0.2671 which is not significant.

Being physically active decreases neck pain, as the result of this study showed that recreation activity had a significant p value to be 0.0001, which is in consistency with previous studies[1, 3, 4, 5, 13.] Study by Hildebrandt et al, who suggested that addition of leisure time physical activity in daily routine may constitute one of the means of decreasing musculoskeletal morbidity in the working population, particularly sedentary workers.[1]

Work related factors:

Often holding the neck flexed in a single posture for a prolonged period of time leads to neck pain, though the pain varies with angle of neck flexion. In this study it was found that neck pain increased with increase in angle of neck flexion which is consistent with the study by Ariens et, al[5], who found out that there exists a relation between neck flexion and neck pain, significant results was found with p=0.0001 in this study which showed that increased neck pain with subjects who flex their neck for greater than 20^0 during their computer work.

In this study no significant relation was found between duration of constant sitting and Duration of employment with p=0.1674 and p=0.1500 which is not consistent with other studies. [1, 2,18,19]

Doing monotonous work, throughout the working hours of the subject did not show any significant result in this study relating to Northwick park pain scale and Perceived stress scale, which is different from the result of study by B. Cagnie et al who used "Dutch Musculoskeletal Questionnaire" [1].

Psychosocial factors:

A significant positive relation was found between physical tiredness, break during work and neck pain when reported with NPPS and PSS in this study which is in consistent with other study[1,3,20.]

Significant relation was also found between Mental tiredness at the end of the day and neck pain reported with NPPS and PSS which is also consistent with other studies[1,3, 14,21]

Stressful lifestyle of the subject lead the neck pain when reported with both NPSS, and PSS, as shown in this study which was significant, which was also consistent with other study.[1,3].

Based on these results, intervention should be applied to increase the time of rest intervals during work, and reduce stressful lifestyle, and addition of recreational activity on daily basis. The correct placement of screen such that individual using the computer places his neck in the neutral position also reduces the prevalence of neck pain.

The study showed that work related neck pain was due to individual factors, work related factors and also psychosocial factors.

Different studies have taken the psychosocial and work related factors for neck pain. But the variables within psychosocial and work related risk factors were different in this study and also related to neck pain.

To conclude the present study has demonstrated that the significant barriers inducing neck pain in computer workers were monotonus work, physical tiredness and mental tiredness at the end of the day, break during work, neck position during computer work, recreational activity at the end of the day. In our present study some variables did not show any statistical significance such as, body mass index, duration of employment, duration of constant sitting, which may be due to one time reading.

CONCLUSION

The present study concluded that inconvenient location, driving for long time, monotonous work, physical tiredness and mental tiredness at the end of the day, recreation activity at the end of the day, break during work, neck position during computer working hours. In addition the result also showed that perception of mental tiredness, lead to psychological stress which was also major reason for stress related neck pain. Future outcome of the study can be that, this article can be used for further study to evaluate the workstation barriers for neck pain in computer workers.

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