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Effect of Scapular Position in Computer Professionals with Neck Pain

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Abstract: ***Present study comprises cross sectional study design. Primary objectives of study were to study the effect of neck pain on scapular position in computer professionals and to compare scapular position in computer professionals with and without neck pain. Background atypical scapular position is defined as visible difference in the static position and dynamic motion of the scapula with respect to thoracic spine. Faulty postural habits especially during working and prevalence of neck pain are enhanced among individuals who work predominately in front of computer/ screen. Methods and measures A cross sectional study was performed with convenience sampling among 100 subjects. Further scapula position was assessed using kiblers scapula assessment method at three different positions. Vernier caliper was used for the examination of distance from inferior border of scapula and its corresponding spinous process. Further scapula upward rotation measurements were performed using baseline digital inclinometer at four positions i.e. at rest, at 60 degrees abduction, 90-degree abduction and 120^0 degree abduction Results The results exhibit significant observable changes in scapula protraction as well as scapula upward rotation among computer professionals having neck pain as compared to those who were not having neck pain.***

Keywords: Neck pain, scapula position, altered scapular position, computer professionals, musculoskeletal disorder, poor posture

1.Introduction

The anatomical position of scapula at resting position corresponds as ideal position, however any change in orientation of scapula position may lead to alterations in other anatomical associated structures which may further tend to develop musculoskeletal disorders if not corrected.[1] ideally scapula rest posteriorly on the thorax.[2] Movement of scapula during arm elevation and depression plays important role in normal functioning of glenohumeral joint especially. Rotation of scapula during arm elevation facilitates the glenohumeral movement hence any alteration or restriction of scapula rotations specially scapula upward rotation it will lead to restriction of shoulder movements and hence leads to development of musculoskeletal disorders.

Scapula plays very prime role in upper arm movements and its associated or supported soft tissues/ structures are primarily required for the smooth functioning of glenohumeral joint. Positioning of scapula primarily depends upon strength of scapula muscles especially serratus anterior hence any weakness or pathology of scapular muscles may lead to development of alteration of scapula positioning.[3] latest evidence suggest continuous or overuse of any soft tissue/ muscular structure may lead to development of muscle fatigue which gradually leads to development of work-related musculoskeletal disorders.[4]

Scapula position can be affected by various factors, such as altered or abnormal motion of scapula with respect to glenohumeral joint. Computer professionals mostly work in front of computer screens for long hours which executes enormous stress and load on cervical/ neck musculature.[5] Research evidence suggest that any disparity in translatory force of scapula especially downward rotation and enhanced posterior tipping may leads to development of anomalous position of scapula[6].

Work related musculoskeletal disorders (WRMSD) in present scenario considered to most hazardous health related disorders affecting various countries.[7] This is a gross term which is presently used to describe the health status and overall, wellbeing of office workers. Development of musculoskeletal disorder occurs due to various reasons such as excessive work pressure, long hours, working in awkward posture/ poor work posture, sedentary lifestyle, poor health, and enhanced stress level.[9]

Presently neck pain found to be very common musculoskeletal disorders among computer professionals which may affect their overall health and quality of life if left untreated. Most common faulty work posture comprises rounded shoulder/ protracted shoulder, forward head posture, and scapular winging or tipping.[10] computer professionals tend to work in head down posture for long hours which executes enormous stress on the cervical spine and supporting soft tissues/ structures hence if such poor work postures continue it may affect the orientation of scapula and shoulder joint orientation and functioning to a greater extent.[11]

Development of clinical symptoms among computer professionals is a gradual process and it is very important to identify the factors which are responsible for development of such symptoms. Since neck pain is among computer professionals is very common and overtime muscular system and soft tissues becomes tighten due to prolonged work in in certain position it may affect the orientation and alignment of structures associated with each other. Excessive loading and tightening of soft tissues structure gradually leads to development of decreased blood flow and oxygen demand which results in development of pain. Most of the times office workers find it difficult to maintain the head and neck in optimal position and tend to work in slouched posture and head down posture which further leads

to development of alterations in supporting structures and hence it's a vicious cycle.[12,13]

Increased work of computer professionals leads to development of enhanced prevalence of work-related musculoskeletal disorders predominately of upper limb (WRMD). Latest evidence suggests that posture its self is prominent risk factor for development of work-related musculoskeletal disorders among computer professionals.[14,15] Aberrant scapular muscle activity is also one of the key factors for development of altered positioning of scapula.[16] positive relationship is observed among neck pain and neck flexion while working, further suggesting computer professionals who work in flexed position may develop neck pain gradually.[17]

Excessive work in forward head posture may lead to development of weakness of anterior neck muscles and these changes may further lead to alterations in scapula function as well, which is a major concern and needs to be addressed and hence need of present study is to find out how scapula positioning is affected among computer professionals having neck pain

2.Method and Material

Study Design

Study adapted cross sectional study design with convenience sampling technique for data collection.

Participants

150 Male and female computer professionals working in IBM, Bangalore were screened out of which 100 fulfilled the inclusion and exclusion criteria were included in the research. Inclusion criteria – Computer professionals having neck pain, Daily working hours at least 8 hours per day, age group comprises 25-45 years. Exclusion criteria – Any recent surgery of neck and back, any kind of diagnosed neurological disorder, participants who are taking any kind of treatment for neck pain, any pathology preventing scapular position examination, and participants who are undergoing any kind of medications especially steroids.

Study Protocol and allocation

Subjects who full filled inclusion and exclusion criteria, were provided with patient information sheet comprising details about the research work such as objectives and procedure of the study. Subjects who were willing to participate in the research work submitted their consent to the examiner. A brief assessment was performed. Subjects were allocated in to two groups. Group 'A' computer professionals who are having neck pain and group 'B' computer professionals who are not having neck pain.

Outcome measure

Scapula protraction was assessed using kiblers lateral scapula slide test, scapula protraction was assessed at three different positions i.e at rest, hands on hip position, 90^0 glenohumeral abduction[18,19]

Scapular upward rotation was assessed using baseline digital inclinometer. Scapula protraction was assessed at three different position i.e at rest, 60^0 glenohumeral abduction, 90^0 glenohumeral abduction[20]

VAS visual analog scale was used to assess pain intensity[21].

Technique

Before examination of scapular position brief demographic data was obtained which includes experience as computer professionals, working hours per day, height, weight (for BMI), daily commute timings, and duration of neck pain.

Scapula protraction was assessed using kiblers lateral scapula slide test. Subjects were asked to stand comfortably. Examiner explained the complete procedure and palpated inferior border of scapula. With the help of marker markings were made on inferior border of scapula and its corresponding spinous process. First position of scapula assessment is at rest. Second position of scapula assessment is at 'hands on hip' position and third position is at 90 degree glenohumeral abduction. Measurements were taken from inferior border of scapula and its corresponding spinous process. Measurements were recorded thrice and average was calculated and recorded.

Scapula upward rotation of scapula was examined at three different positions. Baseline inclinometer was used for assessment. Assessment was recorded at three different positions i.e. at rest, at 60-degree abduction and 90-degree abduction.

Statistical Analysis

SPSS software version 15.0 was used for analysis of data and Microsoft excel was used for generation of graphs and tables. Descriptive statistics were performed to analyse the findings from the present study. Measurement of scapula protraction and upward rotation was done for both right side and left side at above mentioned three different positions. Mean of right side with left side was compared between Group A (computer professionals having neck pain) and Group B (computer professionals not having neck pain). Mean value, standard deviation, Confidence interval, t-value, and p value was obtained. Independent t test used to compare means in terms of distance of right and left side among group A and group B, also t test was used to compare the scapular position at three different positions of scapula protraction and scapula upward rotation.

3.Results

A total of 100 subjects were included in the research work. further divided into two groups. group A (N-50) comprises computer professionals having neck pain and group B (N-50) comprises computer professionals without neck pain 50 subjects. Since its an extension of research work done by the author hence earlier findings were quoted in Table 1, 2, 6, 7,9 along with newer findings. Findings from study exhibits effect of neck pain on scapula upward rotation, psychosocial characteristics and work-related characteristics.

Table 1 Demographic characteristics of group A (with Neck pain) and group B (without neck pain)[22]. Table 1 gives details of demographics characteristics i.e. age, working hour per day and experience of computer professionals. Results shows maximum age included was 36 years with mean 31.71 (1.87), maximum working hours per day was 12 with mean 9.48 (0.76) and minimum hours was 8.

	Computer professionals with neck pain					Computer professionals Without neck pain				
	N	Min	Max	Mean	S. D	N	Min	Max	Mean	S. D
Age (in years)	50	30	36	31.71	1.87	50	30	36	31.78	1.28
Working Hour (per day)	50	8	12	9.48	0.76	50	8	12	10.38	1.38
Work experience (in years)	50	5	9	6.14	0.98	50	5	9	6.4	0.99

Table 2 Gender distribution among two study groups[22]. Results suggest majority of computer professionals with neck pain N38 and without neck pain N-40 were males as compared to female computer professionals.[22]

Group	Females	Males	Total
Computer professionals with neck pain	12 (24%)	38 (76%)	50 (50%)
Computer professionals without neck pain	10 (10%)	40 (80%)	50 (50%)
Total	22 (22%)	78 (78%)	100

Table 3 Demographic characteristics of group A (with Neck pain) and group B (without neck pain). Results exhibits majority of computer professionals were married N35 (with neck pain) & N 42 (without neck pain) and fall under normal BMI N 34 (with neck pain) and N 35 (without neck pain).

	Computer professionals with neck pain (N-50)	Computer professionals without neck pain (N-50)
Females	12 (24%)	10 (10%)
Males	38 (76%)	40 (80%)
Married	35 (70%)	42 (84%)
Unmarried	12 (50%)	8 (16%)
BMI (Normal)	34 (68%)	35 (70%)
BMI (Overweight)	15 (30%)	14 (28%
BMI (Obese)	1 (2%)	1 (2%)

Table 4 Work related Characteristics of computer professionals with neck pain and without neck pain. Results suggest that majority of computer professionals tend to work in wrong posture which is static head down posture for more than 2 hours N 39 (with neck pain) and N 29 (without neck pain). Also, majority of computer professionals tend to work continuously for long in sitting posture where they are not having enough upper back support while working further suggest poor work posture and incorrect ergonomics.

	Computer professionals with neck pain (N-50)	Computer professionals without neck pain (N-50)
Static head down posture (> 2hr/day)	Frequency (%)	Frequency (%)
Yes	39 (78%)	29 (58%)
NO	11 (22%)	21 (42%)
Prolonged Sitting (> 4 hr/day)		
Yes	45 (90%)	35 (70%)
No	5 (10%)	15 (30%)
Comfortable Upper back Support		
Yes	18 (36%)	23 (46%)
No	32 (64%)	27 (54%)

Table 5 Psychosocial Characteristics of computer professionals with and without neck pain. Results suggest work environment plays important role in overall well-being. It seems that job satisfaction and co worker support is very important not only professionally but also it affects physical and mental wellbeing of the professional.

Variables	Computer professionals with neck pain (N-50)	Computer professionals without neck pain (N-50)
Supervisor support		
Always	12 (24%)	16 (32%)
Often	7 (14%)	8 (16%)
Sometimes	8 (16%)	6 (12%)
Seldom	4 (8%)	8 (16%)
Never	19 (38%)	12 (24%)
Social Support		
Always	32 (64%)	35 (70%)
Often	8 (16%)	10 (20%)
Sometimes	7 (14%)	4 (8%)
Seldom	2 (4%)	1 (2%)
Never	1 (2%)	0 (0%)
Co- Worker Support		
Always	10 ((20%)	12 (24%)
Often	15 (30%)	17 (34%)
Sometimes	9 (18%)	8 (16%)
Seldom	6 (12%)	3 (6%)
Never	10 (20%)	10 (20%)
Job Satisfaction		
Highly satisfied	15 (30%)	16 (32%)
Satisfied	8 (16%)	10 (20%)
Neutral	12 (24%)	12 (24%)
Unsatisfied	12 (24%)	9 (18%)
Highly Unsatisfied	3 (6%)	3 (6%)

Table 6 Homogeneity between two study groups[22]

	N	Mean age	Working / day	Work experience	p- value
Computer professionals with neck pain	50	31.71	9.48	6.14	<0.001
Computer professionals with neck pain	50	31.78	10.38	6.40	<0.001

Table 7 Scapula Protraction among computer professionals with and without neck pain[22]. Results suggest computer professionals with neck pain have significant changes as compared to those who are not having neck pain at all three positions i.e. at rest, at hands on hip and at 90^0 glenohumeral abduction. (p value <0.005)[22]

Position of scapula	Computer professionals with neck pain				Computer professionals without neck pain			
	Right	Left	t- test	p-value	Right	Left	t- test	p-value
1. At rest	12.04 (1.57)	10.07 (1.22)	1.98	0.000	11.68 (1.65)	11.68 (1.49)		
2. Hands on hip	13.67 (1.56)	11.74 (1.24)	1.98	0.000	13.32 (1.61)	13.35 (1.47)	1.98	0.995
3. 90^0 glenohumeral abduction	14.51 (1.63)	12.52 (1.24)	1.98	0.000	14.02 (1.61)	14.03 (1.47)	1.98	0.93

Table 8 Scapula upward rotation among computer professionals with and without neck pain. results from present research suggest that computer professionals with neck pain having altered scapula upward rotation movement as well at all four positions i.e. at rest, at 60^0 abduction, at 90^0 abduction and at 120^0. Results suggest computer professionals with neck pain have altered scapula protraction[22] as well as scapula upward rotation hence suggesting both alterations may happen simultaneously among patients having neck pain.

Position of scapula	Computer professionals with neck pain			Computer professionals without neck pain		
	Right	Left	p-value	Right	Left	p-value
1. At rest	10.2	8.1	0.000	10.2	9.8	0.99
2. 60^0 Glenohumeral abduction	14.3	12.2	0.000	14.3	14.2	0.98
3. 90^0 glenohumeral abduction	15.3	13.1	0.000	15.3	14.2	0.99
4. 120^0 Glenohumeral Abduction	18.1	16.1	0.000	18.1	17.1	0.98

Table 9 Comparison between two groups[22]

Position of scapula	Computer professionals with neck pain (mean)	Computer professionals without neck pain (mean)	
	Mean	Mean	p-value
Scapula Protraction At rest	1.97	0.01	0.00
Scapula Protraction At hands of hip	1.93	0.03	0.00
Scapula Protraction At 90^0 glenohumeral abduction	1.99	0.01	0.00
Scapula Upward rotation at rest	2.0	0.4	0.00
Scapula Upward rotation at 60^0 Glenohumeral abduction	2.1		0.00
Scapula Upward rotation at 90^0 Glenohumeral abduction	2.2	1.1	0.00
Scapula Upward rotation at 120^0 Glenohumeral abduction	2.0	1.0	0.00

4.Discussion

In present research work scapular position among computer professionals with and without neck pain was studied. Results suggest significant changes in scapular protraction at rest (1.97), at hands on hip position (1.93) and at 90^0 glenohumeral abduction (1.99).

Also, scapular upward rotation has significant changes at rest (2.0), at 60 degree abduction (2.1), at 90^0 abduction (2.2), and at 120^0 Abduction.

Observed changes in scapula position can be explained with the fact that neck pain mostly occurs due to poor ergonomics or wrong working posture.

Bart N Green suggested that there are various contributing factors which are responsible for development of work-related musculoskeletal disorder WRMD among computer professionals. It was observed that females were more prone to develop WRMD as compared to males[23]. A clear positive relationship exists among office workers who had history of any neck, back and other musculoskeletal pain mostly develops neck pain. literature also suggest that behaviour pattern also results in development of neck pain among computer professionals, especially when they work in awkward posture for prolonged hours, they tend to develop neck pain which may further lead to development of other musculoskeletal disorders.[24] Present study also suggested computer professionals who are working in wrong and static head down posture develops neck pain.

Findings from Russ Paine et al suggested that weakness of scapulothoracic muscles predominately leads to development of altered position of scapula, alterations in scapulohumeral rhythm and overall shoulder complex dysfunction. Since trapezius muscle activity is most commonly affected in neck pain hence it may contribute as one of the factors for altered position of scapula.[25,26]

The reduced activity in acromial elevation is related with several glenohumeral problems. Most of the WRMD are traced from abnormal biomechanics of shoulder joint complex especially scapulohumeral rhythm which is resultant from improper functioning of scapula.

Especially scapula rotation. These alterations happen mostly due to scapular alterations, instability.[26] serratus anterior and trapezius muscles are mostly affected in neck a pain patient which leads to abnormal mechanics of scapulothoracic joint. The serratus anterior and lower trapezius contributes to the important upward rotation force couple that produces acromial elevation[27].

Aberrant activity of scapulothoracic musculature during shoulder elevation activity associated with cervical pain/ neck pain. computer professionals since mostly develop neck pain due to wrong work mechanics/ poor ergonomics experience weakness of scapulothoracic musculature as well which further leads to development of altered positioning of scapula as in scapula protraction and scapular upward rotation[28,29]

5.Conclusion

In the present study, it was observed that scapular protraction is altered in computer professionals who are suffering from neck pain in all three positions that is at rest, hands on hip, and 90-degree abduction including scapular upward rotation at four positions that is at rest, at 60^0 abduction, at 90^0 abduction, and at 120^0 abduction.

Declaration of Interest

The authors report no declarations of interest.

References

[1] Bureau of Labor Statistics. Lost-worktime injuries and illnesses: Characteristics and resulting days away from work, 2003. United States Department of Labor News, USDL; 2005. Mar 30, 05–521. [Google Scholar]
[2] Bernaards CM, Ariëns GA, Hildebrandt VH. The (cost-) effectiveness of a lifestyle physical activity intervention in addition to a work style intervention on the recovery from neck and upper limb symptoms in computer workers. BMC Musculoskelet Disord.2006; 7: 80. [PMC free article] [PubMed] [Google Scholar]
[3] Barbe MF, Barr AE. Inflammation and the pathophysiology of work-related musculoskeletal disorders. Brain Behav Immun.2006; 20 (5): 423–429. [PMC free article] [PubMed] [Google Scholar]
[4] Cagnie B, Danneels L, Van Tiggelen D, De Loose V, Cambier D. Individual and work related risk factors for neck pain among office workers: a cross sectional study. Eur Spine J.2007; 16 (5): 679–86.
[5] Ludewig, P. M and T. M Cook, Alterations in shoulder kinematics and associated muscle activity in people

with symptoms of shoulder impingement, World Journal of sport science, vol3, 276-291, 2000.
[6] Sally Wegner et al, The effect of a scapular postural correction strategy on trapezius activity in patients with neck pain, Journal of manual therapy, 2010.
[7] Tsauo J, Jang Y, Du C, Liang H. Incidence and risk factors of neck discomfort: A 6-month sedentary-worker cohort study. J Occup Rehabil.2007; 17: 171–179. [PubMed] [Google Scholar]
[8] Korhonen T, Ketola R, Toivonen R, Luukkonen R, Hakkanen M, Viikari-Juntura E. Work and related individual predictors for incident neck pain among office employees working with video display units. Occup Environ Med.2003; 60: 475–482. [PMC free article] [PubMed] [Google Scholar]
[9] Hush JM, Maher CG, Refshauge KM. Risk factors for neck pain in office workers: a prospective study. BMC Musculoskelet Disord.2006; 7: 81. [PMC free article] [PubMed] [Google Scholar]
[10] Siivola SM, Levoska S, Latvala K, Hoskio E, Vanharanta H, Keinanen-Kiukaanniemi S. Predictive factors for neck and should pain: a longitudinal study in young adults. Spine.2004; 29 (15): 1662–1669. [PubMed] [Google Scholar]
[11] Aaras A, Horgen G, Bjorset H, Ro O, Thoresen M. Musculoskeletal, visual and psychological stress in VDU operators before and after multidisciplinary ergonomic interventions. Appl Ergon.1998; 29 (5): 335–354. [PubMed] [Google Scholar]
[12] Fredriksson K, Alfredsson L, Ahlberg G, et al. Work environment and neck and shoulder pain: the influence of exposure time. Results from a population based case-control study. Occup Environ Med.2002; 59: 182–188. [PMC free article] [PubMed] [Google Scholar]
[13] Bernard BP. Musculoskeletal disorders and workplace factors: A critical review of epidemiologic evidence for work-related musculoskeletal disorders of the neck, upper extremity, and low back.2nd ed. Cincinnati: U. S. Department of Health and Human Services; 1997. [Google Scholar]
[14] Exercises at work for computer operators, neck pain postures, 67-75, 2007.
[15] T Korhonen, R Ketola, et al, Work related and individual predictors for incident neck pain among office employees working with video display units, occup Environ Med 2003; 60; 475-482, doi: 10.1136/oem.60.7.475.
[16] Prawit Janwantanakull, Praneet Pensril, et al, Prevalence of self reported musculoskeletal symptoms among office workers, occupational medicine, vol 58, issue 6, p-436-438, 2008.
[17] G A M Ariens, P M Bongers, et al, Are neck flexion, neck rotation, and sitting at work risk factors for neck pain? Results of a prospective cohort study, occupational and environmental medicine, vol 58, issue 3, 2001.
[18] Kibler WB. The role of the scapula in athletic function. *Am J Sports Med.1*998; 26: 325–337 [PubMed] [Google Scholar]
[19] Ludewig PM, Cook TM. Contribution of selected scapulothoracic muscles to the control of accessory scapular motions. *J Orthop Sports Phys Ther.1*997; 25: 77 [Google Scholar]
[20] Michael I Johnson, Philip W McClure, New Method to Assess Scapular Upward Rotation in Subjects With Shoulder Pathology, Journal of Orthopaedic & Sports Physical Therapy 2001; 31 (2): 81-89
[21] H. Breivik, P. C. Borchgrevink, S. M. Allen, L. A. Rosseland, L. Romundstad, E. K. Breivik Hals, G. Kvarstein, A. Stubhaug, Assessment of pain, *BJA: British Journal of Anaesthesia*, Volume 101, Issue 1, July 2008, Pages 17–24, https://doi.org/10.1093/bja/aen103
[22] Dahiya J, Ravindra S, A Study of Neck Pain and Role of Scapular Position in Computer Professionals, Indian Journal of Physiotherapy & Occupational Therapy. October-December 2014, Vol.8, No.4
[23] Johnston V, Souvlis T, Jimmieson NL, Jull G. Associations between individual and workplace risk factors for self-reported neck pain and disability among female office workers. Appl Ergon.2007 Epub ahead of print, PMID: 17761137. [PubMed] [Google Scholar]
[24] Department of Defense Ergonomics Working Group. Creating the ideal computer workstation: A step-by-step guide. Washington, DC: Department of Defense; 2000. Retrieved November 9, 2007, from http://chppm-www.apgea. mil/ergowg2/index.htm. [Google Scholar]/; p
[25] Glousman R, Jobe FW, Tibone JE, Moynes D, Antonelli D, Perry J. Dynamic electromyographic analysis of the throwing shoulder with glenohumeral instability. *J Bone Joint Surg Am*.1988; 70: 220–226 [PubMed] [Google Scholar]
[26] Warner JJ, Micheli LJ, Arslenian LE, Kennedy J, Kennedy R. Scapulothoracic motion in normal shoulders and shoulders with glenohumeral instability and impingement syndrome: a study using Moire topographic analysis. *Clin Orthop*.1992; 285: 191–19
[27] Kibler WB. The role of the scapula in athletic shoulder function. *Am J Sports Med*.1998; 26: 325–337 [PubMed] [Google Scholar]
[28] Stefen I Jmker, Maaike A Huysmans et al, Software-recorded and self – reported duration of computer use in relation to the onset of severe arm-wrist-hand pain and neck-shoulder pain, occupation and environmental medicine, 2010.
[29] B. M Blatter, P. M Bongers et al, Should office workers spent fewer hours at their computer? A systematic review of the literature, vol 64, 211-222, occupational and environment medicine, 2006