Work 20 (2003) 77–80
IOS Press

An analysis of VDT monitor placement and daily hours of use for female bifocal users

Joseph L. Lyon, Jr., Dean R. Lillquist, Steven Alder, Dale Stephenson and Donald S. Bloswick *
Rocky Mountain Center For Occupational and Environmental Health, Department of Family and Preventive Medicine, 75 South 2000 East, Salt Lake City, Utah 84112-5120, USA

Received 30 July 2001
Accepted 5 November 2001

Abstract. A population of 72 bifocal wearers was studied to determine the relationship between VDT (video display terminal) placement for those who reported musculoskeletal pain and those who did not. The mean hours worked was 50.4 minutes ($p = 0.003$) greater for those who reported head/neck pain versus those who did not and 48.6 minutes ($p = 0.004$) greater for those who reported shoulder/arm pain that those who did not. There was no statistically significant difference between the means of monitor height, distance, or angle for those who reported pain symptoms versus those who did not. This study indicates that, self reported pain symptoms are correlated with hours of VDT work and that there appears to be a threshold at approximately five hours for pain symptoms among bifocal wearers. No such correlation can be made for monitor placement

Keywords: Bifocal, video display terminals, musculoskeletal disorders

1. Introduction

Bifocal wearers often assume static and awkward postures while performing VDT work and the use of video display terminals (VDT) is generally recognized as a cause of numerous health problems [9]. Bifocal use has been identified as an aggravating factor in neck and shoulder pain [1,2,5–8]. As the work population ages and the use of VDTs increase there will be an increased number of people at risk [3]. Although there are many guidelines for placement of VDTs for the general population, there is very little specific information on VDT placement for those who wear bifocals.

A questionnaire was used to identify a population of bifocal wearers who use VDTs each day. It was hypothesized that, due to the limited neck angle for current focus in bifocal wearers, there would be a significant difference in VDT placement for bifocal wearers who report head/neck or hand/arm pain versus bifocal wearers who do not report these symptoms. It was also hypothesized that the hours/day of VDT use would be greater for bifocal wearers who identified musculoskeletal pain than those who did not report pain.

2. Subjects and methods

2.1. Study group

A questionnaire was sent to 1,270 persons in secretarial and administrative positions at the University of Utah and 618 responded (48.6%). Respondents recorded their subjective complaints on the questionnaire. The small number of male respondents (12 or 1.9%) were excluded from the study to eliminate the possibility of introducing gender as a confounding factor. Of the 606 females who responded, 173 (28.5%) wore bifocals (24.5%) or trifocals (4%). Trifocal users were grouped with bifocal users. The mean age of the 173 female subjects in the study was 52 (20–80, SD = 8.5).

*Corresponding author: Tel.: +1 801 581 4163; Fax: +1 801 585 5261; E-mail: bloswick@mech.utah.edu.

Table 1
Difference in Eye to VDT Distance

Type of symptoms	Symptoms reported	Number reporting	Mean (cm)	Standard deviation	T	Degrees of freedom	P
Head or neck pain	No	32	60.86	12.47	−0.135	70	0.893
	Yes	40	61.26	12.67			
Shoulder or arm pain	No	39	60.25	12.70	−0.599	70	0.551
	Yes	33	62.03	12.37			
Head or neck and Shoulder or arm pain	No	22	61.65	12.85	0.259	70	0.797
	Yes	50	60.81	12.47			

Table 2
Difference in monitor angle among reporters of symptoms by symptom type

Type of symptoms	Symptoms reported	Number reporting	Mean (degrees from horizontal)	Standard deviation	T	Degrees of freedom	P
Head or neck pain	No	32	2.2	3.42	1.317	55.32	0.193
	Yes	40	3.2	2.52			
Shoulder or arm pain	No	39	2.9	3.26	−0.375	70	0.709
	Yes	33	2.6	2.67			
Head or neck and Shoulder or arm pain	No	22	2.4	3.70	0.563	30.7	0.814
	Yes	50	2.9	2.63			

2.2. Questionnaire

Since questionnaires may underestimate the prevalence or incidence of MSDs, Ohlsson et al. [7], a follow-up examination of the workstation was used to verify the information gathered in the questionnaire and to take physical measurements of the workstation configuration. The questionnaire consisted of a single page of 25 questions divided into three sections. The first section requested basic demographic information, job history, time spent performing VDT work, phone use while using the computer, and headset or neck rest use. The second and third sections requested information relating to the type and intensity of head/neck pain, and shoulder/arm pain respectively. Two additional questions related to the height adjustability of the chair and VDT. For a subject to be assigned to the positive pain category she must have answered "yes" to the question "Do you have head or neck pain or shoulder or arm pain when working on the computer."

2.3. Follow-Up workstation examinations

Follow-up was attempted on all 173 respondents who indicated that they wore bifocals and was completed for 72 (44%). All bifocal wearers were asked to assume their normal work posture wearing their bifocals. Measured workstation parameter involved (1) seated eye height from the floor, (2) height of center of the VDT screen, monitor angle from horizontal, and (3) distance from the eye to center of the monitor. All follow-up measurements were made by one individual to the nearest millimeter using a standard tape measure. The screen angle was measured by the same person with an adjustable bubble level.

3. Results

On the average bifocal wearers had worked 15 years (0.5–43, SD = 9.4) and worn bifocals for 6.4 years (0.17–35, SD = 6.1). Bifocal wearers reported an average of 5.4 hours (0–11, SD = 1.9) of VDT work per day.

Of bifocal users, 80% talked on the phone while doing VDT work, and 36% reported using a headset or neck rest. Almost all (95%) respondents had adjustable chairs. Bifocal users reported that 54% had a VDT that was adjustable for height and 57% reported that the VDT was adjustable for distance.

There was no statistically significant difference in the mean number of centimeters of the eye from the VDT, between those who reported pain and those who did not (Table 1).

There was no statistically significant difference in monitor angle between the bifocal users who reported pain and those who did not (Table 2).

There was no statistically significant difference in the mean number of centimeters of the center of the monitor below the eyes between bifocal users who re-

Table 3
Eye height to center of VDT

Type of symptoms	Symptoms reported	Number reporting	Mean (cm)	Standard deviation	T	Degrees of freedom	P
Head or neck pain	No	32	−14.45	7.75	−0.415	70	0.653
	Yes	40	−13.46	1.29			
Shoulder or arm pain	No	39	−14.15	1.24	−0.247	70	0.806
	Yes	33	−13.59	8.10			
Head or neck and shoulder or arm pain	No	22	−14.27	8.53	−0.237	70	0.814
	Yes	50	−13.72	9.55			

Table 4
Type of symptoms reported compared to hours worked per day

Type of symptoms	Symptoms reported	Number reporting	Mean (hours)	Standard deviation	T	Degrees of freedom	P
Head or neck pain	No	86	4.95	1.99	−3.05	171	0.003
	Yes	87	5.79	1.61			
Shoulder or arm pain	No	89	4.98	1.84	−2.93	171	0.004
	Yes	84	5.79	1.77			
Head or neck and shoulder or arm pain	No	60	4.70	1.94	−3.59	171	< 0.001
	Yes	113	5.73	1.70			

ported pain and those who did not (Table 3). The group that reported pain had a slightly lower average monitor placement than the group that did not.

There was a statistically significant difference in the mean number of hours worked by those who reported musculoskeletal pain symptoms and those who did not. The group that did not report pain worked slightly less than 5 hours/day on the average and the group that reported pain worked approximately $5\,\frac{3}{4}$ hours.

4. Discussion

There is a statistically significant difference in the hours per day performing VDT work between bifocal wearers who reported pain symptoms and those who did not for both head/neck pain and shoulder/arm pain. The more hours worked the more likely the respondent was to report pain symptoms. Those that reported head or neck pain performed VDT work an average of 0.84 hours or 50.4 minutes longer per day ($p = 0.003$) than those who did not and those that reported shoulder or arm pain 0.81 hours or 48.6 minutes longer per day ($p = 0.004$) than those who did not. Workers that reported both head or neck, and shoulder or arm pain performed VDT work an average of 1.03 hours or 61.8 minutes ($p < 0.001$) longer per day than workers that did not report any pain.

The results of this study revealed no statistically significant difference relative to monitor placement (for the three variables of VDT distance, VDT height and VDT angle) between bifocal users who reported pain symptoms and those who did not. The group that reported pain had slightly lower mean monitor heights than the group that did not. While the difference is not statistically significant, this may suggest that the importance of monitor height is a determinant of pain and merits further investigation.

The variables for the monitor distance, height, and angle were analyzed independently. Further study might investigate the interaction effects.

5. Conclusion

This study indicates that for bifocal users, self reported pain symptoms can be correlated with hours of VDT work and that there may be a threshold of approximately five hours/day for head/neck and shoulder/arm pain symptoms to develop. It is unknown if there is a biological mechanism that could explain this result. There were no significant differences in monitor placement or angle between bifocal wearers who identified pain and those who did not. Although some general guidelines exist, there is still a need to develop specific guidelines for those who must perform VDT work and wear bifocals. An intervention or case/control study might be a better approach to determine which monitor placements and configurations, if any, are most correlated with upper extremity musculoskeletal disorders.

Acknowledgements

This study was supported by the University of Utah, Department of Environmental Health and Safety. Some authors of this article were partially supported by Training Grant No. T42/CCT810426-08 from the Centers for Disease Control and Prevention/National Institute for Occupational Safety and Health. The contents are solely the responsibility of the author(s) and do not necessarily represent the official views of the National Institute for Occupational Safety and Health. The authors would like to thank Joyce Trapman whose editorial and computer skills facilitated the completion and formatting of this paper.

References

[1] M. Collins, B. Brown, K. Bowman and A. Carkeet, Workstation Variables and Visual Discomfort Associated with VDTs, *Applied Ergonomics* **21** (1990), 157–161.

[2] S.J. Dain, A.K. McCarthy and T. Chan-Ling, Symptoms in VDU Operators, *Am J Optom Physiol Opt* **65** (1988), 162–167.

[3] J. Draeger, H. Wirt, K. Wannovius, D. Elbracht and H. Schacher, Experimental Studies on the Correction of Presbyopia, *Klin Monatsbl Augenheilkd* **187**(1) (1985), 63–68.

[4] T.R. Hales, S.L. Sauter, M.R. Peterson et al., Musculoskeletal Disorders Among Visual Display Terminal Users in a Telecommunications Company, *Ergonomics* **37**(10) (1994), 1603–1621.

[5] T.R. Hales and B.P. Bernard, Epidemiology of Work Related Musculoskeletal Disorders, *Orthopedic Clin North Am* **27**(4) (1996), 679–709.

[6] D.K. Martin and S.J. Dain, Postural Modifications of VDU Operators Wearing Bifocal Spectacles, *Applied Ergonomics* **19** (1988), 293–300.

[7] K. Ohlsson, R.G. Attewell, B. Johnsson, A. Ahlm and S. Skerfving, An Assessment of Neck and Upper Extremity Disorders By Questionnaire and Clinical Examination, *Ergonomics* **37**(5) (1994), 891–897.

[8] O. Parsisinen, J. Kirjonen and K.M. Saari, Wearing of Spectacles and Occurrence of Ocular Symptoms in Close Work in Different Occupations, *Scand J Soc Med* **15** (1987), 99–103.

[9] L. Punnet and U. Bergqvist, *Visual Display Unit Work and Upper Extremity Musculoskeletal Disorders: A Review of Epidemiologic Findings*, National Institute of Working Life, Solna, Sweden, 1997.