

# REDUCED EYE-BLINKING WHILE PERFORMING VDU WORK. THE ONLY CAUSE OF VISUAL DISCOMFORT?

Helland M<sup>1</sup>, Horgen G<sup>1</sup>, Kvikstad T M<sup>1</sup> and Aarås A<sup>1</sup>

1. Buskerud University College, Department of Optometry and Visual Science.  
P. O. Box 235, N-3603 Kongsberg, Norway  
E-mail: [magne.helland@hibu.no](mailto:magne.helland@hibu.no)

*In this presentation the results from both laboratory and field studies on VDU-workers concerning eye blinking will be discussed. A marked reduction in the eye blink rate while performing VDU work has been found. This seems to be the case both for visually demanding tasks both using normal and small text size, and independent of glare in the near VDU-screen surroundings. Age seems also not to be a factor influencing the reduction in the eye blink rate while performing VDU work. In this presentation the reduced eye blink rate, and other possible individual and external factors which might cause visual discomfort while performing VDU-work, will be discussed.*

*VDU work, eye-blinking, visual discomfort, causative factors*

## 1 Introduction

Visual display unit (VDU) work is a steadily increasing part of office work throughout the whole world. In Norway more than 90% of enterprises with 10 employees or more have access to Internet (StatisticsNorway 2006<sup>1</sup>), so computers are indeed very common in the Norwegian work force. Also in private households the use of computers has become a part of most people's daily activities. More than 70% of all households in Norway have access to the Internet, and 80 per cent of these subscriptions are broadband connections (StatisticsNorway 2006<sup>2</sup>).

Visual discomfort has a high prevalence among VDU workers (Horgen and Aarås 2003). According to a review paper by Thomson (1998) the prevalence of eye problems among VDU workers range from 25 to 93 %. According to Sheedy et al (2003) eyestrain is the most frequent symptom reported by computer users.

Many studies have found a reduced eyeblink rate when performing VDU work compared with other less visually demanding tasks (eg. Acosta et al 1999; Patel et al 1991). The eye blink rate at rest as reported in the literature typically varies widely (12-19 blinks per minute). Tasks as listening, talking, arithmetical exercises and silent rehearsal increase the blink rate. The blink rate while working with computers has been shown to fall below resting conditions (eg. Patel et al 1991). However, according to our knowledge, the connection between eyeblink rate and the combination of glare and small characters during VDU work has not been studied so far. It was also of interest to compare the results from the laboratory studies with a real life situation, using the same methodology for recording the eyeblink rate.

## 2 Objectives and Methods

We have performed both laboratory studies on presbyopes and young adults to investigate whether a change in the luminance levels of the surroundings of a VDU and the size of the characters on the screen had any influence on the eyeblink rate (Helland et al 2005; Helland et al 2006), and field studies to compare eye blinking during VDU work in at lab situation with similar work in a real life situations (Helland et al 2007<sup>1</sup>, Helland et al 2007<sup>2</sup>). All studies were

performed on groups of experienced VDU users. Details on the experimental set up, the size of the study groups, inclusion and exclusion criterias etc. for the laboratory studies have been published previously.

For both the laboratory and the field studies a digital video camera (Sony DCRTRV22; 25 frames per second) and a video editing program (Pinnacle Studio DV 8) was used to record and investigate the eyeblink rate. The videotapes were later analysed by visual inspection, and counting of eye blinks were done by a mechanical counter.

### **3 Results**

The two laboratory studies showed a marked reduction in eye blink rate for VDU work compared with a typical rest situation in between work sessions. This applies both for young adults and presbyopes. A reduction from approximately 24 blinks per minute (group mean) during easy conversation in between VDU work sessions to approx. 5 blinks per minute during active visually demanding VDU work was found. This was true whether the character size on the screen was "normal" or fairly small, and whether the work was done under good and recommended visual conditions, or with glare in the near surrounding of the screen.

In one field study on VDU workers performing their ordinary daily computer work the average eyeblink rate was approximately 10 blinks per minute (group mean) versus approximately 21 during "rest" periods (Helland et al 2007<sup>1</sup>).

### **4 Discussion**

The results from our studies confirm a marked reduction in eyeblink rate for VDU work, both during visual demanding conditions in a laboratory setting, and also in a real everyday work situation, even though to a slightly lesser extent.

The reduced blink rate is likely to be one of several possible causes of dry eye symptoms and visual discomfort experienced by VDU workers. However, there are many other possible causes of visual discomfort among the steadily increasing number of people who spend a considerable daily time in front of their computer screens (Brewer et al 2006; Sheedy et al 2003). These other factors might be considered under the three broad categories; Personal factors, External factors, and Work related factors. It is also important to distinguish between discomfort likely due to external factor versus discomfort due to internal factors (Sheedy et al 2003; Aakre and Doughty 2007).

The oral presentation will give an overview of all possible factors that might cause visual discomfort under and after VDU work. Being aware of these factors is of major prophylactic concern to ensure comfortable and symptom free visual conditions among VDU workers. In particularly all health care providers who encounter patients with VDU related visual discomfort must be able to take a relevant history, and ideally see the patients work station design, to sort out the most likely cause(s) of the problem, such that the appropriate management can be selected.

### **5 Acknowledgments**

Our studies on VDU work and vision ergonomics have been supported by grants from The Norwegian Research Council. The authors would like to thank those who participated as subjects both from Buskerud University College and from Alcatel-Lucent Norway.

### **6 References**

Aakre, B. M. & Doughty, M. J. 2007. Are there differences between 'visual symptoms' and specific ocular symptoms associated with video display terminal (VDT) use? *Contact Lens Anterior Eye*, doi:10.1016/j.clae.2007.01.001

Acosta, M. C., Gallar, J., & Belmonte, C. 1999. The influence of eye solutions on blinking and

ocular comfort at rest and during work at video display terminals. *Exp Eye Res*, 68(6), 663-669.

Brewer, S., Van Eerd, D., Amick III, B. C., Irvin, E., Daum, K. M., Gerr, F., Moore, J. S., Cullen, K. & Rempel, D. 2006. Workplace interventions to prevent musculoskeletal and visual symptoms and disorders among computer users: A systematic review. *J Occup Rehabil*. Vol. 16, No. 3, 325-358

Helland, M., Horgen, G., Kvikstad, Aarås, A. 2006. Do background luminance levels or character size effect the eye blink rate during VDU work for young adults? Paper presented at American Academy of Optometry, Dec. 7, Denver, Colorado USA.

Helland, M., Horgen, G., Kvikstad, T. M., Aakre, B. M., Aarås, A. & Bruenech, J. R. 2005. Do luminance levels of the surroundings of Visual Display Units (VDU) and the size of the characters on the screen effect the eyeblink rate during VDU work? Paper presented at Human Computer Interaction International Conference, July 22-27, Las Vegas, Nevada USA.

Helland, M., Horgen, G., Kvikstad, T. M., Garthus, T., Bruenech, J. R., Aarås, A. 2007<sup>1</sup>. Musculoskeletal, visual and psychological stress in VDU operators after moving to an ergonomically designed office landscape. *Applied Ergonomics*. Submitted for publication.

Helland, M., Horgen, G., Kvikstad, T. M., Garthus, T., Aarås, A. 2007<sup>2</sup>. Will musculoskeletal, visual and psychosocial stress change for visual display unit (VDU) operators when moving from a single person office to an office landscape? *International Journal of Occupational Safety and Ergonomics (JOSE)*. Submitted for publication.

Horgen, G., & Aarås, A. 2003. Visual discomfort among VDU-users wearing single vision lenses compared to vdu-progressive lenses. Paper presented at the Human Computer Interaction International, Crete.

Patel, S., Henderson, R., Bradley, L., Galloway, B., & Hunter, L. 1991. Effect of visual display unit use on blink rate and tear stability. *Optom Vis Sci*, 68(11), 888-892.

Sheedy, J. E., Hayes, J., & Engle, J. 2003. Is all asthenopia the same? *Optometry and Vision Science*, Vol. 80, No. 11, 732-739.

StatisticsNorway. 2006<sup>1</sup>. Use of ICT (Information and Communication Technology) in enterprises, 2006. Retrived 2007/05/15 from [http://www.ssb.no/english/subjects/10/03/iktbrukn\\_en/](http://www.ssb.no/english/subjects/10/03/iktbrukn_en/)

StatisticsNorway. 2006<sup>2</sup>. 6 out of 10 households have broadband. Retrieved 2007/04/20 from [http://www.ssb.no/vis/english/subjects/10/03/ikthus\\_en/art-2006-09-14-01-en.html](http://www.ssb.no/vis/english/subjects/10/03/ikthus_en/art-2006-09-14-01-en.html)

Thomson, D. 1998. The computerised office. Part one - a site for sore eyes? *Optician*, 215 (5651 (May 15)), 18-24.

