A reliable and valid questionnaire was developed to measure computer vision syndrome at the workplace

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Abstract

Objectives: To design and validate a questionnaire to measure visual symptoms related to exposure to computers in the workplace.

Study Design and Setting: Our computer vision syndrome questionnaire (CVS-Q) was based on a literature review and validated through discussion with experts and performance of a pretest, pilot test, and retest. Content validity was evaluated by occupational health, optometry, and ophthalmology experts. Rasch analysis was used in the psychometric evaluation of the questionnaire. Criterion validity was determined by calculating the sensitivity and specificity, receiver operator characteristic curve, and cutoff point. Test–retest repeatability was tested using the intraclass correlation coefficient (ICC) and concordance by Cohen's kappa (κ).

Results: The CVS-Q was developed with wide consensus among experts and was well accepted by the target group. It assesses the frequency and intensity of 16 symptoms using a single rating scale (symptom severity) that fits the Rasch rating scale model well. The questionnaire has sensitivity and specificity over 70% and achieved good test–retest repeatability both for the scores obtained [ICC = 0.802; 95% confidence interval (CI): 0.673, 0.884] and CVS classification (κ = 0.612; 95% CI: 0.384, 0.839).

Conclusion: The CVS-Q has acceptable psychometric properties, making it a valid and reliable tool to control the visual health of computer workers, and can potentially be used in clinical trials and outcome research. © 2015 Elsevier Inc. All rights reserved.

Keywords: Asthenopia; Computer terminals; Occupational health; Occupational exposure; Eye diseases; Diagnosis

1. Introduction

The expansion of information technologies in recent decades has resulted in increased use of video display terminals (VDTs) in the workplace. The European Working Conditions Survey (EWCS 2010) notes that about 30% of workers use computers *all the time* during their working day and 25% use them *between one-fourth and three-fourths of the time* [1]. Because of this extensive use of computers, many studies have been conducted in an attempt to address questions concerning safety and health for VDT workers [2–6].

Office work involves a range of activities including typing, reading, and writing. These tasks require intense visual efforts, focusing at different distances at which objects are placed, mainly from intermediate to near with different accommodation and convergence demands. They also require good coordination of eye movements to observe objects in different locations from paper to screen and keyboard so that fusion images of both eyes occur and an adequate binocular vision is obtained [7]. Studies have shown that eye-related symptoms are

What is new?

- This report is the first to present a validated questionnaire to evaluate ocular and visual symptoms related to VDT use, specifically developed with wide consensus among experts in the field, and well accepted by the target group.

- The CVS-Q has aceptable psychometric properties; fits the Rasch model, and shows adequate internal validity and reliability. Its sensitivity and specificity are over 70%, and it achieves good test-retest repeatability both for the scores obtained and for the classification or diagnosis.

- The CVS-Q identifies the occurrence of each particular symptom and the overall symptoms (CVS score) in computer workers, so that results can be compared between different individuals or in the same individual at different times and circumstances.

- The CVS-Q is a valid and reliable tool to be included in eye examinations conducted in regular patient care and in clinical trials for the control and monitoring of the visual health of workers exposed to computer screens.

considered one of the most common health-related complaints in VDT workers [8,9]. It has been estimated that 90% of the 70 million workers in the United States who use a computer more than 3 hours/day experience such symptoms [10].

It is clear that the economic impact of the visual and musculoskeletal symptoms associated with computer use is high (because of the increased number of errors made during a computer task). Minimizing symptoms that reduce occupational efficiency will result in substantial financial benefit [11]. Hayes et al. [12] conclude that environmental variability at work is associated with eye symptoms that have a significant impact on quality of life and physical symptoms.

The American Optometric Association (AOA) defines computer vision syndrome (CVS) as the complex of eye and vision problems related to near work, which are experienced during or related to computer use. CVS is characterized by visual symptoms resulting from interaction with a computer display or its environment. In most cases, symptoms occur because the visual demands of the task exceed the visual abilities of the individual to comfortably perform the task [13]. These symptoms comprise a complex of ocular and visual symptoms (such as itching, burning, dryness, blurred vision, or photophobia) that occur during or immediately after the workday. Although the symptoms reported by patients are quite consistent across studies, it is

notable that the literature offers little guidance about the operational definition of CVS. There are even differences about the criteria used to establish when the worker is considered symptomatic, given the lack of validated measurement instruments. The instruments used for diagnosis are usually unstructured questionnaires focusing on the frequency of occurrence of the symptoms [14–16], their intensity [17], or both [18,19], for example, in the studies of Carta et al. [19] and Fenga et al. [20]. The first study asks about the frequency (number of episodes per week) and intensity (on a scale of 1 to 5) of 12 symptoms (burning, eye pain, headache, eye redness, photophobia, tearing, repeated blinking, heavy eyelids, itching, blurred vision at distance and near, and double vision); workers are then classified as asymptomatic or with insignificant, mild, or intense symptomatology according to the score obtained on the questionnaire, yielding a CVS prevalence of around 50%. The second study, however, classifies workers as symptomatic if they present at least one of the nine symptoms included in their questionnaire (burning, eyestrain, eye redness, photophobia, tearing, frequent blinking, eye heaviness, itching, and feeling of a foreign body) but does not ask about either the frequency or intensity of symptoms, finding a CVS prevalence of 80%. Thus, the results about the association between work-related risk factors and CVS are questioned.

The availability of a validated questionnaire to measure CVS would allow rigorous evaluation and monitoring of its effects on the visual health of VDT workers and precise determination of its relation to ergonomic, environmental, and psychosocial risk factors in the workplace or to the individual worker's conditions, thus improving prevention and surveillance in this group.

Accordingly, the objective of this study was to design and validate a questionnaire to measure visual symptoms related to exposure to VDTs in the workplace.

2. Methods

The items to be included in the first version of the questionnaire were selected based on a literature review. The questionnaire was then validated by discussion with an expert panel and performance of a pretest, pilot test, and retest (Fig. 1).

2.1. Questionnaire design

2.1.1. Literature review

We reviewed the evidence available in the scientific literature on the associations between VDT exposure and the occurrence of ocular and visual symptoms to establish a definition of CVS and determine how to conduct a quantitative assessment of the syndrome. The literature search (for the period January 2001 to December 2010) was carried out using MeSH terms and free text words in the title