COMMENTARY

Ocular health among radiologists in the age of PACS: is it time for our profession to open its eyes to this issue in light of existing European legislation?

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ABSTRACT. The regular use of visual display units (VDUs) at work has been shown to cause the development of a constellation of symptoms ranging from dry eyes to temporary myopia. European workers who use VDUs are now protected under detailed legislation enacted by the European Union (Directive 90/270/EEC). The use of picture archiving and communications systems, which are almost ubiquitous in European countries, means that, as a profession, radiologists fall under the remit of this legislation. This paper aims to assess the impact that full implementation of this law would have on a radiologist's practice and to more broadly examine the issue of eye care as an occupational health issue in radiology. The authors conclude that eye care in the setting of regular VDU use among radiologists is an important quality control and occupational health issue. There is a clear legal basis requiring employers to provide regular eye examinations and reporting breaks. In the absence of leadership from employers on this issue individual radiologists have a responsibility to ensure that their work practices reflect the legal situation and minimise the effect of eye strain on their performance.

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The regular use of visual display units (VDUs) at work has been shown to cause the development of a constellation of symptoms ranging from dry eyes to temporary myopia. European workers who use VDUs are now protected under detailed legislation enacted by the European Union (Directive 90/270/EEC) [1]. The use of picture archiving and communications systems (PACS), which are almost ubiquitous in European countries, means that, as a profession, radiologists fall under the remit of this legislation. This paper aims to assess the impact that full implementation of this law would have on a radiologist's practice and to more broadly examine the issue of eye care as an occupational health issue in radiology.

Discussion

Radiology relies on the detailed interrogation of an image and the efficient extraction of clinically relevant information from that image. The daily routine of radiology reporting requires a prolonged focus on objects close to the eyes, necessitating a persistent combination of ocular convergence and accommodation. This understandably places considerable pressure on both the ocular musculature and the intrinsic protective mechanisms of the eye.

In no other medical specialty and in few other professions is the visual acuity (VA) of the practitioner

of such significance. There is huge emphasis placed upon quality control issues with regard to radiological image acquisition, processing and display. The visual ability of the person interpreting the image is a largely overlooked component in the imaging sequence. The occupational health of any profession is of the utmost importance. In radiology departments, radiation protection and infection control are, correctly, the occupational health issues of primary concern. However, particularly when seen as a vital link in the imaging quality control paradigm, the assessment and preservation of VA among radiologists should be a topic of concern for our profession.

The preservation of optimal visual function among radiologists can be approached from both a short-term perspective, viewed across a working day, and a long-term perspective, viewed across an average working life. A radiologist's visual performance should be expected to be as accurate when reading the last radiograph of the day as the first in the morning, and equally the radiologist needs to have as high-functioning near vision in their seventh decade as they did commencing their career.

The advent of the regular use of computerised VDUs in radiology has added a hitherto unheralded factor in the equation. The use of PACS is by now almost universal in westernised healthcare systems. PACS usage has many self-evident advantages, which have facilitated its widespread acceptance. One of the consequences of PACS usage has been that most radiologists now spend the vast majority of their working day in front of a computer monitor. Even when not directly

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reporting, most radiologists will perform multidisciplinary meetings in front of a computer and a large amount of the administrative workload of a department is carried out using a personal computer. The result is near-constant exposure to VDUs over the course of a working day. This huge paradigm shift means that we are currently training the first generation of radiologists who will never have been exposed to film-based radiology.

It is well established that in a general population the prolonged use of VDUs is associated with ocular symptoms. Females, elderly computer users [2, 3] and those who wear monofocal corrective lenses are at higher risk of developing symptoms of eye strain (aesthenopia), which may affect up to 40% of office workers regularly using VDUs [4]. Aesthenopia manifests as a complex of symptoms, including pain and a sensation of grittiness. It is caused by fatigue of the ciliary and extraocular muscles, and an increased surface area of the cornea owing to eye position and decreased blink rate [5]. In the general population, the use of VDUs for 4 h reduces the amplitude and increases the latency of visually evoked cortical potentials (a parameter used to assess the visual pathway's response to visual stimuli), in addition to causing a reduction in contrast sensitivity [6]. Furthermore, VDU users demonstrate temporary myopia in up to 20% of cases at the end of a working shift [5, 7].

The concerns that the above studies raise regarding the general population seem to be born out in the limited literature available specifically addressing radiologists' use of VDUs. The prevalence of eye strain has been determined at 36% among American radiologists by Vertinsky and Forster [5]. As in the general population, females were more likely to suffer eye strain. Differing from the general population, younger radiologists were most affected and wearing corrective lenses did not confer a risk for eye strain. As might be expected, those working longer days and with fewer breaks were more likely to suffer symptoms, as were those performing regular CT screening work. Vertinsky and Forster state that the strongest risk factor for eye strain in their study group was the length of the working day, but that, significantly, taking a break at least every hour reduced the risk of eye strain. The length of break was noted to be unimportant [5].

As with the issue of eye strain, there is limited literature available addressing the issue of VA levels among radiologists. It has been shown that the VA of radiologists decreases slightly over the course of a working day [8]. It has not been ascertained whether this reduction in VA has any impact on diagnostic performance. Safdar et al [8] determined that 16.7% of American and Pakistani radiologists could not remember ever having had VA testing. Among British radiologists, Quaghebeur et al [9] found that 13.4% had had VA testing as a result of "headaches and problems related to work", but that among the 41% of people to have had an occupational health assessment, only 4% had undergone eye testing as part of this. In the same study it was determined that 20% of practising radiologists may benefit from either the use of corrective lenses or the updating of a current corrective lens prescription, given that they had a VA of $<6/6$ [9].

While the literature regarding this topic in radiology is limited, there is a legal basis underpinning eye care

among regular occupational VDU users. The introduction of European legislation on this matter in 1990 placed the legal onus on employers to implement rules regarding this matter at a local level. There are very specific requirements for employers regarding employees who use VDUs, as outlined by Directive 90/270/EEC:

... workers shall receive information on all aspects of safety and health relating to their workstation ... In all cases, workers or their representatives shall be informed of any health and safety measure taken in compliance with this Directive ... The employer must plan the worker's activities in such a way that daily work on a display screen is periodically interrupted by breaks ... Workers shall be entitled to an appropriate eye and eyesight test carried out by a person with the necessary capabilities:

- before commencing display screen work,
- at regular intervals thereafter.

This EU Directive has been transcribed into national law in member states, for example in Britain as Health and Safety (Display Screen Equipment) Regulations 1992, and in Ireland as S.I. 44 of 1993. Despite this, there is a relatively poor knowledge of the European legislation underpinning this area. Just 37% of British radiologists were aware of Directive 90/270/EEC. Of those who were aware of it, 98% felt it was relevant to radiologists for "personal or safety reasons and for potential effects on work efficiency" [9]. A large majority (82%) of UK radiologists would be amenable to undergoing regular eye testing, while a slightly smaller number (71%) felt that such testing should be mandatory for a radiologist during their career [9]. There are precedents to establish mandatory eye testing for professionals in whom good VA is felt to be important to their job. Pilots in the UK, for example, are subject to annual eye testing throughout their working lives [9], while similar standards are set by the federal aviation authority in America.

We feel that there are several key issues relating to this area that need to be highlighted either at a local level by individual hospitals or at a national level by governing bodies. First, should VA testing be mandatory for radiologists entering the profession, and at regular periods thereafter? There are certainly ethical considerations to take into account regarding this area. As a professional, there is clearly a strong onus on the individual radiologist to seek help if they notice a problem with VA or another aspect of their vision. There also seems to be broad support among radiologists for the concept of mandatory eye testing [9]. Optimal patient care is the goal of any health service and healthcare professional. The addition of intermittent eye testing would seem a reasonable additional safeguard of this in the radiology setting.

Strict local enforcement of Directive 90/270/EEC would probably regulate the length of both reporting time and reporting breaks. While common sense should clearly be used by individual radiologists, this matter should be addressed by radiological governing bodies and is ultimately the responsibility of the healthcare employer. One concern (particularly at a local level) might be that efficiency of reporting would decrease if regular

breaks were introduced, either in a self-regulated model or as enforced by management. However, work rates have been shown to increase in scenarios such as this among non-radiologists, a fact that should alleviate any concerns regarding potential loss of productivity [10]. In addition to fulfilling their existing legislative responsibility, employers (as well as radiologists and their governing bodies) should be encouraged to educate those working with medical VDUs as to simple steps that may be taken to reduce visual symptoms. For example, the 20–20–20 rule encourages VDU users to focus the eyes 20 feet away from the workstation for 20s every 20 min, while the use of artificial tears (or even the simple act of more frequent blinking) can help lubricate the cornea.

Conclusion

Eye care in the setting of regular VDU use among radiologists is an important quality control and occupational health issue. There is limited literature pertaining to this subject, and while the regular use of VDUs appears to impact on radiologists both symptomatically and in regards to VA, the potential (if any) impact on diagnostic accuracy has not been assessed. There is a clear legal basis requiring employers to provide regular eye examinations and reporting breaks. In the absence of leadership from employers on this issue, individual radiologists have a responsibility to ensure that their work practices reflect the legal situation and minimise the effect of eye strain on their performance.

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