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ORIGINAL ARTICLE

Identifying visual stress during a routine eye examination

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KEYWORDS
Colour;
Eye examination;
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Abstract
Purpose: To investigate whether the clinical tests used in routine eye examinations can identify adults whose reading rate increases with their preferred coloured overlay(s).
Methods: Routine optometric tests were used to measure 73 undergraduate students' refractive error, visual acuity, stereo-acuity, amplitude of accommodation, near point of convergence, associated heterophoria at near, colour vision and ocular motility. Participants chose an overlay or combination of overlays with colour optimal for clarity, and completed the Wilkins Rate of Reading Test with and without an overlay(s) of this colour.
Results: Overall, there was a significant increase in reading speed with overlay ($t(72) = -5.26$, $p < 0.0005$). Twenty-six participants (36%) increased their reading rate by >5% with their chosen coloured overlay(s). Ten participants (14%) had a reading speed increase of >10%. The increase in reading speed was not significantly associated with any clinical finding.
Conclusion: Tests which are completed in routine eye examinations did not identify those participants who benefitted from coloured overlays in terms of reading speed.

PALABRAS CLAVE
Colour;
Examen ocular;
Estrés visual

Identificación del estrés visual durante un examen ocular rutinario

Resumen
Objetivo: Investigar si las pruebas clínicas utilizadas durante los exámenes oculares rutinarios pueden identificar a aquellos adultos cuya velocidad de lectura se incrementa con uno o varios filtros del color identificado como preferido por el paciente.
Métodos: Se utilizaron pruebas optométricas rutinarias para medir el error refractivo, la agudeza visual, la agudeza estereoscópica, la amplitud de acomodación, el punto próximo de

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convergencia, la heteroforia en cerca asociada, la visión del color y la motilidad ocular en 73 estudiantes universitarios. Los participantes utilizaron un filtro, o una combinación de filtros con el color óptimo en términos de claridad, y completaron el Wilkins Rate of Reading Test, con o sin el o los filtros de dicho color.

Resultados: En general, se produjo un incremento significativo de la velocidad lectora con el filtro ($t(72) = -5{,}26$, $p < 0{,}0005$). Veintiséis participantes (36%) incrementaron su índice de lectura en un >5% con el o los filtros coloreados escogidos. Diez participantes (14%) obtuvieron un incremento de la velocidad lectora de>10%. El incremento de la velocidad lectora no se asoció significativamente a ningún otro hallazgo clínico.

Conclusión: Las pruebas que se realizaron durante los exámenes oculares rutinarios no identificaron a aquellos participantes que se beneficiaron de los filtros coloreados en términos de velocidad lectora.

Introduction

Visual stress is a condition characterised by symptoms of asthenopia and visual perceptual distortions when observing striped patterns,[1] including lines of text.[1–6] Visual stress during reading was first characterised by Meares[7] and Irlen[8] and has also been termed Meares–Irlen syndrome.[3,5,9–13] The aetiology of visual stress has yet to be fully elucidated.

In the United Kingdom, people are usually screened for visual stress only if they report their subjective symptoms to optometrists, teachers or other professionals, who are aware of visual stress. Once referred (normally to an optometrist), patients undergo a thorough assessment of binocular vision which may be followed by an assessment of pattern glare. Patients then choose their preferred coloured overlays, and undergo tests of reading speed with and without the chosen overlay or combination of overlays. A diagnosis of visual stress is made if the coloured overlays immediately improve reading speed and/or if there is voluntary sustained use of the chosen overlays.[2,10,11,14,15] This screening method is very subjective and ignores those people who benefit from coloured overlays without reporting symptoms of visual stress. There is no generally accepted criterion for the percentage increase in rate of reading necessary to justify prescribing coloured overlays, although a 5% increase is commonly used.[16] Kriss and Evans suggest that a criterion of 10% is most appropriate.[10] The appropriateness, however, depends upon the sensitivity and specificity required.[16] Some individuals with specific learning difficulties,[17] dyslexia,[10,18] poor reading ability,[19,20] migraine[21,22] and autism[23] show a benefit from coloured filters. Patients who would benefit from coloured filters but do not report their symptoms are not currently identified, and many individuals benefit from overlays without initially being aware of their symptoms. The present paper aims to investigate whether there are indications of visual stress in the results of the clinical tests used in routine eye examinations.

Blaskey et al.[24] investigated the effect of vision therapy compared to Irlen filters, in a sample of children and adults, but only selected participants with vision problems. Evans[25] stressed the importance of eye examinations to identify those patients whose symptoms indicative of visual stress are in fact due to other, optometric, issues. Other studies investigating the optometric correlates of visual stress have been undertaken with children.[12,26,27] Only one of these studies[27] used an unselected sample and the participants in this sample were not refracted. In the following study adult participants were included regardless of existing ocular and ocular-motor conditions and participants wore their optimum refractive correction throughout the experimental procedure. This was the first study to use an unselected sample of adults, who wore their optimal refractive correction throughout the testing.

Methods

Participants

The participants were recruited by advertisement from the first and second year undergraduate student population attending a university, which made no mention of visual stress symptoms of any kind. The participants were recruited without any knowledge of whether they experienced symptoms of visual stress. All individuals were included regardless of any visual, refractive or ocular-motor abnormalities or symptoms of visual stress, apart from one participant with epilepsy. Seventy-three participants (19 male and 54 female), aged between 18 and 30 years (mean 20.2 years, SD 2.4 years), were included.

A small additional sample of three students (two females aged 18 and 19 and one male aged 25) who were prescribed coloured filters by the university's eye clinic, and had used them for at least 6 months, underwent the same battery of optometric tests. Their results were analysed separately.

All procedures conformed to the tenets of the Declaration of Helsinki and were approved by the University Ethics Committee. All participants gave written informed consent after an explanation of the research study.

Procedure

The tests were conducted in the following order: