



Topic Exploration Report

Topic explorations are designed to provide a high-level briefing on new topics submitted for consideration by Health Technology Wales. The main objectives of this report are to:

- Determine the quantity of evidence available for a technology of interest.
- Identify any gaps in the evidence.
- Inform decisions on topics that warrant fuller assessment by Health Technology Wales (HTW).

Topic exploration report number:	TER328
Topic:	Colourimetry interventions to support people with visual stress
Summary of findings:	<p>Visual stress, also referred to as Irlen Syndrome, is considered as a postulated visual processing disorder, caused by sensitivity to light wavelengths. Colourimetry is a non-invasive technology using coloured overlays or lenses in the form of coloured glasses or contact lenses. This method is intended to reduce or eliminate visual processing errors by filtering out light waves to support the brain to process visual information.</p> <p>This topic exploration report summarises evidence on the effectiveness of colourimetry for people with visual stress. We identified one systematic review, which concluded that colourimetry should not be considered as a treatment option for people with visual stress and dyslexia. An overview of systematic reviews, examining the efficacy of coloured overlays and lenses for treating any reading difficulties (not limited to visual stress) conclude that there was insufficient evidence to support the use of this intervention. Two individual studies (not included in the aforementioned reviews) also reported no evidence for any immediate advantage of coloured overlays for children with reading difficulties or dyslexia. One individual study reported that neutral and coloured backgrounds or overlays might be beneficial for children with or without dyslexia during reading. Additionally, another experimental study reported that using coloured lenses in social perception and reading tasks can possibly be beneficial for children with autism.</p> <p>The authors of the systematic review also highlighted that there is a great need for improvements towards visual stress diagnosis in future research as well as for larger and rigorous randomised controlled trials assessing visual stress interventions.</p>

Introduction and aims

Visual stress, also referred to as Irlen Syndrome, constitutes a postulated visual processing disorder, due to sensitivity to particular light wavelengths (Irlen & Lass 1989). Visual stress practitioners claim that this condition is due to heredity, involving six different deficit classifications impacting perception rather than vision: (1) photophobia, (2) distortion of the fundus, (3) graphical distortions during reading, (4) decreased visual field, (5) difficulty in ocular fixation during reading and (6) change in depth perception (Irlen 1994). This postulated condition is not currently identified by any standardized medical or educational manuals and/or screening tools (Irlen Institute 2021b).

Colourimetry constitutes a non-invasive technology using coloured overlays and tinted lenses in the form of coloured glasses or contact lenses (Irlen & Lass 1989, Irlen Institute 2021a). This method is intended to decrease or eliminate visual processing errors by filtering out light waves aiming to assist the brain to process visual information (Irlen & Lass 1989). It is claimed that colourimetry improves attention, concentration and reading skills, such as fluency and comprehension (Irlen Institute 2021a).

Health Technology Wales researchers searched for evidence on the clinical and cost effectiveness of colourimetry for people with visual stress.

Evidence overview

Guidance and HTA

No relevant national guidelines or guidance relating to the use of colourimetry to support people with visual stress were identified.

Systematic reviews

We identified one systematic review of controlled trials on visual stress using intuitive overlays or intuitive colourimeter (Evans & Allen 2016). They reported that although individualised prescribed coloured overlays have shown improvements in reading performance of people with visual stress, it is uncertain if the intervention can influence the memory and phonological difficulties related to dyslexia (Evans & Allen 2016). Thus, Evans & Allen (2016) suggested that they should not be considered as a treatment option for people with dyslexia. They concluded that larger and more robust randomised controlled trials (RCTs) evaluating visual stress interventions are required, while also highlighting the urgent need for improvements towards visual stress diagnosis in future research (Evans & Allen 2016).

Suttle et al. (2018) conducted an overview of systematic reviews, examining the efficacy of coloured overlays and lenses for treating any reading difficulties (not limited to visual stress). In addition to the review by Evans & Allen (2016), which focussed on visual stress, they identified three other systematic reviews studying this intervention in reading difficulties in general, published between 2008 and 2016. All three of these reviews concluded that there is insufficient evidence to support the use of coloured overlays or lenses for reading difficulty. Suttle et al. (2018) concluded that further high quality, low bias research is needed to investigate their effectiveness in different forms of reading difficulty and discomfort for adults and children.

Individual studies

We identified four individual studies (Denton & Meindl 2016, Jakovljevic et al. 2021, Ludlow et al. 2012, Ritchie et al. 2011) examining the effects of coloured overlays in children with visual stress in co-occurrence with another disability (i.e., reading difficulties, dyslexia or autism spectrum disorder). Three (Ritchie et al. 2011, Denton & Meindl 2016, Ludlow et al. 2012) out of these four relevant studies have not been included in the systematic review by Evans & Allen (2016), although they have been published before the systematic review. We have not identified the justification why these three studies have not been selected and included by Evans & Allen (2016). We included these three relevant individual studies published before the systematic review to provide as great as possible overview of the available evidence.

Reading difficulties or Dyslexia

Ritchie et al. (2011) conducted an experimental study evaluating the efficacy of Irlen coloured overlays aiming to improve reading difficulties due to visual stress. This study included sixty-one children, between seven and twelve years old, with reading difficulties which were assessed by an Irlen practitioner. Ritchie et al. (2011) used a within-subject study design examining the differences in reading-rate tests across three different conditions: (1) use of prescribed coloured overlays, (2) use of non-prescribed coloured overlays and (3) use of no overlays. Additionally, they used a between-group design examining the Irlen coloured overlays effects on a global reading measurement scale for a subset of forty-four children. Ritchie et al. (2011) reported no evidence for any immediate advantage of Irlen coloured overlays as measured by the reading-rate test or the global reading measurement scale in children with reading difficulties.

Denton & Meindl (2016) also conducted an experimental study examining the effects of coloured overlays on reading difficulties due to visual stress in co-occurrence with dyslexia. This study involved three participants, two children and one adult, diagnosed with dyslexia. Denton & Meindl (2016) used a multi-element study design examining the differences in reading fluency across two different conditions: (1) use of coloured overlays and (2) use of no overlay. They reported that undifferentiated responding and/or reduced reading accuracy suggested that coloured overlays were not effective and possibly harmful towards participants' reading skills (Denton & Meindl 2016). Thus, they applied other evidence-based reading methods across all participants. Denton & Meindl (2016) found that coloured overlays do not improve reading performance of people with dyslexia, while also highlighting that other evidence-based interventions do.

Jakovljevic et al. (2021) conducted an experimental study examining the differences in electroencephalography, heart rate variability, electrodermal activities and eye movements of coloured overlays during reading tasks. This study included 36 children, between 8 and 12 years old, of which 18 were diagnosed with dyslexia and further 18 had no diagnosed disability (control group) (Jakovljevic et al. 2021). The reading task involved reading while using 13 different combinations of coloured backgrounds and overlays. Jakovljevic et al. (2021) found that children with dyslexia demonstrated longer (1) reading duration, (2) fixation count, (3) fixation duration average and (4) fixation total as well as longer (5) saccade count, (6) saccade duration average and (7) saccade total when reading using white and coloured (i.e., turquoise, yellow) backgrounds or overlays. They concluded that both neutral and coloured backgrounds or overlays were helpful for reading to both groups (Jakovljevic et al. 2021).

Autism Spectrum Disorder

Ludlow et al. (2012) conducted an experimental study evaluating the effects of coloured overlays used to enhance the visual perception of social cues for children with autism. This study included 30 children, between 8 and 17 years old, of which 15 were diagnosed with Autism Spectrum Disorder

and 15 attended mainstream schools (control group). Ludlow et al. (2012) used a matched-pairs study design, demonstrating to children photos of the periocular region of several faces and requesting which emotion was being conveyed in the eyes. Ludlow et al. (2012) reported significant improvements in the facial expression perception of emotions in children with autism, when the photo demonstrated was covered by a coloured overlay. On the contrary, they reported that the control group showed no significant effect towards the coloured overlays during the same task. Ludlow et al. (2012) concluded that children with autism can potentially benefit on social perception and reading tasks when using coloured lenses.

Economic evaluations

No economic evaluations were identified which considered colourimetry as method to support people with visual stress.

Areas of uncertainty

Based on the identified evidence, some areas of uncertainty remain to be clarified. These include:

- Visual stress and coloured overlays or lenses continue to be a controversial issue. There is no consensus on how to diagnose the condition, or the population it is most likely to affect. This adds to the challenge of collecting and identifying reliable evidence on interventions to treat the postulated condition.
- Overall, there is a lack of existing evidence synthesis reporting specific clinical and educational outcomes. Although there might be sources available to evaluate some educational outcomes, such as reading fluency, they are not clearly defined. For example, effective reading fluency involves (1) accuracy, (2) rate and (3) prosody simultaneously. Further research, ideally in the form of randomised controlled trials, should include clear definitions of the population, intervention as well as primary and secondary objectives.
- Currently, colourimetry is not offered by NHS in Wales, but only by some Optometry private practices. The same applies across all of the UK. This policy is supported by systematic reviews suggesting that there is not enough and robust evidence to recommend coloured overlays or lenses to improve reading difficulties or visual discomfort.

Literature search results

Evidence reviews and economic evaluations

Evans BJW, Allen PM. (2016). A systematic review of controlled trials on visual stress using Intuitive Overlays or the Intuitive Colorimeter. *Journal of Optometry*. 9(4): 205-18. doi: <https://doi.org/10.1016/j.optom.2016.04.002>

Individual studies

Denton TF, Meindl JN. (2016). The Effect of Colored Overlays on Reading Fluency in Individuals with Dyslexia. *Behavior Analysis in Practice*. 9(3): 191-8.

Evans BJW, Allen PM. (2016). A systematic review of controlled trials on visual stress using Intuitive Overlays or the Intuitive Colorimeter. *Journal of Optometry*. 9(4): 205-18. doi: <https://doi.org/10.1016/j.optom.2016.04.002>

Jakovljevic T, Jankovic MM, Savic AM, et al. (2021). The Relation between Physiological Parameters and Colour Modifications in Text Background and Overlay during Reading in Children with and without Dyslexia. *Brain Sciences*. 11(5): 25.

Ludlow AK, Taylor-Whiffen E, Wilkins AJ. (2012). Coloured filters enhance the visual perception of social cues in children with autism spectrum disorders. *Isrn Neurology Print*. 2012: 298098.

Suttle CM, Lawrenson JG, Conway ML. (2018). Efficacy of coloured overlays and lenses for treating reading difficulty: an overview of systematic reviews. *Clin Exp Optom*. 101(4): 514-20. doi: <https://doi.org/10.1111/cxo.12676>

Ritchie SJ, Sala SD, McIntosh RD. (2011). Irlen Colored Overlays Do not Alleviate Reading Difficulties. *Pediatrics*. 128(4): e932-e8. doi: <https://doi.org/10.1542/peds.2011-0314>

Other references used in 'Introduction and aims' section

Irlen H, Lass MJ. (1989). Improving reading problems due to symptoms of scotopic sensitivity syndrome using Irlen lenses and overlays. *Education*. 109(4): 413-7.

Irlen HL. (1994). Scotopic sensitivity? Irlen syndrome: hypothesis and explanation of the syndrome. *Journal of Behavioral Optometry*. 5(62): 65-6.

Irlen Institute. (2021a). The Irlen method. Available at: <https://irlen.com/the-irlen-method/> [Accessed 21 Jan 2022].

Irlen Institute. (2021b). What is Irlen Syndrome? : Irlen Institute. Available at: <https://irlen.com/what-is-irlen-syndrome/> [Accessed 21 Jan 2022].

Date of search:

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Concepts used:

visual stress; syndrome and (Irlen or scotopic sensitivity); colo?rimetry; colo?r* and (overlay* or lense*)