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Prevalence of symptoms of scotopic sensitivity syndrome/Irlen syndrome

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Abstract
Scotopic sensitivity syndrome is a visual perceptual disorder characterised by light sensitivity, slow reading and difficulty in judging distance etc. The aim of the present investigation is to observe the prevalence of symptoms of scotopic sensitivity syndrome/Irlen syndrome in healthy college and school going students. A sample of 103 (n = 103) college and school going students (boys & girls) age range from 12 to 25 years from Agra and Kashipur city, India, has participated in the present study. To measure the prevalence rate of the symptoms of scotopic sensitivity, "The Irlen Syndrome (Visual Sensory Stress) Self-Test: Short" (1994) was administered. The results showed that up to 50% of the students have reported positive on the major ten symptoms of the scotopic sensitivity syndrome. Therefore, it is important for every school, college and educational professionals not to avoid or misinterpret the complaints of students regarding reading difficulties and concentration problems. It might be the symptoms of scotopic sensitivity syndrome not just an excuse to escape from study.

Keywords: Scotopic sensitivity syndrome, visual perceptual disorder, light sensitivity

Introduction
Irlen syndrome was first revealed in the 80's by Helen Irlen in U.S. That's why this condition is now known as Irlen syndrome. The Irlen syndrome which is also known as visual stress, Meares-Irlen syndrome and scotopic sensitivity syndrome. Scotopic sensitivity syndrome is a perceptual processing disorder. It is not an optical problem. It is an issue with the brain's ability to process visual information. Chouinard, Zhou, Hrybouski, Kim, Cummine (2012) [2] evaluated the data from subjects in a reading study who were diagnosed with Meares-Irlen syndrome/visual stress (MISViS). MISViS is marked by visual disruptions and somatic issues, which are remediated using coloured filters. The present case study is explaining neurobiological comparisons of MISViS versus a control group. This study included eleven English language speakers who participated in behavioral and neuroimaging versions of a language experiment with varied proportions of regular and exception words. Behavioral measures involved accuracy and response times. Neuroimaging has been conducted using a 1.5T Siemens Sonata MRI. The MISViS subject's data was removed from the overall experiment and analysed as a case study. Impulse response functions (IRFs) and percentage of active voxels were extracted from four regions of interest: BAs 17, 18, 19, and the postcentral gyrus (PG) and two control regions (BA6 and left BA45). The results revealed that there is a significant differences between the control group and the MISViS subjects for IRF intensity in two regions (BA6 and PG) and percentage(%) of active voxels in four areas (BA17, BA19, PG, and BA6). No significant differences were noticed in left BA45 for either variable of interest. There was no significant difference found for behavioural measures.
Scotopic sensitivity syndrome is more common than the heart disease and asthama, but it is often looked as the possible cause of learning difficulties in many children and adults. This visual difficulty up to 46% of children with and without learning difficulties and approximately 30% of children with ADHA, dyslexia and autism have a high risk of suffering with scotopic sensitivity syndrome. It might affect 12 to 14% of general population. Individuals might not have any leaning difficulty and even they may be gifted students. As in scotopic sensitivity syndrome, the brain continuously struggling to make an interpretation of the visual information it receives. This process of brain struggling causes various symptoms from visual distortion such as headaches, eye strain, problem with sustaining attention,

reading difficulties and depth perception etc. Certain situations and environment can make the symptoms worsen such as fluorescents lighting, bright light, glare on page etc. The symptoms can vary individual to individual. These symptoms can become a major barrier for learning to an individual. Robinson, Foreman, Dear (1996) [6] studied the familial incidence of Scotopic Sensitivity/Irlen Syndrom in which parents of 751 children have been identified with symptoms. Children were recognised by methods independent of their parents' symptoms or lack of symptoms. For these children, there was an 84% chance of either one or both parents showing similar symptoms, with similar numbers of mothers recognised with symptoms as fathers. The data revealed that Scotopic Sensitivity/Irlen Syndrome can be a genetically based deficit in visual processing, but the simplest genetic models do not appear to fit.

There are several misconceptions about this condition which are not true, such as scotopic sensitivity syndrome is just about the reading? Scotopic sensitivity syndrome is a problem with the eyes and does this condition co-exist with other conditions like autism, ADHD and dyslexia. When giving the answers of these questions. It is very important to know that Scotopic sensitivity is not just a problem with the reading skills. Instead it does impact the overall life style of an individual suffering with scotopic sensitivity syndrome. It is a neurological condition which results in the over activity of the stimulated brain. When the brain is over stimulated it does affect many other areas of functions including well-being, attention, academic performance, reading difficulties and the day to day life tasks. Here it is very clear to understand that reading and leaning skills are not just restricted to the academic fields. It can cause migraines, headaches, fatigue, nausea and anxiety, and sometimes these physical symptoms can be debilitating. It is not just about being able to see words clearly. Kevan and Pammer (2008) [3] argued that visual processing deficits in dyslexic readers are said to evolve as a result of reading failure. This investigation examines the children's dorsal stream functioning before they commence formal reading instruction to establish whether visual deficits precede reading difficulties? Coherent motion and visual frequency doubling detection has been measured in children at familial risk for dyslexia and in children unselected for family reading history. Here the results showed that children who are at family risk for dyslexia displayed dorsal stream deficits before they learn to read, while demonstrating no corresponding deficits in coherent form and static grating control tasks. Results indicate that the dorsal visual deficits observed in dyslexic readers are unlikely to be the result of reading failure.

Scotopic sensitivity syndrome is also not the issue with eyes. It is a problem with the brain processing. Even though the eyes function perfectly but the brain is overly stimulated, continuously struggling to make a genuine sense of what the information it is receiving. Scotopic sensitivity syndrome requires separate and distinct assessment and intervention from eye problems. The most up-to-date research on Scotopic sensitivity syndrome has moved beyond reading to look at other population. As many as 80% of people on the autism spectrum report having distorted perception, and research on scotopic sensitivity syndrome and autism has shown that interventions for scotopic sensitivity syndrome successfully correct this distorted world to make it clear and stable. The similar is true for people struggling with headaches, reading and academic difficulties after a concussion or head injury. When it comes to the connection between scotopic sensitivity syndrome and ADHD and Dyslexia, up to 30 percent of individuals who have these conditions also suffer from scotopic sensitivity syndrome. Therefore, there is often a misdiagnosis of ADHD and dyslexia, when the true problem is scotopic sensitivity syndrome.

Major symptoms of scotopic sensitivity syndrome

- **Light sensitivity:** This can also lead to physical symptoms which include feeling tired, sleepy, dizzy, anxious, and irritable. Sensitivity to light can cause headaches, mood changes and restlessness.
- **Reading related problems:** This includes poor comprehension, misreading texts or a general tendency to avoid reading. Such people have difficulty in writing also, often misdiagnosed as dyslexia.
- **Discomfort to eyes:** Those suffering from scotopic sensitivity syndrome often complaint about their eyes hurting or becoming watery.
- **Attention and concentration problems:** Problems with concentration when reading and doing academic tasks, is another common symptom, often misdiagnosed as ADHD.
- **Computer related issues:** Strain or fatigue from computer is a common complaint for those suffering from scotopic sensitivity syndrome.
- **Depth perception:** Inability to guess the depth correctly lead to issues like difficulty in driving, catching balls, judging distances and stairs etc.

If an individual complaint any of these symptoms, should be assessed for scotpic sensitivity syndrome carefully. Some studies reveals that 46% of such people have learning disabilities like reading problems, 35% of them end up with head injury, concussion, trauma or whiplash, 47% suffer from ADHD and dyslexia, 30% suffer from autism spectrum and only 14% of the general population are gifted and good readers. Now here arises a big question that if an individual is complaining about any of the symptoms, is he/she is suffering from scotopic sensitivity syndrome or not?

Scotopic sensitivity syndrome can be detected by first administering the Self-Test technique or the Reading Strategy Questionnaire (RSQ) which can be administered to groups of children. Following this initial pre-screening, individuals identified as being at risk of having Scotopic sensitivity syndrome may undergo a formal screening by a certified screener. This formal screening utilises a proprietary method and set of tasks proven to reliably identify the condition, assess severity level, and determine the appropriate intermediary intervention with coloured overlays.

The pre-screening includes some of the basic question related to the symptoms which an individual may experience. These questions are related to reading difficulties, depth perception and light sensitivity like do you skip words while reading? Do words move on the paper? Do you bothered by fluorescent lighting/glare on the white page when reading? Do you see stripes/polka dots/patterns on the paper? Etc.

Objective
To observe the prevalence of symptoms of scotopic sensitivity syndrome/Irlen syndrome in healthy college and school going students.

Sample
The data used in the present study was obtained from a sample of 2 university and 2 schools of Agra and Kashipur city of India. 103 (N = 103) college and school going students age range from 12 to 25 has been taken purposively. Sample included girls and boys. Students with any kind of mental as well as physical disabilities (Injury) have been excluded from the sample. Students with some kind of eyes problems have been also excluded from the study sample.

Instruments
To discover the prevalence of the most common symptoms of scotopic sensitivity syndrome, 'The Irlen Syndrome (Visual Sensory Stress) Self-Test: Short (1994)' has been used. Student's responses on 'The Irlen Syndrome (Visual Sensory Stress) Self-Test: Short (1994) has been recorded for the analysis. Parents were also asked to give the information about the student's performance at home and in daily life tasks. The percentage of student who might have been at the high risk has been calculated.

Analysis of result
The objective of the present research is to find out the prevalence of symptoms of scotopic sensitivity syndrome/Irlen syndrome in healthy college and school going students. The percentage (%) has been calculated of the students who have reported on 10 most prominent symptoms of scotopic sensitivity syndrome as collected from the Irlen Syndrome (Visual Sensory Stress) Self-Test (1994).

Table 1: Percentage (%) of students reported on major symptoms of scotopic sensitivity syndrome

S. No.	Symptoms of scotopic sensitivity syndrome	% of students responded "yes"	% of students responded "no"	% of students responded "don't know"
1.	Slow reading/words change after a while	68% (n = 70)	25.2% (n = 26)	6.8% (n = 7)
2.	Reading gets worse with time	69.9% (n = 72)	22.3% (n = 23)	7.8% (n = 8)
3.	Strain & fatigue with extended reading	59.2% (n = 61)	35.9% (n = 37)	4.9% (n = 5)
4.	Do you become restless while reading?	59.2% (n = 61)	35.9% (n = 37)	4.9% (n = 5)
5.	Print distortions, especially with black print on white paper	68% (n = 70)	25.2% (n = 26)	6.8% (n = 7)
6.	Dislike of bright light or glare/prefer dim light	53.3% (n = 57)	36.9% (n = 38)	7.8% (n = 8)
7.	Difficulty working on computer screen	54.4% (n = 56)	43.7% (n = 45)	1.9% (n = 2)
8.	Dislike stripes/polka dots/patterns	65% (n = 67)	22.3% (n = 23)	12.6% (n = 13)
9.	Lack of depth perception of difficulty in judging distances	83.5% (n = 86)	13.6% (n = 14)	2.9% (n = 3)
10.	A feeling of clumsiness when negotiating uneven terrain	71.8% (n = 74)	24.3% (n = 25)	3.9% (n = 4)

As the data in the table no. 1 shows, the percentage (%) students responded "yes" to the symptoms of scotopic sensitivity syndrome indicating that students may be at a risk of developing scotopic sensitivity syndrome and required a proper assessment. Loew, Marsh and Watson (2014) [4] surveyed the specific incidences of nine widely-recognised symptoms of visual stress (VS) in a group of 20 subjects diagnosed with CFS. The presence of each symptom of VS in the CFS group has been compared to its respective presence in both an age and sex matched healthy comparison group of 46 individuals and an age and sex matched group comprised of 14 individuals diagnosed with VS. Results revealed that the frequencies of all nine VS symptoms in the CFS-diagnosed group were significantly higher ($p = .032 – p < .0005$) than in the comparison group, with only two symptoms being statistically less frequent in the CFS group than in the VS-diagnosed group. The usual number of VS symptoms has been reported by the CFS group was significantly higher than the comparison group, yet not significantly different from the VS group. Hence, the incident of VS symptoms in subjects diagnosed with CFS appears to be far greater than previously reported, which in turn may indicate the interplay of some yet to be identified underlying factor(s) common to both conditions.
On the basis of the above results it can be said that individual experiencing any of the symptom which can lead an individual or child for many of the difficulties like reading, writing and difficulties in perceptual tasks. Individuals reporting positive on the self-test of scotopic sensitivity syndrome should be properly assessed and not to misdiagnosed with any other disorder such as ADHD, dyslexia and autism etc.

Interpretation and Discussion
After the analysis of the present investigation it can be said that the prevalence of the key diagnostic symptoms of scotopic sensitivity syndrome might be misdiagnosed with other disabilities instead of scotopic sensitivity syndrome. As students have reported the symptoms like 'lack of depth perception & difficulty in judging distances'(83.5%), 'a feeling of clumsiness when negotiating uneven terrain'(71.8%), 'reading gets worse with time' (69.9%) and 'print distortions, especially with black print on white paper' (68%) etc. Hence, it is very important to understand the symptoms of scotopic sensitivity syndrome at the initial stage to provide students and individual a proper diagnosis.
Chang, Kim, Kim and Cho (2014) [1] studied the visual symptoms and signs of Meares-Irlen syndrome (MIS) and non-specific dyslexia from other ophthalmologic disease (NODs). The study included 45 patients. 34 MIS patients those symptoms of have been improved with tinted lenses. Other 11 patients whose reading difficulty was improved with the ocular therapy were the part of the study. The results showed that in MIS group the most common symptoms were doubling the image (53%), difficulty to move lines (85%) and difficulty in bright lighting condition

(27%). The symptoms like blurring were most common symptom in the NODs group. The associated ocular diseases in the two groups were refractive error (79% and 73%), exophoria (6% and 27%) and dry eye (29% and 18%), respectively.

Thus, the graph is showing the percentage (%) of the prevalence of ten major symptoms of scotopic sensitivity syndrome found in the present investigation.

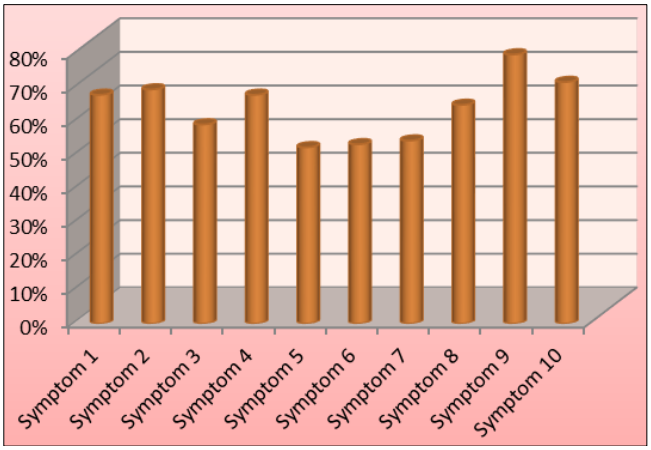

Fig 1: The graph is showing the percentage (%) of the prevalence of ten major symptoms of scotopic sensitivity syndrome found in the present investigation

Implications

Now there is a question that, is scotopic sensitivity syndrome treatable? Hence, scotopic sensitivity syndrome is treated through a fascinating application of the science of color. The Irlen Method is non-invasive technology that uses colored overlays and filters to improve the brain's ability to process visual information. Our brain process light waves of varying as various colors and some color can be irritable the brain process of some individuals. To treat scotopic sensitivity syndrome there are some color overlays and colored lenses which filtered out some irritable wavelengths of color to reduce the high stimulation of the brain to correct the visual processing deficit. It is the only method scientifically proven to successfully correct the processing problems associated with scotopic sensitivity syndrome. It is very important to ensure that the overlays and colored glasses meet the standards of color balancing and is helping the individual according to their color preferences. The use of color overlays and glasses are helpful and effective. These two methods can improve reading fluency, comprehension, comfort, attention, and concentration while reducing light sensitivity. Correcting Irlen Syndrome can lead to improved comprehension, motivation, self-esteem, and academic/work performance.

Winterbottom and Wilkins (2009) [7] found that the aspects of lighting in classroom can raise discomfort and impair task performance through glare, and barely visible 100 Hz flicker from fluorescent lighting, has been examined in a sample of UK schools. It was observed that in 90 classrooms, variables measured involved illuminance at desks, flicker, and luminance of whiteboards. Results revealed that 80% of classrooms were lit with 100 Hz fluorescent lighting that may cause headaches and impair visual performance. Mean illuminance (from excessive day- and artificial lighting) was in additional of recommended design illuminance in 88% of classrooms, and in 84% exceeded levels beyond which visual comfort decreases. The amount of the glare spot differentiated between various brands of whiteboard. The ambient lighting, required for close work at pupils' desks, decreased image contrast. Venetian blinds in 23% of classrooms had spatial features appropriate for involving pattern glare. There was significant difference between schools and local authorities. These findings can provide insights into small-scale reports linking pupils' behaviour, attainment and learning to classroom lighting, and it can also help in explaining some of the benefits of coloured overlays for pupils' reading.

Conclusion

Scotopic sensitivity syndrome is a visual perception deficit which primarily affects reading and writing and it is thus likely to have secondary effects on attention and concentration skills that are difficult to distinguish from ADHD and dyslexia as well. Students having trouble with fluorescents lights can lead to disruptive classroom behaviour and difficulties in academic performance. Therefore, it is suggested that either an exceptional degree of symptoms overlap and/or comorbidity exists between these poorly understood conditions, or that many individuals with scotopic sensitivity syndrome may have been incorrectly diagnosed. In regards to further directions in this area, more follow-up researches are needed.

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