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LETTER TO THE EDITOR

Colored filters enhancing visual evoked potential (VEP) response in multiple sclerosis

Scientific letter

This scientific letter is to show a case report of multiple sclerosis (MS) in a 35-year-old Caucasian female with visual disturbances in absence of active optic neuritis or reduced visual acuity. Late effects of recurrent optic neuritis, including profound vision loss is typically managed with vision rehabilitation modalities such as magnifiers and contrast enhancing tinted/colored lenses; however, utilizing the visuo-cortical response via visual evoked potential (VEP) measures is not standard clinical protocol. The enhancing effect of tinted lenses on symptomatology and visuo-cortical responses are presented as a novel approach to cases of symptomatic patients with multiple sclerosis during remission periods.

Clinical examination

A 35-year-old Caucasian female with relapsing-remitting multiple sclerosis (RRMS) and previous bouts of optic neuritis presented with blur vision of both eyes and constant dizziness exacerbated with peripheral visual motion.

Neuro-optometric examination

Patient's neuro-optometric examination findings are described below:

Snellen's Visual Acuity (Normal): OD – 20/20; OS-20/20; OU-20/20

Randot® Stereotest (Normal): Local Stereoacuity = 100 sec of arc; Global Stereoacuity = 250 sec of arc

Optic Neuritis Test (Red Cap Comparison): OD-95%; OS-100% (No optic neuritis)

Ishihara Color Vision Test (Normal): OD-11 out of 11 plates correct; OS-11 out of 11 plates correct

Humphrey 30-2 SITA-Fast Visual Fields Test: OD-Scattered nasal defects; OS-Inferior temporal scotoma

Based on MS patient's symptoms the following intervention (colored filters) and clinical test (VEP) were performed:

Colored filters (CF) selection

Use of colored filters – CF have already been used clinically to reduced abnormal visual motion sensitivity (VMS) in mild traumatic brain injury (mTBI) patients.[1–3] Abnormal VMS is also called as visual-vertigo syndrome, as peripheral visually-stimulating environments might provoke symptoms such as dizziness, disorientation. This MS patient also has constant dizziness exacerbated with peripheral visual motion, therefore, plano (i.e., no prescription) CF were introduced in both eyes over the habitual spectacle correction. The patient was tasked to identify the CF which provided a noticeable difference in symptoms. CF trials were performed multiple times in normal room illumination with random repeated application for confirmation.

- **Brown CF with 80% transmittance** – patient found no subjective difference
- **Grey CF with 80% transmittance** – patient found no subjective difference
- **Yellow CF with 80% transmittance** – patient found positive subjective difference, patient responded by stating that her dizziness was less with yellow filters and she also felt comfortable in walking with yellow filters.

Patient's visual symptoms seems to be improved with the yellow CF, therefore, an objective clinical VEP test was performed with and without yellow CF.

Visual evoked potentials (VEP)

VEP testing parameters

Standard clinical pattern VEP testing was performed with as well as without yellow CF binocularly. The DIOPSYS NOVA-TR VEP (Diopsys, Inc., Pine Brook, NJ) system was used (15V x 17H degrees, black-and-white checkerboard stimulus, 1Hz alternation). The following standard optimal clinical pattern VEP parameters were used:[4–6] check size 20 min arc, contrast 85%, test duration 20 s, and luminance 74 cd/m^2. Two trials per condition were performed and averaged for analysis.

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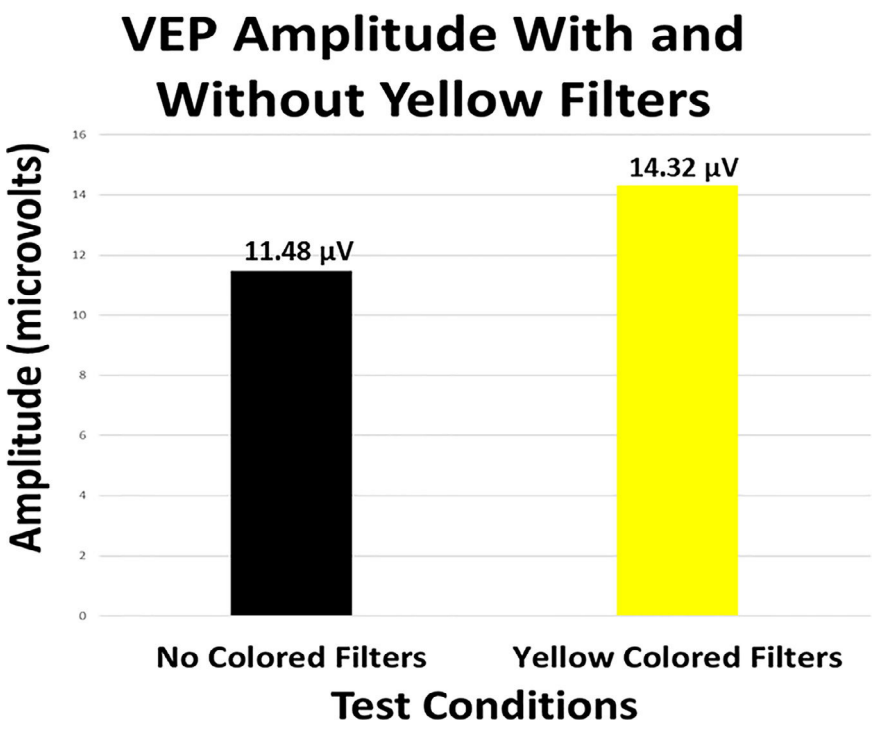

Fig. 1 VEP amplitude in multiple sclerosis (MS) patient with and without yellow colored filters.

VEP results

There was a significant enhancement in VEP amplitude (~3 μV) (Fig. 1) with yellow CF, as compared to without CF. In addition, no significant change in latency values (~129 ms) was found both with and without yellow CF.

Discussion

There are two possible neurophysiological mechanisms involved in increase in visuo-cortical activity with yellow CF even as early as the primary visual cortex (V1). First possible mechanism is based on the concept of faulty filtering mechanism,[1, 2] that is, yellow CF seem to reduce luminous intensity of the bothering peripheral stimulus. Therefore, it reduces the amount of neural noise entering the visual system and cause increases in the amount of neural signals processed at the V1 level. In addition, increase in neural signals are also responsible for enhancement of neural synchronization at the V1 level and also between different cortical areas.[7] Second possible mechanism is based on mechanism of visual attention, assuming that yellow CF seems to reduce some of the irrelevant, bothersome, and distracting peripheral visual attention, thus, responsible for enhancement of central visual attention.[1,2] Due to this, there was increase in neuronal activity at the V1 level and also improvement in MS patient's visual symptoms.

Clinical implications

This case report has several important clinical implications. First, clinicians could apply this novel approach of using CF in MS patients presenting with visual disturbances such as constant dizziness exacerbated with peripheral visual motion during remission. Second, clinical VEP testing could be used to assess the effect of CF at the visuo-cortical level. Third, this approach would help clinicians quantify efficacy when prescribing CF in MS patients to reduce visual disturbances.

Summary

With yellow CF, an enhanced objective visuo-cortical response was correlated with the MS patient's positive subjective visual impression. In addition, yellow CF helped MS patient in reducing dizziness symptoms, therefore, also helpful in improving their activities if daily livings (ADLs).

Declaration of Competing Interest

The authors report no conflicts of interest.

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