



The effects of spectral filter intervention in the oculomotor coordination profile of children with reading and learning disabilities

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Oculomotor incoordination is recognized as a main barrier regarding the acquisition of successful learning and reading skills. (Quercia, Feiss & Michel, 2013; Ventura et al., 2009). Reading disabilities lead to a significant socioeconomical and educational impact in the affected children and their families (Handler et al. 2011). In this study we analyse the effect of the use of individually selected spectral filters in reading fluency skills and oculomotor coordination patterns within a 12 month period in a group of patients diagnosed with Irlen Syndrome.

The sample was composed by 108 subjects (68 boys and 39 girls) with age range between 10 e 14 years (11,38 years \pm 1,19), with visual acuity of 20/20 by Snellen Chart with or without refractive correction and a confirmed diagnosis of Irlen Syndrome. All the subjects were seen at the Neurovision Department of Hospital de Olhos de Minas Gerais and followed a strict protocol required by the local Board of Ethics Committee as the study was performed in a clinical setting and was done in *anima nobili* – thus following the Helsinki's code.

The protocol which was done in a two day schedule in all cases, included along with the routine eye exam procedures (refractometry with and without cycloplegia, biomicroscopy, funduscopy, cover test, accommodation amplitude measurements and IOP measurements), stereopsis in seg/arc, Keystone check-up, aberrometry by I Tracey, contrast sensitivity under photopic and mesopic stimulation by Optec 6500, ETDRS visual acuity with best corrected vision or PLANO, phorias, static visual field by Octopus Zeiss and dynamic peripheral vision by FDT – Welch Allyn Humphrey ViewFinder. We also performed OCT by Cyrrus Zeiss and color vision testing using Ishihara and saturated and Desaturated Farnsworth D15. The analysis of the reading skills in the group of Learning and Reading disabled children was done by Visagraph™ III Eye-Movement Recording System (Taylor, 2006), which is a computer based system that provides quantitative measurements of each eye's movements during visually guided activities such as reading (Tannen & Ciuffreda, 2007).



The subjects' reading skills were registered before the use of Irlen filters and 12 months later. Eight parameters were taken into consideration: Number of Fixations/100 words (NF), Avg. spam of Recognition (AR), Number of Words Read by minute or Reading Rate (PM), Grade Level Efficiency (GEL) e Cross Correlation (CB). The data followed the criteria for submission to parametric testing (normal distribution, variance homogeneity and non existing extreme variance or *outliers*). The analysis of variance (ANOVA) for repetitive measurements showed a statically significant variance between the previous obtained data without the use of selective filters and the data obtained after one year of filter use [$F(5,422) = 26,63; p < 0,01$]. The *post hoc Fisher LSD Test* showed statistically significant differences in all the studied variables ($p < 0,01$). With the use of filters, the **NF** went from $172,22 \pm 70,67$ to $115,29 \pm 53,74$; the **AR** from $0,60 \pm 0,27$ to $1,01 \pm 0,41$; the **PM** of $134,18 \pm 53,56$ to $230,51 \pm 95,85$; the **GEL** de $2,32 \pm 1,54$ to $8,57 \pm 5,06$; and the **CB** from $82,39\% \pm 13,60$ to $90,85\% \pm 5,85$. Thus, during reading activities after one year of using filters in a daily basis, the number of fixations decreased 33,05%, while the number of words read per minute went up 71,79%; the spam of recognition 68,33% and the cross correlation 10,26%. Due to this, the Grade Level Efficiency went up to 269,39%. Therefore, the use of individually selected Irlen spectral filters significantly improves the oculomotor pattern and reading fluency skills in children with learning related visual disabilities.

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CRM-MG 10160

September 2013