VISUAL PERCEPTION FOR WELDING TASK: CONVENTIONAL PROTECTIVE OPTICAL FILTER VS NOVEL PROTECTIVE OPTICAL FILTER OF SELECTIVE ABSORBANCE

Pérez-Carrasco MJ[1], Bonnin-Arias C[2], Chamorro E[2], Ramírez-Mercado JG[2], Lobato-Rincón LL[2], Navarro-Blanco C[2], Sanchez-Ramos C[3]

[1]School of Optics . Universidad Complutense Madrid (UCM) Madrid Spain, [2]Neuro-Computing and Neuro-Robotics Group Collaborator. UCM. Madrid. Spain, [3]Neurocomputing and Neurorobotics Group. UCM. Email: celiasr@opt.ucm.es.

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TRODUCTION

ple whose work tasks involve the use of welding torches are at special risk of suffering eye uries due to the emission of visible, short wavelength radiation. Although conventional tection spectacles and screens available to workers does absorb the noxious bands of ctromagnetic radiation, they also block out 99% of the entire visible spectrum such that bility is greatly reduced. For this reason, during welding, the worker can avoid the use of se kind of elements.

order to go beyond this circumstance, we have developed several optical filters, to ctively block harmful light while preserving optimal vision and luminosity.

URPOSE

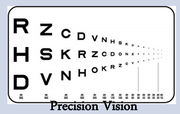
s study was designed to compare visual performance using the new UCM-AET selective-orbance filter and a conventional filter used for eye protection by welders.

ATERIAL

absorbance-selective UCM-AET filter fails to affect al acuity. Moreover, the transmitance curve of the new illustrates how it fully absorbs the short wavelengths ted by a welding torch and attenuates the rest fo the elengths.

following **tests** were performed in random order with ithout the use of a filter, which was also random:

Fig. 1.- Transmittance curves of the new (green) and two conventional filters

Traditional Runge near vision pocket card (Precision Vision, USA).	Titmus for assesing stereoacuity and depth perception.	VCTS (Vistech Consultants, INC, 1988, Stereo Optical Company).
 Precision Vision	 webeye.ophth.uiowa.edu	 pip.ucalgary.ca

Fansworth Munsell D-28 Hue for color discrimination.	Frequency-doubling technology (FDT) perimetry.
 Mapfre.com	 perimetry.org

METHODS

Sample characteristics: The study participants were 36 subjects of mean age 44±14 years: 22 men (47±14 years) and 14 women (39±14 years).

Experimental procedure: All participants completed a series of tests designed to assess binocular vision and monocular visual field under three treatment conditions: 1) without a protective filter, 2) with a conventional protective filter used by welders 3) with the new absorbance-selective AET-UCM filter. All tests were performed under normal work photopic luminance conditions. This meant that measurements were made with best-correction for near distance tasks if needed. The variables determined were: binocular visual acuity, contrast sensitivity, stereoacuity, color discrimination and central and paracentral contrast threshold.

Statistical analysis: Data were compared among the three treatment conditions to assess the effects of the filters on the different measures of visual performance. All comparisons were pairwise and significance was set at a $p<0.05$ and statistical power at 0.8.

RESULTS

No significant effects were induced by the new filter on **near visual acuity and depth perception** but significantly reduced measures were observed with the conventional filter.

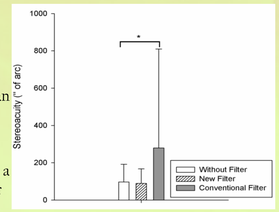


Fig. 2.-Mean stereoacuity recorded with/without the use of a protecti ve filter

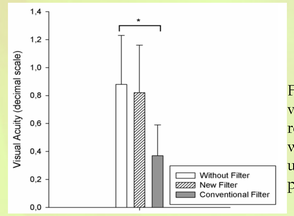


Fig. 3.- Mean visual acuity recorded with/without the use of a protective filter

Contrast sensitivity recorded for the new filter were closer to those obtained without a filter than the values recorded for the conventional filter. In addition to this, our results indicate that both filters significantly compromise **color discrimination**.

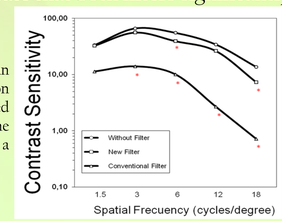


Fig. 4.- Mean color vision errors recorded with/without the use of a protective filter

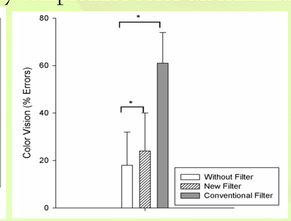


Fig. 5.- Mean recorded contrast sensitivity with/without the use of a protective filter

Our **visual field data** indicated significantly reduced **contrast thresholds** for all the zones examined using both filters although this reduction was more marked for the conventional filter. Thus, the UCM-AET filter achieved a 9-19% reduction in the contrast threshold while this was 91-99% for the conventional filter. This means that with the new filter, the contrast threshold is 76-85% improved over the normal working conditions of welders

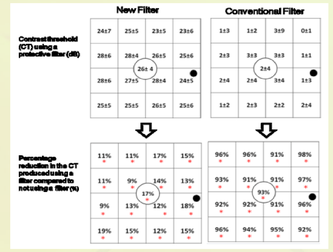


Fig. 6.- Mean FDT visual field results recorded with/without the use of a protective filter

CONCLUSIONS

1. To promote the regular use of eye protection in the welding environment, a protective component is required that will not reduce the visual acuity of the worker enabling, therefore, to avoid work accidents and improve the performance in detailed welding work.

2.- The UCM-AET filter absorbs short wavelengths of light but is able to transmit medium and long wavelengths. This allows for improved visibility in the work field since practically normal contrast thresholds are maintained.

3. The different aspects of vision were dramatically reduced when the conventional filter was used. In contrast, the new filter was able to avoid or minimize these effects emerging as a good protection system for welders along with their habitual spectacle correction used for work activities.

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