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EDITORIAL

Binocular vision in the twenty-first century

Visión binocular en el siglo XXI

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This special issue of the Journal of Optometry has a focus on “binocular vision”. Over the past decade, the area of binocular vision, and related oculomotor-based reading performance and visual comfort, as well as other visual aspects, has taken on a special prominence. This is primarily due to two factors.¹ First, there are the United States conflicts that have persisted in the mideast over the past decade or so. Mild traumatic brain injury (mTBI) has been the ‘signature’ and frequently the ‘invisible’ war injury, with its pervasive, adverse effects on binocularity, in particular the vergence and accommodative systems, with carryover to the complex act of reading and visual performance in general. In fact, reading problems, typically of an oculomotor nature, are the most frequent visual symptoms in this population. Second, the same holds true for the area of sport concussions. These two phenomena have converged and brought to the forefront the range of visual sequelae in both the war and sports arenas, and mTBI in general. And, in turn, they have specifically highlighted these common binocular vision problems, as well as the importance and efficacy of vision therapy (VT)/neuro-optometric vision rehabilitation), in the millions of afflicted patients worldwide.^{1,2}

This leads to the important notion of brain plasticity, and more specifically of visual system plasticity. Just over 10 years ago, visual system plasticity, in particular in adults, was “rediscovered” by the Oliver Sacks/Sue Barry (“Stereos Sue”) collaboration.³ Of course, such plasticity at all ages was always ‘there’, but perhaps not brought to the public eye in such a dramatic and widespread manner. Those in optometry performing high-level vision therapy in both children and adults, including in strabismics, knew this all along. This was not new, but rather it gave important confirmation and affirmation to the wide range of successful optometric interventions in such patients. Yes, vision therapy “works”, even in adults!! How could it not “work”, as its underlying

mechanisms are perceptual and motor learning, which were developed and well-established in the field of psychology over the past 120 years.^{4,5} And, perhaps most remarkably, VT has had considerable success in the adult, mTBI population despite their markedly damaged and older brains. Lastly, and so importantly, over the past decade or so, all of the above has been scientifically-documented by several clinical (e.g., clinical trials) and laboratory (e.g., objective recordings) investigations.^{1,2}

The above rather lengthy and global remarks bear important relevance to the papers of the current issue with its broad binocular vision theme. All of the papers bear either directly or indirectly on the topic. Perhaps the two papers most directly related involve the treatment of convergence insufficiency and also of strabismus, with two diametrically opposed approaches, namely vision therapy and surgical intervention, respectively. The former has its impact at the brain level by altering synaptic strength (e.g., Hebb’s ‘cell assembly’ model, the forerunner of neural networks)^{1,4,5} with the latter affecting more peripheral mechanisms (i.e., the cranial nerve/extraocular muscle interface). Very different, but both relatively successful. Two other papers, namely one dealing with visual stress and the other with visual fatigue, while more diagnostic in nature, have important therapeutic implications. In the former, only once the clinician has developed diagnostic guidelines and thus high-yield diagnostic “biomarkers”, can efficacious therapy be implemented. The same can be said for the paper on visual fatigue while watching 3-D movies, as this area likely expands along with the more encompassing journey into virtual reality. The other papers, while being more indirectly related, are also very important, as problems in these areas, such as visual acuity and optimal word length for reading, can lead to a constellation of visual symptoms in need of vision remediation.

In conclusion, binocular vision in the twenty-first century remains an important and evergrowing area of vision and visual information processing, both at the clinical and basic science levels. Following more theoretical development in the area over the next several years, instrumentation assistive in the diagnosis and treatment of binocular vision disorders will become more sophisticated and sensitive, thus improving detectability and early intervention, especially in our children and other “special, at-risk” populations.

References

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