1040-5488/12/8909-1244/0 VOL. 89, NO. 9, PP. 1244–1245
OPTOMETRY AND VISION SCIENCE


GUEST EDITORIAL

# New Challenges in Low-Vision Research

In recent years, there has been a surge in interest and activities in low-vision research. There are now national and international conferences and workshops dedicated to low-vision research; the number of presentations related to low vision has increased at the annual meetings of the American Academy of Optometry and the Association for Research in Vision and Ophthalmology and many journals on vision science have seen an increase in the number of published articles on low-vision research. A quick survey on PubMed for articles that contained the keywords *low vision, visual impairment* and *visually impaired* in the title or abstract returned that the number of these articles doubled in the past decade, from 35 published in 2002 to 72 published in 2011. Many of the advances in vision science have seen their applications in the arena of low-vision research, for example, the application of standardized questionnaires to evaluate the effectiveness of low-vision rehabilitation or the quality of life of individuals with low vision. Another example is the use of a gaze-contingent method to simulate the loss of visual field, a method that provides an improved methodology to study how individuals with specific types of visual field loss perceive visual targets and carry out their daily activities. In this feature issue of *Optometry and Vision Science*, we showcase many facets of low-vision research, highlighting how recent advances in vision science can be applied to low-vision research and patient care.

Low vision, whether research or patient care, emphasizes the functional capabilities of the individuals. We are pleased to include two perspective papers in this feature issue, one on a basic determinant of visual function—visual acuity[1]—and the other on an activity of daily living—driving with bioptic telescopes.[2] The authors of these two papers, authorities in their respective fields, nicely summarize the critical issues related to their topics, offer insightful suggestions to improve patient care, and identify the critical issues that will help shape future research work on these topics.

The emphasis on functional capability in low vision is further demonstrated by our collection of articles on original research. The development of the Berkeley Rudimentary Vision Test allows the quantification of vision at much lower levels of acuity, which is useful in both clinical and research settings.[3] The measurement of three-dimensional scotomas (volume scotomas) would allow clinicians to better evaluate the impaired functional vision for tasks at different distances.[4]

As most low-vision clinicians know well, reading and mobility are the two top reasons for patients with visual impairment to seek low-vision care. Many low-vision patients suffer from a loss in contrast sensitivity; therefore, information on the dependence of reading ability on text contrast would be very helpful in offering advice or prescribing low vision devices to these patients. This is evaluated in two studies, one focusing on the general population of older adults,[5] and the other focusing on people with glaucoma.[6] Another study investigates whether people with central vision loss suffer from more crowding because of the need to use the peripheral retina, and if so, whether reading can be improved using text with increased letter spacing.[7]

Detecting and recognizing steps and ramps is an important component of mobility. One paper examines whether visual texture on the ground plane can improve the detection and recognition of steps and ramps in the presence of simulated low vision and whether the effects change with locomotion.[8] The recent advances in retinal prostheses raise many interesting and important questions, including whether mobility can be improved with prosthetic vision.[9]

Several authors provide informed advice and guidelines on the prescription of optical low vision devices for reading[10,11] and information about the use of the prescribed devices and their impact on quality of life.[12] In addition to the task of reading, optical devices such as prisms have been used to "expand" the visual fields and increase spatial awareness for patients with homonymous hemianopia. The effects of eye dominance, suppression, and background on the use of these prisms for vision rehabilitation are reported in one study,[13] while another article documents the interesting observation of how a torsional strabismus with harmonious anomalous retinal correspondence provides an effect similar to a visual field expander.[14] Although it is clear that optical devices are very useful for the task of reading and field expansion, their use may be limited for other tasks such as identifying objects and faces in more complex settings, especially when the contrast of the objects is not high. Under these conditions, image enhancement may be helpful, but the question remains as to whether people with visual impairment prefer the enhanced images and/or exhibit improved search performance.[15]

The recent development of high-speed eye-tracking technology combined with a gaze-contingent display paradigm allows us to study many interesting questions that were methodologically challenging a decade ago. In this feature issue, two groups of investigators independently report the use of this technique to stabilize an artificial central scotoma on normally sighted individuals and examine the effects of such an artificial scotoma on the performance of visual search tasks. The questions they asked are different. One paper investigates whether contour enhancement benefits searching for an object in the presence of central vision loss,[16] and the other investigates how the oculomotor system adapts to the loss of central vision.[17] These studies also elucidate a more fundamental question—are the visual experience and consequences due to an

artificial central scotoma in normally sighted individuals the same as those due to an actual central vision loss in patients? An interesting related question is whether patients with bilateral central scotomas are aware of their field defects.[18]

Over the past decade, there have been many advances in the use of psychometrics to evaluate health outcomes. The application of these methods has helped answer many questions in low-vision research. In this feature issue, one article evaluates the effectiveness of low-vision research in South Australia,[19] while another evaluates whether visual impairment has any impact on the daily life of pediatric patients.[20]

Finally, we have a case report on the benefit of applying adaptive optics to correct for aberration at the preferred retinal locus of an individual with Stargardt disease.[21]

We thank all the authors for their enthusiasm, hard work, and patience in working with us on completing this very important task. Without the unqualified support of the Editor-in-Chief, Anthony J. Adams, OD, PhD, FAAO, and the Managing Editor, Kurt Zadnik, this feature issue would never have been possible. We, the Guest Editors, are indebted to their help in promoting low- vision research. In putting together this feature issue, we hope that the articles will be stimulating and provide effective advocacy for addressing the pressing research questions and critical clinical issues facing low-vision rehabilitation. Our goal for this feature issue is not simply to celebrate the most recent advances in the field, but also to stimulate ideas and questions for future research. More rigorous research can provide better patient care to the visually impaired. We sincerely hope that we have achieved these goals, and we are proud to present to you this feature issue on Low Vision. Enjoy!

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