Visual Impairment Due to Brain Injury; Clinical, Therapeutic, and Research-Related Topics

Chair: Carolyn Carman, O.D., F.A.A.O .
Co-Chair: Douwe Bergsma, Ph.D.

Working with patients of all ages in need of low vision/vision rehabilitation services started as a passion at the Southern College of Optometry in Memphis, Tennessee, where Dr. Carman graduated before completing a residency in ocular pathology and low vision at the VA Medical Center in Kansas City, Missouri. She began her practice as Director of Dallas Services for Visually Impaired Children and went on to be Founder and Director of the Low Vision Centers of Texas with 13 patient evaluation sites across Texas. She later founded and directed the Advanced Low Vision Clinic as well as the Polytrauma Traumatic Brain Injury Clinic at the VA Medical Center in Dallas, Texas. In addition, she developed the vision rehabilitation clinic for brain injury adults and children at Baylor Institute for Rehabilitation and later at Our Children’s House, a comprehensive rehabilitation hospital program where she has served for over 20 years. Dr. Carman is currently a Clinical Professor at the University of Houston College of Optometry where she is the Director of the Center for Sight Enhancement at the University Eye Institute.

Dr. Carman is Board Certified/Diplomate of the American Board of Optometry (ABO), a Fellow of the American Association of Optometry (AAO), and a member of the American Optometric Association (AOA). She has had an opportunity to serve in many capacities including Chair of the Texas Optometry Board, Board of Director for the Texas Optometric Association, and Founder and Chair of the American Optometric Association Neuro-Optometric Rehabilitation Committee. She has served on the AOA Ethics and Values Committee, Legal and Legislative Committee, Give One Day (Texas Chair), Association of Regulatory Boards of Optometry Telehealth Committee (Chair), and International Committee, and member of the National Board Review Team. Dr. Carman has earned the TOA Young Optometrist of the Year, Molly Armstrong Leadership Award, Physician for the Day at the Texas House of Representatives, and Texas Rehabilitation Association Physician of the Year. Dr. Carman has lectured extensively in the field of low vision and vision rehabilitation both nationally and internationally. She currently serves on the Texas Medical Advisory Board for the Department of Public Safety and has been a long-standing advocate for bioptic telescope driving.

Symposium Outline/Abstract:

Since a large portion of the brain is related to vision, visual impairments due to brain injuries, including cerebral vascular events, are highly possible. These brain injuries may be traumatic, acquired, or congenital and the visual difficulties may present as a variety of perceptual or visual problems including visual field loss. The evaluation and management of patients with visual difficulties may also be challenged by the compounded effect of other related impairments that may be present. This Symposium will address the evaluation and management of visual impairment following brain injury from a clinical perspective, present the research study results relating to peripheral prism use and training effects on performance, and the research conclusion of training-induced reduction of visual field defects.

Symposium Presenters and Presentation Title:

1. Carolyn Carman, O.D., F.A.A.O. (USA); **Overview of Visual Impairment Due to Brain Injury**
2. Henk L.M. Stam,B.Optom/F.A.A.O. (NL); **“Break in the Lifeline” Due to Acquired Brain Injury; Recognizing These Patients in An Optometry Office**
3. Douwe Bergsma, Ph.D. (NL); **Segregation of Spontaneous and Training Induced Reduction of Visual Feld Defects in Early Stroke Patients**
4. Kevin Houston, O.D., M.Sc., F.A.A.O. (USA); **Peripheral prisms and perceptual-motor training improve blind-side detection of people with hemianopia**

Abstracts:

1. Overview of Visual Impairment Due to Brain Injury

Carolyn Carman, O.D., F.A.A.O.
Clinical Professor, University of Houston College of Optometry, Houston, Texas, USA
Vision Clinic Founder/Consultant, Baylor Institute for Rehabilitation Hospital, and Our Children's House, Dallas, Texas, USA

This presentation will cover common visual impairments associated with brain injury or stroke. Along with giving a broad overview of various brain-related visual problems, a practical approach to assist in the evaluation and management of visual deficits suffered by brain injury patients will be discussed.

2. "Break in the Lifeline" Due to Acquired Brain Injury; Recognizing These Patients in An Optometry Office

Henk L.M. Stam, B.Optom/F.A.A.O.

In the Netherlands, there are 17 million inhabitants with 600,000 persons suffering from acquired brain injury. Approximately 50% have 'vision problems' and 40% of these patients have a form of hemianopia or quadrantanopia. Therefore, 3.5% of this population may experience problems with their 'vision' due to acquired brain injury. However, many providers, therapists, optometrists, or ophthalmologists may not readily be aware of the vision problems of patients with acquired brain injuries or may attribute perceived or observed problems to other deficits. This presentation will discuss how to more readily identify vision problems due to acquired brain-injury, based on the experience of a hospital-based optometrist.

3. Peripheral prisms and perceptual-motor training improve blind-side detection of people with hemianopia

Kevin Houston, Eli Peli and Alex Bowers
Faculty, Harvard Medical School, Department of Ophthalmology Staff, Mass Eye and Ear Vision Rehabilitation Service; Spaulding Rehab Hospital Outpatient Vision Clinic Investigator, Vision Rehabilitation Lab, Schepens Eye Research Institute; Schepens Eye Research Institute, Massachusetts Eye and Ear, Department of Ophthalmology, Harvard Medical School, Boston, MA.

Background: Homonymous hemianopia (HH) causes difficulties in detecting objects on the non-seeing (blind) side. We conducted a pilot study to evaluate whether peripheral prism (p-prism) glasses and perceptual-motor training improve blind-side detection for drivers with HH.

Methods: Eleven patients with complete HH were fitted with 57Δ (30°) oblique p-prism glasses. After 2 weeks wearing the glasses at home, they attended 6 visits for perceptual-motor training with the p-prisms. The training involved detecting and touching checkerboard stimuli appearing in the prism expanded vision. Blind side detection performance was objectively evaluated using a driving simulator. Participants drove along pre-determined routes and pressed the horn upon detection of pedestrians (26 each from right and left) which ran towards the roadway. Four driving simulator assessments were performed one each without p-prisms, with p-prisms before training, with p-prisms after training, and at a 3 month follow-up.

Results: In the training task, touch error reduced significantly for stimuli in prism-expanded vision from a pre-training median of 16.6° to 2.7°at the end of training ($p = 0.01$). In the simulator, p-prisms improved blind-side detection from 42% to 56%, which further improved after training to 72% (all $p < 0.001$). P-prisms also improved blind-side timely responses (adequate time to have stopped the vehicle) from 31% of pedestrians without to 44% with p-prisms ($p < 0.001$), which further improved with training to 55% ($p = 0.02$). At the 3 month follow-up, improvements in detection were maintained (65%; $p = 0.02$) and timely response rates were still better than without p-prisms (43%; $p = 0.001$), but not different from pre-training levels ($p = 0.725$). However, blind side detection and timely responses rates were not as good as on the seeing side (100% and 93%, respectively).

Conclusions: Our results suggest that oblique p-prisms improve detection of blind-side hazards by patients with HH and that training may further improve performance.

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Disclosures: Eli Peli has rights in a patent related to the peripheral prism glasses (assigned to Schepens Eye Research Institute) and licensed to Chadwick Optical. Kevin Houston and Alex Bowers have no disclosures

4. Segregation of Spontaneous and Training Induced Reduction of Visual Feld Defects in Early Stroke Patients.

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Background: about 25% of all stroke patients have visual field defects, which can cause problems for activities of daily life (e.g. reading, driving, navigating). Treatment consists of adaptive prisms, compensatory eye-movement training and/or vision restoration training. We studied restoration-training effects in early stroke patients.

Methods: restoration training is controversial partly because placebo-controlled studies are lacking. In our view, a true placebo-training is not possible. We therefore studied restoration-training effects in 30 subjects using within-subject control methods (border area training vs. no training). Visual fields were measured using a Goldmann perimeter. In earlier studies, training started at least 10 months after stroke onset to rule out a contribution of spontaneous recovery. To profit from a larger recovery potential, we started training within 6 weeks after the stroke event (20 patients). Using the same protocol, we also trained a group in the chronic phase (10 patients). Spontaneous and training-induced components of recovery were distinguished by training one half of the defect for 8 weeks during which the other (non-trained) half served as a control. Subsequently, we trained the former control part of the defect and used the formerly trained part as control.

Results: Defect reduction was significantly greater in the trained half of the defect than in the simultaneously non-trained half of the defect. Spontaneous recovery was significantly smaller in the second training period than in the first and recovery as a result of training was comparably large in both periods and similar to training effects in the chronic phase. Both reading speed and GAS-scores were significantly correlated to defect reduction.

Conclusion: restoration training adds to the spontaneous recovery of visual field defects, i.e. the total recovery in the early stroke stage is larger when restoration training is applied.

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