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Visibility

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Special Considerations for the "Oldest-Old" in Low Vision Rehabilitation

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The fastest growing demographic in the United States is the "oldest old" group, people aged 85 and older. From 1960 to 1994, this group increased 274%, compared with the 100% increase of persons 65 years old and over, and a 45% increase in the total population. The oldest old demographic is projected to continue to be the fastest growing segment of the elderly population into the next century.[1] One quarter of the oldest old experience vision loss, due to age-related changes in their eyes and low vision disorders.[2] These changes affect visual function, ability to perform daily activities and quality of life.[3] Older adults with low vision report significant disability in leisure, work, social and mobility activities.[4, 5]

To effectively address leisure, work, social and mobility activities, vision rehabilitation professionals working with older adults must consider both environmental and personal factors.[5, 6] The Person-Environment-Occupation-Performance (PEOP) model illustrates how intrinsic and extrinsic factors interact to enable or hinder occupational performance and community participation (Figure 1). All components should be considered during the rehabilitation process because each client has individual valued roles, tasks and activities. A client's functional vision and quality of life are affected by multiple factors and treating the person holistically is the ultimate goal.[6] The following are components of the model that especially affect the oldest old cohort with low vision and their living situation: physiology (e.g. co-morbidities associated with aging, increased risk of falls),

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ABOUT ENVISION UNIVERSITY

The mission of Envision University is to provide multi-disciplinary continuing education and research opportunities for low vision rehabilitation professionals, establishing best practices to ensure continued research and clinical care for individuals who are blind or visually impaired. Our promise is to collaborate with vision rehabilitation and research professionals to provide relevant multi-disciplinary continuing education and research opportunities that address practice gaps in current standards of care and research.

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Special Considerations for the "Oldest-Old" in Low Vision Rehabilitation... continued from front page

psychology (e.g. depression, coping), social support, social capital, and physical environment (e.g. aging in place vs. facility care, static vs. dynamic).

Background: Intrinsic Factors Affecting Independence and Participation for the Oldest Old with Low Vision

The oldest old can greatly benefit from low vision rehabilitation, but growing empirical evidence demonstrates that there are factors in addition to low vision that affect their participation.[5, 7] Impairments in muscle strength and vision are associated with increased falls, decreased walking speed, functional dependence and disability.[8] From age 60 and beyond there is a steady decline in muscle strength of 1-1.5% per year. Muscle strength decrements may impair activities such as lifting groceries and standing up from a chair.[9] Reduced acuity, reduced visual field, and decreases in the eye's ability to adapt to different light levels – whether due to age-related decline or low vision disease – hinder older adults' ability to avoid obstacles and navigate dim and changing environments, putting them at a greater risk of falls. Older adults with low vision are more likely than their sighted peers to have postural instability putting them at a greater risk for falls.[10]

Older adults with low vision are twice as likely as healthy peers to have clinical depression. The relationship between functional impairment and depression is complex: depression can worsen activities of daily living (ADL) function, and reduced ADL function can cause depression. Older adults with low vision may experience negative psychological feelings due to fear of further visual decline, driving cessation, institutionalization, change of roles, or for any combination of reasons. Vision loss may not be the direct cause of depression; other factors should also be considered and appropriate referrals made.[11]

Background: Extrinsic Factors Affecting Independence and Participation for the Oldest Old with Low Vision

Social support can be a facilitator or a barrier to participation in older adults with low vision. Higher social support quality is associated with fewer depressive symptoms, more life satisfaction, and better adaptation to vision loss.[12] Social support can be important to successful rehabilitation – providing transportation to and from appointments and encouragement. Driving retirement, occurring at an average age of 86, is linked to depression, social isolation and risk of long-term care placement. Older adults prefer driving to other modes of travel in their communities[13] but often rely on informal transportation support from friends and family. These older adults may feel that they cannot fully reciprocate in social situations such as driving to and from activities[14] and they may feel concerned about being a burden to others and thus limit their activities.[15] Social support can lead to positive psychosocial effects because of the fulfillment of needs, but an overabundance of support can also cause caregiver burden, excess disability and learned helplessness. Education provided to clients and caregivers should emphasize community resources, autonomous decision-making by the client, and an optimal level of social support.[5]

The environment is external to the person and is where their chosen

Table 1. Senior Care Facilities

	Definition	Services Provided	Inclusion/ Exclusion Criteria	Cost
Nursing Home	Hospital-like settings that provide skilled nursing care and rehab services to people with illnesses, injuries or functional disabilities. Generally house 40-200 residents and are licensed by the Department of Health Services. Patients rely on assistance for most or all daily living activities (such as bathing, dressing & toileting).	PT/OT/ SLP, respiratory therapy, pharmacy services, home health care, adult day care, respite care, hospice care, dialysis	Must have illness, injury, or a disability that limits ADL performance.	~ $84-300 per day private pay. Ancillary charges (i.e. medicines, diapers, personal laundry, etc.) may also apply. A majority are registered to accept Medicare, Medicaid and long-term care insurance in addition to private pay.
Assisted Living	Bridges the gap between independent living and a nursing home. Service plans are developed and updated regularly for each person to ensure appropriate assistance as conditions change. Other common terms: Residential Care, Personal Care, Adult Congregate, Living Care, Adult Foster Care, Retirement Residences	Assistance with a few ADLs and/or medication	24-hour supervision needed. NOT an alternative to a nursing home, rather an intermediate level for long-term care. Able to care for self despite some required assistance with ADL. Patient not able to live alone but does not require constant care.	~ $60-$160 a day. Medicare will NOT cover. Usually private pay. Some insurance plans may cover costs.
Congregate Living	Independent living, generally apartments, with added "hospitality" services (light housekeeping, meals). Community environment with an independent feel. No commitment to the facility, you can move if desired. Does not generally provide personal or health care. Also called: Congregate Retirement Community, Congregate Senior Community, Supported Housing, Residential Care	Shared meals, transportation to shopping and appointments, housekeeping, laundry service, planned social and recreational activities, security, fulltime staff, social companionship, health monitoring. May be part of a continuing care community.	24-hour supervision not needed. For living independently with common "hospitality" services or socialization.	$500-$4000 per month (depending on facility). No Medicare coverage.
Independent Living	Apartments or townhouses to rent or own. Gathers people of similar ages and interests. Also called retirement communities. Provides private living with communal activities and services.	May offer prepared meals, social activities and trips (book groups, baking classes, shopping trips), maintenance, on-call assistance, exercise programs.	For healthy and self-sufficient people who can and want to live independently but do not want to stay at home.	Highly variable, from government subsidized up to luxury communities that require the cost of the home plus an activity fee of up to $2000 a month.
Accessory Dwelling Unit	Independent housing units developed within a single family home. Can also be an attached or separate cottage on the lot of a single family home.	Allows for informal support to an older family member or friend, while allowing the privacy of separate living quarters.	Determined by home owner and occupant. Older adult may be the home owner or the occupant.	Determined by home owner and occupant. This type of arrangement can assist homeowners in maintaining their independence by providing additional income to offset property taxes and the costs of home maintenance and repair.

Continuing care retirement communities are residential settings that provide shelter, social activities and, as needed, healthcare and support services. They are usually campus-like complexes providing a continuum of care options.

activities occur. The environment can be made of physical elements that are both built and natural (e.g. doors ramps, walkways), and social influences (e.g. culture, policy, attitudes). These elements of the environment can facilitate or become barriers to an older adult's occupational performance.[16] Older adults with vision impairment are vulnerable to incidents in the physical environment. The aging process and reduced visual acuity may impair an older adult's ability to interact with the physical environment.[17] The physical environment can be static or dynamic, novel or familiar, simple or complex. Environments that are static, familiar and simple are easiest for the visually impaired to navigate because they are able to use other strategies such as memory and tactile sense to be successful. Decreasing the number of objects, increasing the visibility of objects (e.g. adding or modifying lighting and adding or modifying contrast) and organizing the placement of objects can simplify the complexity of an environment.[18]

Extrinsic Factors Affecting the Living Situation of the Oldest Old with Low Vision

The combination of personal and environmental factors affecting older adults with low vision often influences relocation to a senior housing facility. Eighty-six percent of adults 75 and older, surveyed by AARP in 2005, would like to age in place and continue living at home. Discussions of aging in place versus relocating to a senior housing facility become an issue of

participation during rehabilitation. Therapists have the opportunity to assist clients and their families with determining the appropriate level of support and care to yield the best possible occupational performance. Different types of senior housing facilities and home and community-based services are outlined in Tables 1 and 2.

The first topic that often comes to mind when considering aging in place versus moving to a senior housing facility is safety. Safety issues that arise during many instrumental activities of daily living (IADL) such as setting the right temperature, turning off the oven, managing medication and fall prevention during functional mobility. Senior housing facilities are more likely to have fewer stairs to navigate, more accessible bathroom equipment and personnel available in case of emergency. But are facilities always safer? Clinical observations made by occupational therapists at low vision rehabilitation facilities in Wichita, Boston and San Francisco found that 49% of 61 clients living at home and 45% of 22 clients living in facilities reported a fall within the last year. Those living in senior housing facilities may be more likely to fall due to physical co-morbidities and other extraneous variables, but the numbers suggest that moving to senior housing does not guarantee reduced number of falls.[18]

A second issue that is a consideration in aging in place versus facility living is social isolation versus social interactions. One of the many benefits of living in a senior housing facility is social capital. Social capital is defined as the resources available to an individual resulting from ties to social networks in the community.[19] Examples of social capital available at senior housing facilities include transportation to community outings, art fairs, fitness classes and regular health monitoring. Neighborhood and facility designs that are more likely

Table 2. Home and Community-Based Services

	Definition	Services Provided	Inclusion/ Exclusion Criteria	Cost
PACE – Program of All-Inclusive Care for the Elderly	The Program of All-inclusive Care for the Elderly (PACE) model is centered around the belief that it is better for the wellbeing of seniors with chronic care needs and their families to be served in the community whenever possible. Seniors live in their own home but may attend a day program with activities and healthcare provided in the same location.	May include but are not limited to: primary care (including doctor and nursing services), hospital care, medical specialty service, prescription drugs, nursing home care, emergency services, social services/ counseling, transportation, home care, physical therapy, occupational therapy, adult day care, recreational therapy, dentistry, meals, nutritional counseling, laboratory/X-ray services	55 years of age (65 in some states), meet the Medicaid nursing home eligibility criteria, live in a PACE service area, able to live safely in the community when they join with the help of the PACE services.	Medicare or Medicaid funded program. Some sites are Medicaid-only contracts.
NORC – Naturally Occurring Retirement Community	The NORC is a residential area in which a large percentage of individuals aged 65 and older reside. The federal government recognizes NORCs as communities in which at least 40% of the heads of household are older individuals. States vary on their definition of NORC.	Provides opportunities for meaningful community involvement and increased access to support services.	Varies community to community. St. Louis example: Age, residency and current membership are the only criteria. If you are at least 65 years of age and live within approximately three miles of the Jewish Community Center campus in Creve Coeur, you may be a St. Louis NORC resident.	Supported by public and non-profit organizations. Dues may apply based on ability to pay.
Personal Care Assistance	Provides services to persons who need help with day-to-day activities to allow them to be more independent in their own home. A personal care assistance program may be able to help if a person has a physical, emotional, mental or chronic illness or injury.	May include but are not limited to bathing, dressing, meal preparation and grocery shopping.	Elderly people with disabilities and individuals with chronic or temporary conditions. Varies state-to-state. Common qualifications are orders from a physician, services are medically necessary; the person is Medicaid eligible or state program eligible, lives in the community. Cannot be receiving services from their living arrangement.	**http://www.wid.org/publications/directory-of-publicly-funded-pas-programs/** Medicaid waivers or state plans cover the cost of PCA services.
Consumer-Directed Model of Care	Home and Community-Based Service that gives clients control of recruitment, training, hiring, supervising and firing of the provided care. Improves consumer satisfaction, reduces unmet needs, and enhances quality of life without unduly compromising safety, competence, or amount of care.	May include but are not limited to bathing and dressing, meal preparation and feeding, transfers, bowel and bladder routines, medication administration, transportation to medical appointments, grocery shopping, other routine tasks as allowed under Medicaid. Varies state-to-state.	Services are typically directed at a less disabled population that is not at risk for institutionalization. Must assume the responsibilities listed in the definition including handling financial tasks.	Offered by some Medicaid and state-funded programs.

Figure 1. Person-Environment-Occupation-Performance Model (PEOP)[6]

C. H. Christiansen, C.M. Baurn, and J. Bass-Haugen (Eds.). (2005). Occupational therapy. Performance, participation, and well-being (3rd ed.) Thorofare,, NJ: LACK Incorporated.

to promote social capital are those that are mixed use and pedestrian oriented.[20] These neighborhoods and facilities enable residents to perform daily activities without the use of a car. Many of them have places of worship, a local tavern, a coffee shop, or restaurants within walking distance. Socialization happens by chance rather than by invitation. Many senior care facilities also have video magnifiers or host low vision support groups. Individuals with high levels of social capital tend to be involved politically, volunteer in the community, and get together more frequently with friends and neighbors.[20] The increased social capital in a facility or retirement community, however, must be weighed against networks in the community such as local clubs or auxiliaries that may be lost with a move to a facility. Senior housing facilities are not necessarily safer than aging in place and social capital can be gained or lost by relocating. An older adult's home may or may not be more static, familiar and simpler than a facility. Ultimately, each older adult has an individual set of barriers and facilitators that must be taken into account when advising about living situations.

Outpatient Low Vision Therapy Delivery for the Oldest Old

The oldest old cohort, in addition to vision impairment, is likely to have other age-related impairments (e.g. cognitive) and medical comorbidities. They are at high risk for depression, being caregivers, and having inadequate social support.

Case Study

Mr. S is an 87-year-old patient diagnosed with bilateral maculopathy, autoimmune retinopathy and a choroidal nevus. In his initial evaluation with the low vision ophthalmologist, he reported that he was no longer able to read his mail, read medication labels, write checks, or use his kitchen appliances, due to his vision loss. Mr. S presented with a ring-scotoma pattern of vision loss, sparing the foveal area of retina. His single letter acuity was good enough that he did not qualify for state services, such as rehabilitation teaching or social work. He was able to identify individual letters, but could not piece sentences together in order to read fluently. He had initially reported that he could measure his blood glucose level, but when the OT evaluated him in his home, Mr. S was unable to match the test strip to the drop of blood on his finger. He was highly motivated with excellent cognitive functioning, thus he was an excellent candidate for vision rehabilitation.

This patient lived 57 miles from the low vision clinic and was no longer driving due to the vision loss. He was a widower and his only daughter worked fulltime. Like many of the oldest old population, he also had co-morbidities, such as diabetes, fatigue and limited mobility due to orthopedic conditions. He also had an autoimmune condition that required him to seek expensive special medical treatments in which his daughter was transporting him to, already requiring her to miss work and putting a financial strain on the family As a result, the patient was unable to come back into the clinic for low vision rehabilitation services, and his numerous vision and health issues were causing his family to be greatly concerned about him living alone. His daughter was encouraging the patient to consider leaving his home of 35 years for an alternative living environment, such as an assisted living facility.

Because of the numerous factors that affected his ability to access services at the low vision clinic, the occupational therapist conducted home visits. His treatment consisted of five home visits totaling four treatment hours and a total of 570 miles of driving. At the time of discharge from occupational therapy, Mr. S was able to independently pay his bills using large-print checks, bold pens and a task light. He was also able to operate his kitchen appliances using tactile and high contrast markings, mend clothes using an adaptive needle threader, and watch the news on his television using telescopic glasses. Fall prevention and safety were thoroughly addressed. Most notably, he was now able to independently manage his diabetes using visual skills training.

If Mr. S. was unable to receive low vision rehabilitation services in his home he would have been unable to pay his bills, cook meals or manage his diabetes. His quality of life and sense of independence would have decreased. He would be facing many of the safety risks that cause many older adults to move to assisted living, at a high cost to both the individual and the healthcare system.

For these reasons, the rehabilitative strategies for the oldest old are different than younger adults.[21] Jackson and colleagues found that the oldest old participants benefited from vision rehabilitation (i.e. initial consultation with an ophthalmologist with assessment of visual function and discussion of the rehab plan according to goals and visual function, and training with an occupational therapist as indicated) one year post rehab. The 25 oldest old participants in their study had significant gains in visual ability and reading ability.[7]

How do we increase access to services based on the intrinsic and extrinsic struggles of the oldest old clients with low vision? A review of data at the Vision Rehabilitation Center at the Massachusetts Eye and Ear Infirmary found that their oldest old clients failed to return for occupational therapy services more often than younger clients. This response is most likely due to the issues discussed earlier such as mobility difficulties, depressed feelings and lack of social supports to provide transportation. Based on this research, the occupational therapy delivery model was changed to involve more home visits for the oldest old and the number of oldest old clients participating in occupational therapy increased. Home visits, transportation assistance, companions, and receiving services in the home community will increase access to rehabilitation for the oldest old.[7]

Conclusion

Currently, one quarter of the oldest old (85+) experience low or reduced vision. Simultaneously, this population's quality of life, performance and participation are impacted by a series of unique factors including physiology, psychology, social support, social capital and physical environment. Occupational therapists and other vision rehabilitation team members have an important role in identifying the barriers and facilitators in the client's environment and providing interventions to modify activity performance or educate the client of alternative options such as senior housing facilities.

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Creating a Vision Rehabilitation Coalition in Five Steps

Sarah Hinkley, OD, FCOVD

You have heard the proverb "it takes a village to raise a child." As someone with a passion for getting the word out about vision rehabilitation amongst doctors' offices and the general public, I offer my own interpretation, "It takes a village of professionals to maximize independence for patients with visual impairment." That sentiment was the impetus behind the formation of the Michigan Low Vision Rehabilitation Coalition. It started with a big idea – to bridge the communication gap that exists between vision rehabilitation professionals and foster teamwork for the good of patients across the state. Although no large and worthwhile idea is easy, I am sharing the steps taken in initiating the Coalition, along with my joys and struggles, in hopes that it may inspire you to do the same.

WHAT: The Michigan Low Vision Rehabilitation Coalition is a task force of individuals from different areas throughout the state of Michigan who communicate about the projects and services of their organization or profession, as well as brainstorm and implement ways to enhance public, doctor and patient education on available low vision rehabilitation services. This Coalition represents a wide variety of doctors, organizations, professionals and patients in order to gain a wide perspective and universal agreement. The diversity of membership also allows the Coalition to identify the most commonly encountered barriers to education about and utilization of low vision rehabilitation services.

HOW: The Coalition developed a mission statement at its first meeting, as well as goals and objectives that guide its use of funding. A secretary was appointed to keep minutes and send communications. Once the coalition reached agreement on the best way to promote and educate the public, patients and doctors about low vision rehabilitation, we created projects that utilize grant funding to accomplish the stated objective (for example, the production of printed materials). Grant funding was also used to facilitate meeting costs and travel, since many of the members have to travel great distances. Virtual or web-based meetings are being explored to save cost.

The Coalition's first project was the production and distribution of a statewide, large print brochure educating doctors and the public about low vision rehabilitation services, including a list of eye care providers across Michigan who practice low vision rehabilitation. Ophthalmologists and organizations across the state were mailed a kit containing a letter of introduction, brochure holder and brochures. Support was provided for ordering refill brochures. The mailing reached 185 offices.

Here are my suggested steps for creating your own Coalition.

STEP 1:
DEVELOP YOUR IDEA.

Decide on a preliminary mission for your coalition. What is its purpose? What type of membership should it contain? Which professions will be represented? Should a patient representative be included? Are there influential organizations in your state that should be involved? My advice is to create a document that answers the following questions on paper: What? Why? When? How? Who? If you can successfully answer these questions then you are ready to proceed to step 2.

STEP 2:
ENLIST SUPPORT FOR YOUR IDEA.

Contact individuals or organizations with influence in your state and pitch your idea. Ask for support in the pursuit of grant funding or donations. Request an official letter of support that you can use in your grant applications. My experience in obtaining grant funding is that the support of influential organizations is a necessity. For our Coalition, I received letters of support from the Michigan Commission for the Blind, our state agency, and the Association for the Blind and Visually Impaired, an influential non-profit organization.

STEP 3:
LOCATE POTENTIAL FUNDING SOURCES.

There are two primary ways to fund a Coalition. The first is through corporate or individual monetary donations. If you have a personal connection with a company involved with vision rehabilitation, use your contacts to pitch the program. Consider an individual benefactor as well, particularly someone with a passion for vision rehabilitation. The other option is application for grant funding. Online searches for available grants are a good way to start. Professional associations or societies may also be an excellent resource connecting you to open grants. Experience with grant-writing is helpful, but with thorough planning and attention to detail, anyone has the potential to be funded. Submit your grant applications in a timely fashion along with your letters of support.

STEP 4:
AFTER FUNDING IS RECEIVED OR WHILE YOU WAIT, BEGIN TO BUILD YOUR COALITION MEMBERSHIP.

Start with individuals from associated rehabilitation professions other than your own. Consider a patient representative as well. I strongly encourage the membership of at least one optometrist and one ophthalmologist who are specifically involved in low vision rehabilitation or at least a strong supporter of referrals for rehabilitative care. Include a representative of any influential organizations in order to keep them apprised of your activities. Ask the members to commit to meetings and small amounts of time in between meetings for project activities. I have found email or an interactive online worksite to be the easiest methods of communication for members. Our Coalition includes a vision rehabilitation optometrist, a Veteran's Administration representative

optometrist, a retinal specialty ophthalmologist, a vision rehabilitation ophthalmologist, a representative of the Michigan Commission for the Blind, a representative of the Association for the Blind and Visually Impaired who is a rehabilitation teacher, a Teacher of the Visually Impaired (TVI), an occupational therapist (OT) specializing in vision rehabilitation, an OT specializing in driving rehabilitation, a patient with visual impairment and a professor of blindness studies and rehabilitation. Your coalition should be small enough to work as a functionally integrated team while large enough to be representative of a diverse array of professionals, organizations and patients. I suggest between five and fifteen members.

STEP 5:
SCHEDULE YOUR FIRST MEETING.

The first is the most difficult and I felt it was important to have one face-to-face meeting prior to beginning our conference calls or emails in order to get to know each other. At the meeting, introduce the services provided by the member's

(continued on page 14)

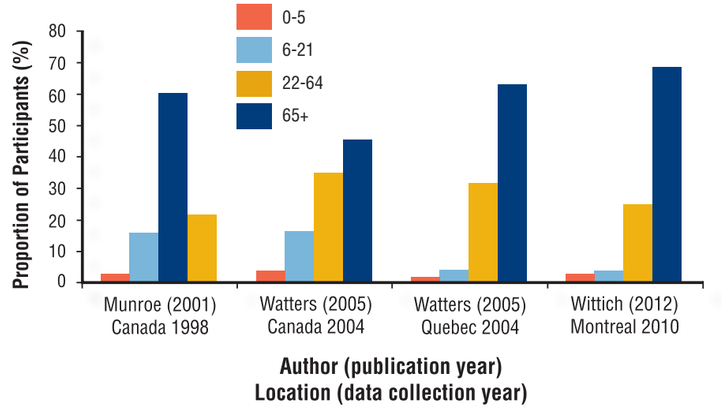
Rehabilitation Services for Combined Vision and Hearing Loss

Walter Wittich, PhD, FAAO, CLVT

Dual sensory impairment (DSI) generally refers to any level of combined vision and hearing loss, independent of age, severity or time/order of onset. Historically, the term deafblind has been more commonly used to describe this population, consisting mostly of children with severe sensory impairments or adults with progressive loss due to conditions such as Usher Syndrome. However, in recent years, research regarding the growing number of older adults with both age-related decline in vision and hearing has brought the term DSI into the literature.

The population prevalence of DSI has been reported to range anywhere from 1.6% to 22.5%, depending on the definition and measurement technique of sensory loss.[1] Subgroup analyses for persons over the age of 55 report prevalence rates ranging from 7.0% to 35% (see [2] for a more detailed review). The increase of DSI with age has been estimated to rise from 1.6% or 3% in those ages 65 to 69 to 13.6% or 21.9% in those ages 80 and over.[3,4] Within Canada, a series of consecutive studies[5-7] has provided an interesting insight into the age distribution among persons with DSI and how the proportion of older adults has increased over time (see Figure 1). The studies by Munroe[5] as well as by Watters et al.[6] aimed at providing demographic profiles of persons with DSI throughout the entire country by identifying individuals through any means possible, including community organizations, disability groups, senior residences, home care associations, regional health associations, government departments, disability service offices and universities, to name only a few. Even though there are some differences in the success rates and recruitment techniques across provinces, the comparison of the Canada-wide data collected from 1998 to 2004 indicates the beginning of a notable increase in the number of older adults with DSI. The estimated proportion of persons over the age of 65 has increased from 21.6% in 1998 to 45.4% in 2005.[5,6] Since the data were provided by province, it was possible to extract the Quebec statistics for comparison with a recent study by our group in Montreal.[7] The proportional shift towards the upper age group seems to continue, specifically in the population that actually accesses the rehabilitation network in an urban environment such as Montreal. It came as no surprise that 69% of DSI rehabilitation clients were over the age of 65, with 43% of the total sample being over the age of 85. The age-distribution is of particular significance because the older participants represent the parents of the baby-boomer generation, since 2010 was the last year before the baby-boomers reach retirement age. Age-related conditions such as macular degeneration and presbycusis (age-related hearing loss) accounted for 49% of the associated diagnoses. When examining the levels of sensory loss in terms of acuity, visual field and average decibel hearing loss, the majority of older adults presented with a sensory profile that reflected residual vision and hearing for them to benefit from low vision rehabilitation and hearing-assistive technology services in order to maximize their functional abilities.

Traditionally, rehabilitation services for vision loss and hearing impairment have been offered separately. The demographic tsunami[8] is changing how rehabilitation services are being provided as professionals in both domains begin to consider the needs of this particular population and how to adjust service delivery.[9-11] This trend requires that rehabilitation agencies prepare new methods of service provision, specifically in programs where clients are potentially affected by more than one impairment. Saunders and Echt[12] have pointed out that the loss of visual and auditory capacity is not simply additive but has a multiplicative effect because clients with DSI cannot compensate for the loss of one sense with the other. Therefore, uni-sensory rehabilitation approaches need to evolve to become more appropriate for dealing with DSI clients.



The rehabilitation system available in Montreal has the advantage that dual impairment rehabilitation services are provided through combined programs offered at agencies that also provide uni-sensory rehabilitation. This involves a multi-disciplinary approach, including optometry, audiology, social work, occupational therapy, psychology, low vision rehabilitation, speech and language pathology, orientation and mobility, hearing-assistive technology, special care counseling, computer accessibility, Braille and sign language instruction. This spectrum of professionals allows the rehabilitation service providers to address

(continued on page 14)

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Creating a Vision Rehabilitation Coalition in Five Steps... continued from page 10

specialty or organizations including the barriers each member feels is present in doctor and public education about low vision rehabilitation. Develop a mission statement. Nominate and elect a secretary for communications and a chair if it is someone other than you. Decide on a first project based around open discussion of the mission statement and coalition goals. Divide tasks to accomplish amongst members and agree to hold each other accountable on the established timeline.

Once you've gotten this far, enjoy the fruits of your labor! A group of motivated members can accomplish so much. I have enjoyed watching our ambitious statewide education project come together and my interactions with Coalition members have been amazing. Despite professional and political differences that arise, our focus on the mission statement keeps us grounded in what is best for patients. Some frustrations that have arisen include difficulty scheduling and coordinating meetings, trouble identifying a source of conference calling technology without associated costs and the tendency to lose momentum after projects are completed. The quest for funding is also a continual battle. Despite the frustrations, it has been worth the effort and I have learned so much from the other members. Best of luck to those who are blazoning this trail in your state.

Rehabilitation Services for Combined Vision and Hearing Loss... continued from page 12

the large variability of functional and diagnostic categories in the DSI population, many of which are rarely discussed in the research context due to low incidence. For example, a growing segment of the DSI spectrum are adults who adjusted to living with a single sensory impairment (hearing or vision) and who develop a second sensory impairment in later life. Their rehabilitation needs are not necessarily entirely clear and less often addressed during the training of rehabilitation professionals. Their priorities may depend on which impairment occurred first and which one developed later in life; however, presently there is very little experimental data or expert-clinician knowledge to guide their rehabilitative services.[13]

The mosaic of sensory aging is further complicated by the fact that other age-related health issues can arise, such as heart and respiratory conditions, arthritis and mobility impairments, and/or cognitive decline. All these and other comorbidities will influence to which degree clients will prioritize their choice to access sensory rehabilitation. The client profile in vision and hearing impairment has changed – and so must the services we provide.

Dr. Sarah Hinkley is an Associate Professor and Chief of Vision Rehabilitation Services at the Michigan College of Optometry at Ferris State University. Her significant didactic responsibilities include course and laboratory instruction in Developmental Optometry, Treatment of Binocular and Accommodative Dysfunction, Low Vision and Clinical Problem Solving. Additionally, she instructs clinical interns at the Ferris State University Eye Center and Cherry Street Health Services in the areas of primary care, contact lenses, pediatrics and binocular vision, vision therapy and vision rehabilitation. She writes frequently on her subject expertise and research for statewide and national publications, including articles in national peer-reviewed journals and serves on the review board of the *Journal of Behavioral Optometry*. She is a frequent lecturer at national and state continuing education seminars and is a certified Michigan Low Vision Specialist.

Neuro-Enhancement: A New Treatment for Optic Neuropathy

Ronald Siwoff, OD, FAAO, DPL-ABO

ABSTRACT

Neuro-enhancement is produced by the use of custom prismatic spectacles, designed and prescribed by looking at visual evoked potentials (VEPs). Improved functional vision results from a decreased latency in signals traveling through the brain and not from simply finding the locus of maximum retinal sensitivity. In a study of 100 patients, the new treatment significantly improved the sight of people with a range of optic neuropathies, including primary and hereditary optic atrophy, stroke, tumor, glaucoma, head injury, optic neuropathy with and without MS, optic nerve hypoplasia, and ischemic optic neuropathy.

INTRODUCTION

It is commonly believed by professionals and lay people that if you damage a sensory neuron to the point that it atrophies, the resulting loss of conduction and function are irreversible. This belief stems from the conceptual model that a sensory neuron behaves like a single strand of copper wire, and that the sensory organ behaves like a telegraph keypad, with the brain having a receiver to decode the message. A break in the wire prevents the interpretation of the message. But what if sensory neurons behave like fiber optic bundles? They would be able to transmit much more information than the copper strand and they would be tunable. The ability to tune would mean that changing the angle of the beam of light would allow many signals to travel through the fiber optic bundle at the same time. Damage to some of the fibers in the bundle would not degrade the signal.

The purpose of this study is to demonstrate that the transmission and function of the human visual system with optic atrophy can be improved by changing the angle of the light entering the eye.

Walter Stanley Stiles and Brian Hewson Crawford first described the directional sensitivity of cone receptors in the human eye in 1933.[1] They were looking at a retinal explanation for the phenomenon they observed: light entering the center of the pupil appears brighter than light entering from the periphery of the pupil. The knowledge of neural processing occurring throughout the entire visual system would not occur until much later.

David Hunter Hubel and Torsten Nils Wiesel greatly expanded our knowledge of sensory processing in their historic experiments of 1959.[2] Their work established the foundation for neurophysiology. Orientation-sensitive fields were described in their study. They demonstrated that vision is a brain function and not an eye function. Their work relied on electrodes inserted into the striate visual cortex. Our study relies on visually evoked potential (VEP), which uses electrodes applied to the scalp with electrode paste.[3] The VEP measures the strength of the signals (amplitude), as well as the time spent traveling through the eye and the brain (latency). The VEP uses a computer to select signals from the brain (EEG) and separate the signals that are produced by the entire visual system (VEP).

Sam Sokol, in 1976, suggested using the VEP to measure the sight of newborns, and also to measure contrast sensitivity and color vision.[4] Our study demonstrates a new and unique use for the VEP, not just to establish the presence of sight, but also, with the use of our assessment technique and measurements, to actually improve sight and overall visual function. The improvement in sight is not the result of a change in retinal function, but rather from a change in brain function, which is activated by decreasing the time it takes for signals to arrive at the primary visual cortex.

METHOD

This study looked at 100 patients, 196 eyes, with optic nerve disease. Four patients had one eye enucleated; 46 patients were female and 54 were male. Their ages ranged

from 5 years old to 97 years old, with a mean age of 60.7 years old.* ***See Figure 1.***

Distance vision was tested on each patient with The Original Distance Chart for the Partially Sighted, arranged by William Feinbloom, OD, PhD. Near acuity was measured with The Lighthouse Near Acuity Test (Second Edition) Modified ETDRS with Sloan letters. Snellen distance and near acuities were converted to a decimal form to facilitate statistical analysis.

Figure 1.
Optic Nerve Diseases

Primary Optic Atrophy	20
Hereditary Optic Atrophy	9
Stroke	17
Tumor	7
Glaucoma	27
Head Injury	2
Optic Neuritis MS	1
Optic Neuritis	1
Optic Nerve Hypoplasia	4
Ischemic Optic Neuropathy	12

Visual acuity varied from 20/20 to no light perception (NLP). Two people had one eye with 20/20. Two people had one eye with NLP. Two people had light perception (LP) in one eye. One person had LP in both eyes. Two people had one eye with hand motion (HM). For the purposes of statistical analysis, NLP, LP and HM were recorded as 0.00. Visual acuity of 20/20 was recorded as 1.00. More conventional forms of presenting acuities, e.g., log transforms, could not be used because of the inclusions of patients with acuities of 0.

The Visual Evoked Potential (VEP) was performed on each patient. Gold cup electrodes (Grass Model F-E56 H Astro-Med Inc., West Warwick, R.I.) were applied to the scalp with EEG paste. The electrodes were placed 4 cm above the inion on the midline and 4 cm above the brow on midline. The ground electrode was placed midway between the other electrodes. The impedance of the electrodes, measured prior to testing, was performed in compliance with the 2009 ISCEV Standard.

A Diopsys Enfant™ System (Diopsys Inc., Pine Brook, New Jersey, USA) was used with a checkerboard reversal pattern at 85% contrast viewed at one meter. First the check size with the biggest amplitude was selected. ***See Figure 2.***

Figure 2. Checkerboard Patterns

128 X 128	4 cycles/degree = 7.5 min/check
64 X 64	2 cycles/degree = 15.0 min/check
32 X 32	1 cycle/degree = 30.0 min/check
16 X 16	.533 cycle/degree = 56.285 min/check

Contrast was set to Michelson 85%. Mean luminance was 66.25 cd/m2.The checkerboard reversed at 2/seconds.

Testing was performed monocularly with best correction. The amount of prism chosen was determined by the patient's visual acuity, as follows: ***See Figure 3.***

Each patient received keratometry with a Haag Streit ophthalmometer and a trial frame refraction. The ensuing best spectacle correction in the trial frame was used for the VEP testing. The four checkerboard sizes were analyzed to determine what size produced the largest amplitude. The selected prism was put in the trial frame and the VEP was performed with the prism base up, base patient's left, base down, and base patient's right (clockwise). After the VEP data was collected, the landmarks were marked on the wave form. The N50, N75 and P100 were identified. The orientation of the prism that produced the largest amplitude with the shortest latency was selected. If two orientations resulted in the largest amplitude, the prescribed orientation was placed between both original orientations. If three orientations resulted in large amplitudes, the orientation was 180 degrees away from the center of the three orientations. If there was no increase in the amplitude and no decrease in latency, no prism was prescribed.

Figure 3.

20/20 to 20/40	2 Prism Diopters
20/50 to 20/70	4 Prism Diopters
20/80 to 20/100	6 Prism Diopters
20/120 to 20/200	8 Prism Diopters
More than 20/200	10 Prism Diopters

RESULTS

Paired-samples t-tests were conducted on the mean score for VA DIST, VA NEAR, AMP and LAT, comparing each variable between the prism and without prism conditions.

There was a significant difference in the VA DIST scores for the without prism (M = 0.16, SD = 0.19) and with prism (M=0.35, SD = 0.29) conditions, t (194) = -11.95, p<.001, 95% confidence interval for the difference (-0.22, -0.15).

There was a significant difference in the VA NEAR scores for the without prism (M = 0.21, SD = 0.23) and with prism (M=0.49, SD = 0.32) conditions, t (194) = -15.05, p<.001, 95% confidence interval for the difference (-0.32, -0.25).

There was a significant difference in the AMP scores for the without prism (M = 5.08, SD = 2.94) and with prism (M=4.23, SD = 3.58) conditions, t (191) = 2.66, p=.008, 95% confidence interval for the difference (0.22, 1.47).

There was a significant difference in the LAT scores for the without prism (M = 106.41, SD = 17.70) and with prism (M=96.07, SD = 28.44) conditions, t (194) = 5.37, p<.001, 95% confidence interval for the difference (6.54, 14.14). ***See Table 1.***

The mean distance vision without prism was 20/125 and 20/57 with prism. The mean near vision was 20/95 without prism and 20/41 with prism.

Distance vision improved 2.19 times and near vision improved 2.33 times. Of the seven people

Table 1

Means, Standard Deviations, t-Statistics

	Without Prism		With Prism			
	M	SD	M	SD	t	(df)
VA DIST	0.16	0.19	0.35	0.29	-11.95***	194
VA NEAR	0.21	0.23	0.49	0.32	-15.05***	194
AMP	5.08	2.94	4.23	3.59	2.66**	191
LAT	106.41	17.70	96.07	28.44	5.37***	194

***p<.001; **p<.01

* Methodology and statistical analysis was done by an independent consultant: Keith Morgen, PhD, Assistant Professor, Centenary College, Hackettstown, NJ.

with profound visual loss, two eyes with no light perception did not improve, three of four eyes with light perception improved (two improved to hand motion and one to 5/300), two of two hand motion eyes improved to 5/400 and 1/600.

DISCUSSION AND SUMMARY

Initially, it was expected that using a prism in various directions would objectively map the locus of greatest retinal sensitivity by moving the image off a scotoma produced by optic nerve disease. We had previously described the use of prisms, called RIT therapy, when there was retinal disease, so we were looking for similar results. We expected to see an increase in the amplitude of the VEP.

A decrease in latency was a better predictor of improved vision than an increase in amplitude. One might assume that the latency would decrease because of an improvement in visual acuity. An improvement in acuity should result in an increase in amplitude and a decrease in latency. This is not what we found. Latency did decrease, as predicted, but amplitude also decreased. This finding suggests that the improvement in vision resulted from a change in the brain and not in the retina. Additional studies are currently underway that are looking at the importance of coding visual information temporally.

The use of neuro-enhancement with prismatic spectacles measured by VEP in patients with optic nerve disease is an important adjunct therapy to be used in combination with traditional medical and surgical management. The improvement in sight results in clearer distance and near functional vision.

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Dr. Siwoff is a member of the National Physician's Advisory Board. He received the 2004 Physician of the Year award from that organization. Other awards for his service to the blind and visually impaired community including the Outstanding Scientific Achievement award from the New Jersey Society of Optometric Physicians and the New Jersey Department of Human Services award for Outstanding Accomplishments and Contributions to the Blind and Visually Impaired Community. Prior to his present position as Director of the Siwoff Low Vision Center, Dr. Siwoff was Clinical Assistant Professor of Ophthalmology at the University of Medicine and Dentistry of New Jersey. He directed the Low Vision Clinic at UMDNJ. He later became Director of the Gerald E. Fonda Low Vision Center at Saint Barnabas Hospital in Livingston, New Jersey. Dr. Siwoff holds several patents for technologies to improve the vision of the visually impaired. He has conducted joint research with the NIH and Harvard Medical School. He is the editor of lowvisionnews.com and the president of Eyecare-4Haiti, a charitable service organization providing eye care services to the poor in Haiti.

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