

**Eyeglasses for People With Vertical Eye Movement Disorders
and/or Ambulation Disorders – from PSP* or Parkinsonism
(*PSP = Progressive Supranuclear Palsy)
Eyeglasses for People Missing Lower Halves of Visual Fields**

The National Institute for Rehabilitation Engineering (NIRE) is a non-profit organization which operated clinics for the development and dispensing of low-vision, mobility, and communications aids (with training) from 1967 through 1987. These clinics assisted *hundreds* of people having permanent visual and/or physical impairments. This paper describes successful clinical methods developed and used during this period for (1) assisting individuals having Reading, Writing and Typewriting problems due to vertical EYE-GAZE DISORDERS or MISSING LOWER-HALF VISUAL FIELDS. And (2) this paper also discusses AMBULATION ENHANCEMENT with the use of prism-compensating eyeglasses to assist some people having NEUROLOGICAL DISEASES to walk more safely. Because the NIRE no longer operates these clinics, the information is being published so that NIRE's methods and data can be used by health-care professionals all over, to assist disabled individuals. *PERMISSION is granted for the free copying and distribution of this © paper provided all copies are complete and unaltered.*

Applicable Disorders & Disabilities

1. Vertical Eye-Movement Problems are experienced by many people having “Progressive Supranuclear Palsy” or PSP. Some patients with other neurological diseases and/or Parkinsonism also experience vertical eye-movement difficulties which make desktop functions such as reading, writing and typewriting difficult or impossible. *These people are unable to turn their eyes downward because of neurological disease.*
2. LOWER-HALF VISUAL FIELD LOSSES render some people unable to see downward even though their eyes move normally and can be turned downward. This condition might result from partial retinal detachment, diabetic retinopathy, optic atrophy, or certain neurological diseases.
3. Ambulation (Walking) Gait Problems typical of Parkinsonism are two additional issues for some disabled people. First is whether or not they can see the floor or ground they are walking on. And, second, is the possibility of significantly improving gait and balance using special eyeglasses.

METHODS FOR HELPING THESE PATIENTS, new and old:

- A. MECHANICAL METHOD (old) was previously used with some success. This involved use of a wood or metal bookstand on which reading material is placed ahead of, not below, the person's line of sight. Some stands are fixed height while other, more costly stands have been built to feature adjustable

heights. DISADVANTAGES include non-portability, size, weight and cost. Also, while adequate for reading, the surface is almost vertical so that writing is not feasible.

- B. ELECTRONIC METHOD (old) was previously used, based on the person buying a table-top “Closed Circuit TV Reading Machine” of the type sold to people with reduced visual acuity for about \$3000. The user sees a TV screen directly ahead of his face and does not need to look downward to the page being scanned. DISADVANTAGES: non-portability, high cost, and user’s inability to look down to see what he is placing on the desktop under the camera.
- C. OPTICAL EYEGLASS METHOD (new) is the best method used by the NIRE and the newest. This method is described in detail below. ADVANTAGES: easy portability for use anywhere, low cost, durability and normal looking appearance, to others.

OPTICAL EYEGLASS METHOD:

TWO TYPES OF CORRECTIVE EYEGLASSES: While, for many of these disabled individuals, special prismatic eyeglasses can greatly help in each of these problem areas, *each area requires different lens specifications*. One pair of glasses usually does **not** suffice for both purposes. Rather, separate, somewhat different lenses are needed. For this reason, a given individual may require two pairs of glasses: one for use while seated, for reading and other deskwork ... and another pair for walking.

DIFFERENT EXAMINATION LOCATIONS MAY BE NEEDED for testing and prescribing lenses for near vision tasks such as reading ... and for walking balance and gait improvement. Obviously, a patient can be trial-fitted and evaluated with lenses in an eye doctor’s office for improved reading, writing, typing and computer use. However, most eye doctors are not trained, staffed or equipped for mobility or movement disorder assessments. Similarly, most movement disorder and physical therapy clinics do not have eye doctors or optical dispensers on their premises. *This paper includes specific suggestions for dealing effectively with this problem.*

Intended Readership: This paper is written for the disabled lay person, for family members, for primary physicians ... and for specialists, including but not limited to: ophthalmologists, neurologists, optometrists, opticians, physical therapists, occupational therapists, mobility trainers, personnel directors, job placement counselors and industrial medicine personnel.

MEDICAL ADVICE: *No medical advice is given or intended by the NIRE.* This paper discusses methods successfully used in the past by this Institute to help specific disabled

individuals to function better, despite their disabilities, using prism lens eyeglasses. Such glasses can never substitute for competent and comprehensive medical care. All disabled readers are advised to consult with and continue under the care of their local physicians.

1. Near Glasses ... for the “Vertical Eye - Gaze Impaired,” for Reading, Writing, Typing & other tasks at desk- or lap- level

BACKGROUND: Most of the vision clinic patients with “Vertical Eye-Gaze” disorders were older, presbyopic people with PSP (Progressive Supranuclear Palsy). A few had been referred to NIRE with other neurological disorders. Some had been referred by primary care physicians and others by ophthalmologists or neurologists. NIRE’s vision clinic was staffed primarily by doctors of optometry, but with ophthalmology and neurology specialists on call.

THE MISSION: NIRE’s mission was primarily to help incurably, permanently disabled people to function as independently as possible for purposes of the activities of daily living (ADL), mobility, transportation, and employment. The “**Eye-Gaze Impaired**” patients generally could see well - straight ahead or upward - but could not turn their eyes downward to read papers on a desk or table, or on the lap. They’d strain to bend their heads down to read but, without the eyes also turning down, lowering the head was never enough. “**Lower-Half Visual Field Loss**” patients could move their eyes up and down but could not see downward even with their eyes turned down, without the special prism, base-down eyeglasses described in this paper.

METHODOLOGY: The doctor at NIRE (usually an optometrist) would perform complete refraction examinations for near, intermediate and distance vision. He (or she) would then test the existing eyeglasses and note their specifications.

Comparisons were made between the old glasses and the current examination findings. In some cases they were the same. In other cases, when new exam findings differed materially from the actual eyeglasses the patient was wearing, a test set of glasses made for comparative testing.

The doctor then tested the patient for near vision and functionality ... for reading, writing and typing at desktop, tabletop or laptop distances. This was always done with the patient seated - if able to walk - in a regular chair. If not, then while seated in his or her wheelchair. Most of these patients were able to clearly see, read and understand papers at the same distance in front of or ahead of themselves. But, they could not see downward, on the tabletop. This is why they were termed to be “Vertical Eye-Gaze Impaired” or “Lower-Half Visual Field Loss patients.” Most had bifocal eyeglasses but

some had single vision lenses and some had no eyeglasses at all.

The NIRE optometrist would then set up a pair of trial glasses containing, single vision lenses with the needed correction for reading distance ... plus prism base-down, for each eye. The desktop and laptop reading tests were then repeated, each time using different prism values (always base-down). These tests were continued until the patient was able to accurately and comfortably read the papers on the desktop or laptop. In these cases, there was little or no downward eye movement. The controlling movements were generally head movements.

FINDINGS: Moderately strong “prism, base-down,” was usually found to be necessary to achieve the desired results. Typically, each lens had 3 to 4 prism diopters, base-down. (Prism must always be the same for both eyes to maintain convergence. However, a few patients needed altered prisms to correct for existing misconvergence). Within this range of prism, almost all of the patients were able to see clearly downward.

The optometrist then proceeded to recreate the patient’s original bifocals or trifocals but with the added prism in each lens. Tests were then conducted to ensure the patient could see down, ahead, and upward so as to be most functional. Limitations were found which were related to age. For patients 60 or younger, as much as 4 prism diopters could be used without blurring or discomfort. For patients 65 to 70 years, 4 prism diopters were tried and some did well. But, it was necessary for some of the older patients to limit the amount of prism to 3.5, or even 3 diopters, to maintain image clarity.

WALKING or MOBILITY ISSUES were discovered. It was consistently established that the great amount of prism, base-down, required for desktop reading created problems for some patients when standing or walking. TO PREVENT INJURIES, the clinic’s policy was firmly established: “prism-down **reading glasses** were to be used ONLY WHILE SEATED – NEVER WHILE STANDING Or WALKING.” Every patient who received these glasses was so cautioned.

NIRE’s medical staff, therapists and mobility trainers were called in to observe the effects of prism, base-down, on people’s ability to walk safely and comfortably. This led to additional research discussed in the next part of this paper.

RECOMMENDATIONS for examining and assisting people with “Vertical Eye-Gaze Disorders” and/or “Lower-Half Visual Field Loss” are as follows:

- a) Have the patient bring in a written list of desired near vision tasks and measured work distances. These should be emulated in the doctor’s office. Because some patients desire to use a computer, eye-to-

keyboard and eye-to-screen distances should be known for emulation purposes.

- b) Verify that the patient's existing lens corrections are optimal. If not, determine new and better corrections and set them up in a trial frame. Verify the best corrected visual acuity.
- c) Evaluate the patient, with his own eyeglasses (or with lenses that you set up in a trial frame) for straight-ahead reading at the desired distance. When this function is found to be good, then place reading material on the desktop or laptop.
- d) If the patient reads downward with obvious difficulty or discomfort, start by adding 1 prism diopter, base down, to each lens. Keep increasing the prism in 0.5 diopter increments until the patient can read desktop or laptop materials comfortably.
- e) Once satisfactory results are obtained, determine the patient's needs for looking at a computer keyboard, below, and at a computer screen, ahead. Determine if bifocal lenses are needed – but for use only while seated – ***NEVER while standing or walking***. Some patients may need trifocals – bottom segment for reading downward; middle segment for seeing ahead as for a computer or TV screen; and top segment to see across the room.
- f) Finally, help the patient choose a suitable eyeglass frame and have glasses made for him that include prism, base-down Rx lenses. (See below for information about eyeglasses for use while walking).
- g) LOW VISION - A few of these patients will be found to have reduced visual acuity in the better eye and some may even be “legally blind” (20/200 or worse, corrected). Low vision patients can and should be assisted using some of the same methods employed to help all other low vision patients. In fact, a person who has both “Vertical Eye-Gaze Impairment” or “Lower-Half Visual Field Loss” **and** “Low-Vision” might best be referred to an established “Low-Vision Clinic” with instructions that they try using prism, base-down lenses to help compensate for the inability to see downward.

TECHNOLOGY UPDATE: Even now, in the year 2002, prism corrections are not possible with laser surgery (LASIK) as can be used to correct refractive errors. Some patients ask about contact lenses and are advised that, generally, contact lenses are not available for this purpose. Even in 2002, eyeglasses with prism, base-down, lenses are the only readily available options. *NOTE: Just as some contact lenses have been made experimentally, to serves as bifocals, it is believed that weighted, self-aligning prismatic contact*

lenses can be made. Such contact lenses are not yet available.

2. Walking Eyeglasses ... for neurologically walking-impaired patients such as those with PSP, Parkinsonism, MS, ALS, etc.

PROBLEMS: Typically, these patients are likely to have two problems.

1. CAN'T SEE GROUND: First and most obvious is that a person who is unable to look downward cannot see the floor or ground. He cannot see where he is placing his feet. Thus, with or without balance problems, such a person is in danger of tripping and injuring himself or others.

2. BALANCE & GAIT PROBLEMS: Many people with PSP, Parkinsonism, or any number of neurological diseases, suffer from impaired gait and/or impaired balance while walking. Many do not have, "Vertical Eye-Gaze Impairment." For these people, the challenge is not merely to help them see the ground. It is to improve their balance and/or gait when standing and walking.

SAFETY RECOMMENDATION: *People with poor balance, abnormal gait, festination, foot dragging, stumbling or other obvious ambulation problems should not be walking with bifocal lenses. Such people should be wearing no glasses or else shatter resistant single vision glasses, for best viewing of the ground or floor. (They can carry separate glasses, bifocals or not, for use while seated.)*

HELPING: Suggested Use of Prism Glasses for Improved Ambulation for:

A. PEOPLE ABLE TO SEE THE GROUND (who do NOT have "Vertical Eye-Gaze Impairment") are more numerous than those with downward vision impairment. With a movement disorder specialist, a physical therapist or a mobility trainer present, the patient should be tried with eyeglasses having single vision (plano or distance Rx) lenses with prism, base-down.

CAUTION - Prism, base-down lenses cause the wearer to perceive that he is walking uphill. The stronger the prism, the steeper the hill. Some people with gait and/or balance impairments are helped by this. Others may not be helped and some may seem to worsen (but only for so long as they wear the prism lenses).

METHODOLOGY - It is recommended that, in the presence of the mobility expert, lenses be tried, always matched bilaterally, beginning with 0.5 prism diopter, base-down. The patient's walking abilities should be carefully

tested, observed and noted on paper. The lenses should be changed to incrementally add 0.5 prism diopter, base-down for each eye. The tests should be repeated with each added increment and results noted. This routine should be repeated again and again, each time with 0.5 prism diopter, base-down, added. The maximum prism used should be 4.0 prism diopters, base-down.

Finally, if any particular prism value is found to significantly help the patient with his or her mobility, then the eye doctor or optical dispenser can help select an appropriate frame for single vision **walking glasses** for the patient to use permanently. NOTE: *For these patients, who can see the ground without prism, the purpose of the prism correction is not for vision; it is for balance and gait improvement.*

B. PEOPLE UNABLE TO SEE GROUND due to “Vertical Eye-Gaze Impairment” have two issues that must be addressed. First, the balance and gait issues discussed above and then the fact that they cannot look down at, ahead of their feet to avoid stepping into an unseen hole or off an unseen curb. The prism requirements for each of these challenges may be quite different. It is this fact that makes these people’s evaluations and trial fittings more complex.

METHODOLOGY – It was found best, and so it is recommended, that the eye doctor and the mobility expert present, follow the trial procedures detailed in A. above to determine the amount of prism, base-down that produces the best improvement in balance and/or gait as the patient walks on smooth indoor floors. With each prism setup, the mobility expert will observe the patient’s balance and gait and will note his observations for later review.

This testing will continue, increment by increment, to deliberately get the patient to adapt to and comfortably use the highest amount of prism that he can comfortably and safely use. Whereas the patient without visual impairment may be found to walk best with as little as 0.75 or 1.0 diopter of prism, it is helpful to accustom the visually impaired patient to as much as 2 to 3 diopters of prism while making certain that this much has not lessened his balance and/or gait.

It is not necessary that the patient be able, while standing, to look down and see his own feet. It is desirable, however, that he be able to look down and see the ground or floor just ahead of his toes. This will enable him to avoid blindly stepping into an unseen hole or off an unseen curb. There will have to be a compromise between the amount of prism that is optimal for improved balance and gait, and the amount of prism necessary for the ground to be visible to the patient just ahead of his toes.

Getting Eye Doctors and Mobility Trainers Together is necessary for

these patients in order for them to be helped with eyeglasses to have better walking balance and gait. Unfortunately, most eye doctors' offices do not have mobility trainers. Similarly, most movement disorder and ambulation assessment centers do not have eye doctors or optical dispensers on their premises. *Two options, as described below, can overcome these problems:*

1. Arrange for Eye Doctor to Visit Movement Disorder/Ambulation Assessment Center regularly, on specific days, for the purpose of trial fitting patients with prism lenses for resident mobility experts to assess and train. Both ophthalmologists and optometrists regularly visit nursing home to refract in-patients. The doctors bring all necessary equipment and trial lenses on these visits and can also visit movement disorder centers. *NOTE: One can learn from area nursing homes who the eye doctors are who make these visits.*
2. Arrange for Movement Disorder Centers to stock trial eyeglasses with plano RX lenses having built-in prism, base-down. These glasses are very inexpensive, each costing about \$75. The centers can easily afford to stock ten pairs of eyeglasses, from 0.5 prism diopters to 5.0 prism diopters in 0.5 diopter increments. Some center staff could be trained to use the trial eyeglasses for patient assessments. Then, those patients clearly helped who want to have such glasses to keep, are referred to the eye doctor's office with notes on the trials, for complete examination, refraction and permanent eyeglass fitting.

For additional information or free technical support, please email: nire@warwick.net or contact us by regular mail or telephone.

The National Institute for Rehabilitation Engineering
Box 1088 – Hewitt, NJ 07421 U.S.A. Tel. (800) 736-2216

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