

CE Credit - Case Report(s) & Topic Review

Enhancing Reading Performance with a Portable Electronic Magnifier: A Case Report on Low Vision Telerehabilitation

Tiana T. Berezú, OD¹; Carmen Perez Sosa, OD¹; Nicholas Green, OD, MPH, FAAO¹; Xiaojing Yu, OD, PhD¹

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ABSTRACT

Introduction: Low vision rehabilitation is important for managing patients with visual impairments; however, many patients face significant barriers to attending in-office rehabilitation appointments because of vision-related challenges with transportation and ambulation. Therefore, telerehabilitation allows for the delivery of patient care to patients with visual impairments. Here, we discuss the effectiveness of telerehabilitation in improving reading performance using a portable electronic magnifier.

Case Presentation: A 47-year-old African-American patient presented for low vision evaluation with a history of proliferative diabetic retinopathy and primary open-angle glaucoma. He reported difficulty reading and recognizing faces. Following refraction and vision-assistive device trials, the patient was prescribed distance spectacles, 4x binoculars, and a portable electronic magnifier (PEM) with maximum magnification 13.5x. Best-corrected distance acuities were 2/16M (SE 20/160) OD, 2/32M (SE 20/320) OS, and 2/16M (SE 20/160) OU. The patient's distance acuity improved to 4/6M (SE 20/30) with 4x binoculars. The patient was able to read 0.4m print size using the PEM.

Management and Outcome: At baseline, reading performance was evaluated using a digital iPad MNREAD chart. The MNREAD chart uses four reading performance metrics: maximum reading speed (MRS), reading acuity (RA), critical print size (CPS), and reading accessibility index (ACC).

At baseline, the patient's reading efficiency was significantly improved with the PEM. MRS increased to 30 words/min, RA improved from logMAR 0.73 to 0.15, CPS improved from logMAR 0.9 to 0.6, and ACC increased from 0.06 to 0.16. Post-telerehabilitation, the patient's reading performance further improved. The CPS and RA improved to logMAR 0.25 and 0.01, respectively. The ACC increased to 0.27, whereas MRS remained stable.

Discussion: Telerehabilitation is a feasible alternative method for delivering effective follow-up care for patients with low vision. It can be used for patient training with vision-assistive devices and monitoring patients' reading efficiency.

Keywords: telerehabilitation, low vision, MNREAD acuity chart, portable electronic magnifier

INTRODUCTION

Low vision telerehabilitation has been shown to be a feasible mode of patient care. Studies on its viability have demonstrated that telerehabilitation has received positive feedback from participants and providers and is an acceptable modality of care for patients with visual impairments.^{1,2}

Studies have shown that low vision telerehabilitation is necessary, especially in rural areas and in areas with a paucity of low vision providers.³⁻⁵ Transportation has been identified as a major obstacle to adequate care for patients with visual impairments. Many patients with visual impairments have co-existing systemic conditions that limit their ambulation.^{6,7} Additionally, telerehabilitation helps patients cope with their loss of vision, reinforces the proper use of vision-assistive equipment, assesses patients' performance with the devices, and provides feedback, education, and counseling in their homes. In the United States, approximately 7 million individuals have low vision, which impacts their activities of daily living and significantly reduces their quality of life.^{6,7}

CASE PRESENTATION

A 47-year-old African-American man presented for low vision evaluation. The patient's ocular history included proliferative diabetic retinopathy, primary open-angle glaucoma, pan-retinal photocoagulation, and cataract surgery in both eyes.

¹Assistant Professor, College of Optometry, Nova Southeastern University, Florida, USA

His medical history included juvenile-onset insulin-dependent diabetes mellitus, hypertension, and hypercholesterolemia. The patient’s recent hemoglobin A1C was 7.50. Family history included glaucoma in the paternal grandfather and diabetes and hypertension in both parents.

Preliminary examination findings were remarkable for a grade 1+ afferent pupillary defect in the left eye (OS) and constricted confrontation visual fields in the right eye (OD) and OS. Uncorrected distance acuities were 2/25M (Snellen equivalent [SE] 20/250) OD, 2/32M (SE 20/320) OS, and 2/25M OU (SE 20/250). Uncorrected near acuity was 0.4/4M (SE 20/200) in both eyes (OU). Contrast sensitivity testing using the MARS chart revealed severe impairment: log contrast sensitivity (CS) 0.96 OD, 0.60 OS, and 0.88 OU.

Slit-lamp examination revealed pingueculae and well-positioned posterior chamber intraocular lenses in both eyes. Intraocular pressure (IOP) measured using Goldmann tonometry was 18 mm Hg OD and 42 mm Hg OS. Undilated fundus examination showed glaucomatous-appearing optic nerves bilaterally, with C/D ratios of 0.6/0.6 OD and 0.8/0.8 OS. Panretinal photocoagulation laser scars and sclerotic vessels were observed in both eyes.

Management and Outcomes

The patient complained of difficulty reading headlines and mail, recognizing faces and price labels, watching television, and viewing computer screens. Previously, he received orientation and mobility training and used a white cane for navigation. Additionally, the patient used a desktop video magnifier at home, allowing him to read with moderate difficulty. During this visit, he aimed to improve reading ability and distance recognition.

Following low vision refraction, the patient’s prescription was -2.00Sph OD and -1.00Sph OS, with best corrected distance acuities of 2/16M (SE 20/160) OD, 2/32M (SE 20/320) OS, and 2/16M (SE 20/160) OU. There was no improvement in near-acuity with various near-addition lenses.

The patient’s distance acuity improved to 4/6M (SE 20/30) with a 4x monocular hand-held telescope, 4x monocular spectacle-mounted telescope, and 4x binoculars. The patient-preferred distance device was a 4x binoculars.

A +12D monocular microscope OD improved the near acuity to 0.10/0.63m (SE 20/126). A 4.3-inch screen portable electronic magnifier (PEM) allowed the patient to read 0.4/0.4m (SE 20/20). The patient preferred the PEM because of its more comfortable working distance and contrast-reversal capability. The PEM offered 1.25–13.5x magnification range and could be used as a hand-held or stand magnifier.

Various Corning filters were used to address decreased contrast sensitivity; no improvement was observed. After examination, the patient was prescribed distance spectacles, PEM, and 4x binoculars. The patient was educated about the proper use of these devices.

A digital version of the MNREAD acuity chart (iPad) was used to assess the patient’s baseline reading performance with and without the PEM. Four standard metrics were obtained: maximum reading speed (MRS), reading acuity (RA), critical print size (CPS), and reading accessibility index (ACC). MRS measurements were used to assess reading performance not limited by print size. The RA measures the smallest print size that a patient can read without making significant errors. The CPS is the measurement of the smallest print that a patient can read at MRS. ACC indicates the patient’s visual access to common printed materials, ranging from 0.0 to 1.0, in which 0 represents no access to print and 1.0 represents average normal access.^{8,9}

Without the portable electronic magnifier, the patient’s MRS was 21 words/min, RA was logMAR 0.73 (SE 20/100), CPS was logMAR 0.9 (SE 20/160), and ACC was 0.06. With the electronic magnifier, the MRS was 30 words/min, RA was logMAR 0.15 (SE 20/28), CPS was logMAR 0.6 (SE 20/80), and ACC was 0.14 (Table 1).

	Without portable electronic magnifier	With portable electronic magnifier
Maximum Reading Speed (words/min)	21	30
Critical Print Size (logMAR)	0.90	0.60
Reading Acuity (logMAR)	0.73	0.15
Reading Accessibility Index	0.06	0.16

Table 1. Baseline MNREAD testing with and without portable electronic magnifier before telerehabilitation.

Telerehabilitation session follow-up was conducted one month after the in-office visit. During the session, the patient was re-educated on the proper use of the PEM, and the patient’s reading performance with the PEM was re-assessed after the session.

Post-telerehabilitation, the patient’s CPS increased to logMAR 0.25 (SE 20/36), RA improved to logMAR 0.01 (SE 20/20), and ACC increased to 0.27. The MRS remained approximately the same 31 words/min (Table 2).

	Baseline with portable electronic magnifier	Post-telerehabilitation with portable electronic magnifier
Maximum Reading Speed (words/minute)	30	31
Critical Print Size (logMaR)	0.60	0.25
Reading Acuity (logMAR)	0.15	0.01
Reading Accessibility Index	0.16	0.27

Table 2. Baseline vs. post-rehabilitation MNREAD testing with portable electronic magnifier.

Additionally, the patient's reading performance was evaluated using reading materials from daily life, including bills, shopping catalogs, medicine bottles, grocery product packaging, and labels. The patient demonstrated proficiency using the PEM for daily reading tasks.

DISCUSSION

In the United States, low vision is the leading cause of disability, with the number of individuals with visual impairment projected to double from 7 to 14 million by 2050.^{7,10} Visual impairment was most prevalent among Hispanic/Latino and Black individuals, those aged over sixty-five, and women.^{7,11} The leading causes of low vision and blindness include age-related macular degeneration, cataracts, and glaucoma.

According to the National Eye Institute, low vision is a condition that affects everyday tasks [and cannot be improved] with regular glasses, contact lenses, medicine, or surgery.¹² Visual impairment significantly reduces patients' quality of life and ability to perform activities of daily living.

Previous studies have demonstrated that the major obstacle to low vision care is transportation issues, which deprive patients of their ability to drive, and other co-existing conditions that limit ambulation in older populations.³⁻⁵ Therefore, an alternative method of delivering low vision care is needed. A pilot study conducted by Bittner et al. showed that low-vision telerehabilitation is a feasible and acceptable modality for managing patients with low vision to improve their reading ability using magnification devices.¹

Accordingly, we performed a telerehabilitation follow-up with our patient to assess the patient's reading performance with the portable magnification device and the patient's ability to use it properly, and to provide the patient with feedback and additional training, if needed. Additionally, this study aimed to assess the feasibility and effectiveness of telerehabilitation sessions.

The patient's reading performance was assessed using the digital version of the MNREAD acuity chart (iPad), which has been validated as a highly reliable and reproducible method for assessing patient reading performance.¹²⁻¹⁵

At baseline, the patient's reading performance was significantly improved with the PEM. MRS increased 1.5 times from 20 to 30 words/min, RA improved by six lines from logMAR 0.73 to 0.15, CPS improved 1.5 times from logMAR 0.9 to 0.6, and ACC increased 2.3 times from 0.06 to 0.14. Therefore, the patient performed better without the PEM for the largest print sizes of logMAR 1.2–0.9 because the minimum preset PEM magnification was excessively high for the largest print sizes. The PEM was most beneficial for print sizes with logMAR \leq 0.8.

Post-telerehabilitation, the patient's reading performance further improved. The CPS improved 2.4 times to logMAR 0.25 and the RA improved by 0.5 lines to logMAR 0.01. The ACC slightly increased to 0.16, whereas the MRS remained approximately stable at 31 words/min. Thus, using the handheld PEM improved patient reading efficiency at baseline and allowed further improvement with telerehabilitation.

Overall, our results showed that telerehabilitation is a useful and feasible mode of delivery for follow-up care for patients with low vision using a PEM for reading. Moreover, telerehabilitation was successful in assessing the patient's reading performance, providing the patient with the necessary feedback, and monitoring the patient's improvement in reading performance remotely.

CONCLUSION

Telerehabilitation is a valuable modality for delivering care to patients with low vision. The benefits of telerehabilitation for patients with low vision include better access to care, training, skill reinforcement for using vision-assistive devices, and counseling. Therefore, low vision telerehabilitation improves the ability to read, perform activities of daily living, and the quality of life of patients with visual impairments.

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