

Rehabilitation of reading skills in patients with age-related macular degeneration

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ABSTRACT •

Reading is the most frequent clinical complaint and the primary goal for patients with macular degeneration seeking vision rehabilitation. The current prevalent methods for reading skills training across the globe are still magnification and basic scotoma awareness training. More recent studies showed that specific eccentric training, comprehension ability training, and specific oculomotor training are all beneficial to reading skills rehabilitation. In clinical practice, ophthalmologists should strive to implement reading skills methods that include assessment of cognitive skills, optimal eyewear, optimal reading material, PRL assessment, training of better oculomotor control, and efficient perceptual training.

Restoring and maintaining the functional ability and independence of a person with low vision (LV) is an intricate process that requires a multidisciplinary effort and involves the collaboration of a number of different health care professionals.¹

Typically a patient is treated by an ophthalmologist and receives the appropriate medical or surgical interventions available. When an LV diagnosis is made the rehabilitation process must begin immediately with specific counselling of the patient addressing the impact of vision loss. Also paramount at this stage is the offer or referral for a formal low vision assessment (LVA) performed by an ophthalmologist or optometrist with a special interest in low vision rehabilitation (LVR). The purpose of the assessment is to document and quantify residual visual functions and skills and also to prescribe remedies as needed.

Referral to low vision rehabilitation is still a difficult issue in the provision of LVR to the public. The reasons for low rates of utilization of LVR are multiple. The most important aspect of patient evaluation in any clinical setting is the disability affecting the activities of daily living (ADL). In eye care the disability can be a direct result from loss of visual acuity, fields of vision, and /or oculomotor control. Such identifiable visual impairments (visual acuity of less than 20/50, any severe field of vision loss and any deficient oculomotor control) should immediately trigger inquiries about ADL and if such identified, the patient should immediately be referred for visual rehabilitation.

On the basis of the LVA, the LV specialist can prescribe devices to enhance residual visual functions, or vision rehabilitation therapy and training (VRT) to enhance better performance with residual skills, or frequently both.¹

Provision of vision rehabilitation therapy and training, with or without devices, falls within the domain of a

multidisciplinary rehabilitation team. Occupational therapists (OT) are an essential and key member of the LVR team.

The purpose of vision rehabilitation therapy and training is to implement rehabilitation plans that improve a person's ability to participate and function independently in all aspects of daily life, including work, self-care, and leisure activities.²

Such a plan may include environmental assessments at home, workplace, and school; it may also include training of residual vision-related skills such as reading and other to improve function and enhance performance for specific ADLs. It may also provide instruction in the use of adaptive strategies and is a source of information regarding available community resources.

The importance of being able to read in order to function in daily life cannot be overemphasized. Reading is the most frequent clinical complaint and the primary goal for patients with macular degeneration seeking vision rehabilitation.³ The rehabilitation aim for reading skills in a patient with LV is to enable readers to retain functional literacy, not only to live daily life independently but also for enjoyment purposes. The focus of this article is to review and discuss the methods available today that we can use in rehabilitation of reading skills and to raise awareness to this topic both among ophthalmologists as well as among vision rehabilitation professionals.

BACKGROUND ON READING SKILLS

Reading is an intricate process requiring involvement of multiple psychophysical and cognitive mechanisms. Many aspects of reading can be quantified; however, reading speed may be the most representative for reading skills abilities assessment.¹ Estimates of stimulus parameters in normal subjects required for optimal reading of scanned

text found to be essential in obtaining maximum reading rates are (i) characters size subtending 0.3° to 2° , (ii) field size up to 4 characters independent of character size, (iii) bandwidth up to 2 cycles/degree independent of character size, and (iv) that 1 spatial-frequency channel suffices for reading. Contrast polarity (black-on-white vs white-on-black text) apparently was found with no effect on reading rates.⁴ Also known is that the visual span parameter in normal subjects required for normal reading rates requires 7 to 11 characters to be recognized at the fovea during a given fixation attempt. This translates roughly into a requirement of 7 degrees visual span on the retina.⁵

In most individuals with macular function loss, functional adaptations occur after loss of central vision and all are based on usage of residual peripheral retina. One such adaptive strategy attempts to develop an eccentric retinal area empowered to assume macular function and restore lost vision-related skills. Potentially, such preferred retinal loci (PRL) have the ability to provide better visual function unmatched by any other locus on the retina.⁶ Development of PRLs hinges also on oculomotor performance able to align the eyeball in a way that incoming images land on the PRL area as well as availability of high retinal sensitivity at the PRL.

Individuals with central vision loss must use vision available at PRLs for performing vision-related tasks such as reading, and this situation presents specific limitations. Vision based on peripheral retina is worse than vision based on normal retinal foveal elements. Resolution acuity decreases in direct relationship to eccentricity from the fovea, as well as all vision-based skills such as reading.⁷ Additional limiting factors found on reading speed when performance is based on PRLs rather than the fovea are poorer oculomotor control, a lower limit on reading speed in cases with central vision loss regardless of magnification used, a limit showing no benefit for addressing crowding beyond the usual $1.25\times$ spacing for letters, words and lines, a limit on reading speed being directionally proportional to the visual span used, and perceptual training protocols that may not be efficient.⁸

REHABILITATION OF READING SKILLS

Efficient rehabilitation of reading skills is multifaceted as listed below in addition to careful assessment of priority tasks for the individual and also addressing specific limitations listed above encountered when using peripheral retinal functions.

Assessment of cognitive skills

Critical to the entire LVR process for training reading skills is establishing a relationship with the patient and making them a willing manager in the efforts of the LVR professional to improve visual function and functional vision. It is at the time of the intake that such cooperation

should be secured in order to continue with the rest of the LVR process. Cognitive competency is essential for establishing cooperation with the LVR process.

Hence before implementation of any rehabilitation program for reading skills it is essential to assess cognitive skills. Cognitive deficiencies are not unusual in LV patients and their presence may introduce major impediments to LVR. A recent study found that about 20% of patients with LV have cognitive deficiencies and another 28% have borderline cognitive abilities.⁹ The Montreal Cognitive Assessment (MoCA) analysis test is a rapid screening instrument for the detection of mild cognitive impairment, validated and used in LV clinical practice, which could be used when planning reading skills rehabilitation. The MoCA test assesses the following cognitive domains: attention and concentration, executive functions, memory, language, visioconstructional skills, conceptual thinking, calculations, and orientation.¹⁰

Illiteracy is sometimes confused with cognitive skills. Literacy varies among individuals in all countries and with all used languages. It is essential to know beforehand the level of literacy in any individual contemplating reading skills rehabilitation. In developed countries one must assume that about 30% of individuals are illiterate and the others may have optimal reading skills at the level of grade 5–6 competency levels.¹¹ In such cases one may have to use resolution acuity tests like the tumbling E test.

PRL assessment

The recently emerged consensus supports the concept that a PRL represents “one or more circumscribed regions of functioning retina, repeatedly aligned with a visual target for a specified task that may also be used for attentional deployment and as the oculomotor reference.”¹² Hence before implementation of any rehabilitation program for reading skills it is essential to assess PRL location and characteristics. Microperimeters offer today the most accurate method for PRL assessments⁶; however, other methods are useful as well.¹³ One has to keep in mind that in about 25% of cases PRLs are inefficient due to their development on a nonfavorable retinal locus. In such case use of PRL rehabilitation techniques are required in order to relocate the PRL on a favorable retinal locus.¹⁴ Also, there are cases where preferred fixation is guided by functional needs and utilizes a retinal locus with a larger span rather than a locus with highest retinal sensitivity.

Optimal eyewear

Optimal eyewear is required for optimal reading skills rehabilitation results.

Optimal eyewear should include optical lenses with most recent refractive error correction, inclusion of adequate add power for optimal reading distance, correction with prisms for oculomotor imbalance if present, inclusion of prisms to compensate for accommodation for

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