CRITICALLY APPRAISED TOPIC

The effectiveness of paper-based & computer-based eccentric viewing training on reading speed in individuals with central scotomas

AUTHOR

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Date 09/07/2012

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Review date 10/01/2012

CLINICAL SCENARIO

A central scotoma is a region of partially or completely degenerated visual acuity located on the macula, or the center-most portion of the retina. There are several types of eye diseases which can cause central scotomas. Age-related macular degeneration (AMD) happens to be the most common among these diseases and is the leading cause of legal blindness in the United States (Centers for Disease Control and Prevention, 2009). It has been estimated that in 2020, the incidence of AMD will increase by 50% to 2.95 million Americans (National Eye Institute, 2004). Other conditions affecting the macula and causing central scotomas include Stargardt disease, cystoid macular edema, and central serous chorioretinopathy (Montgomery, 2012). The most common complaint concerning loss of function in these individuals is difficulty reading (Frennesson, Jakobsson, & Nilsson, 1995). Reading is an essential function which is necessary for the majority of daily living activities including meal preparation, leisure activities, financial management, health management, job performance, etc. The ability to read is often overlooked as an imperative aspect of maintaining independence and function in daily life. Eccentric viewing, which is a strategy for using the residual/Peripheral vision surrounding the scotoma(s) for reading tasks, was first described in 1976. Subsequent work in Sweden provided the first evidence in training programs for eccentric viewing and showed enhanced performance in reading ability and speed (Palmer, Logan, Nabili, & Dutton, 2009). Training will focus on rehearsing the usage of the preferred retinal locus (PRL). This is defined as utilizing the intact peripheral vision surrounding the scotoma(s) by looking slightly away from the word or item the individual is attempting to view. This task can be accomplished through specialized training involving reading worksheets or a reading program on a computer. Training also typically involves rehearsing these eccentric viewing exercises with the proper prescribed usage of lighting and magnification to promote ease of reading (Palmer, Logan, Nabili, & Dutton, 2009). An occupational therapist (OT) is one type of health care professional who teaches eccentric viewing training to clients with low vision. OTs can see patients with low vision in a wide variety of settings including outpatient clinics, in the home, or nursing home settings. OTs gather and assess valuable information regarding how a patient uses their vision. This information is used to assist the occupational therapist in determining the appropriate eccentric viewing position, training them on using this position for reading, and applying this training to their daily activities. While occupational therapists are frequently using eccentric viewing training as part of their low vision rehabilitation program, little is known about the impact on reading ability.

FOCUSED CLINICAL QUESTION

For an individual with central scotoma(s), does paper-based and/or computer-based eccentric viewing training increase reading speed?

SUMMARY OF SEARCH

- Reports from three studies are included in this review. One study investigated the effectiveness of an eccentric viewing training program on reading speed, readable font size, and reading comprehension in individuals with central scotomas due to age-related macular degeneration (Palmer, Logan, Nabili, & Dutton, 2009). Another study investigated the effects of a self-administered eccentric viewing training program with individuals with central scotomas including AMD, glaucoma, trauma, and retinopathy of prematurity on reading...
The final article examines individuals with age-related macular degeneration that have absolute central scotomas and the effects of a computer-based eccentric viewing training program on reading speed, patient satisfaction, and near & far best-corrected visual acuity (Nilsson, Frennesson, & Nilsson, 2003).

**CLINICAL BOTTOM LINE**

Three research studies showed that eccentric viewing training can be an effective method for people with central scotomas to improve reading ability and has been shown to increase the number of words read per minute.

**Important note on the limitation of this CAT**

This critically appraised topic has been peer-reviewed by one other faculty member.

**SEARCH STRATEGY**

**Terms used to guide the search strategy**

- **Patient/Client Group**: Individuals with central scotomas
- **Intervention (or Assessment)**: Eccentric viewing training
- **Comparison**: N/A
- **Outcome(s)**: Reading speed

<table>
<thead>
<tr>
<th>Databases and Sites Searched</th>
<th>Search Terms</th>
<th>Limits Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>OVID</td>
<td>Reading, speed, eccentric, viewing, training, age, macular, degeneration, central, scotoma</td>
<td>Published in previous 10 years English language</td>
</tr>
<tr>
<td>PubMed</td>
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<td>Google Scholar</td>
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<td>CINAHL</td>
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<tr>
<td>PsychInfo</td>
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**INCLUSION and EXCLUSION CRITERIA**

**Inclusion Criteria**

- Studies that chose participants who were diagnosed with an eye condition causing central scotomas.
- Studies that reported the effectiveness of eccentric viewing training by measuring reading speed.
- Studies that used the outcome measure of words/letters read per minute.

**Exclusion Criteria**

- Studies reporting on other visual diagnoses not affecting the macula.
- Studies that did not perform eccentric viewing training methods.

**RESULTS OF SEARCH**

A total of 7 relevant studies were located and categorized based on an adapted version of the American Occupational Therapy Association Literature Review Project for OT outcomes research.
<table>
<thead>
<tr>
<th>Design Level</th>
<th>Sample Size Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>I= Randomized control trial, systematic review,</td>
<td>A= n ≥ 20</td>
</tr>
<tr>
<td>or meta-analysis</td>
<td>B= n &lt; 20</td>
</tr>
<tr>
<td>II= Non-randomized control trial, two groups</td>
<td></td>
</tr>
<tr>
<td>III= Non-randomized control trial, one group,</td>
<td></td>
</tr>
<tr>
<td>pre-test and post-test</td>
<td></td>
</tr>
<tr>
<td>IV= Single-subject design</td>
<td></td>
</tr>
<tr>
<td>NA= Narratives, case studies</td>
<td></td>
</tr>
</tbody>
</table>

(Lieberman & Scheer, 2002)

**Table 1: Summary of Study Designs of Articles Retrieved**

<table>
<thead>
<tr>
<th>Study Design/Methodology of Articles Retrieved</th>
<th>Level</th>
<th>Number Located</th>
<th>Author (Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-randomized control trial – one group, pre-</td>
<td>IIIA</td>
<td>2</td>
<td>Jeong &amp; Moon (2011); Palmer, Logan, Nabili, &amp; Dutton (2009)</td>
</tr>
<tr>
<td>test &amp; post-test</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-randomized control trial – one group, pre-</td>
<td>IIIB</td>
<td>5</td>
<td>Frennesson, Jakobsson, &amp; Nilsson (1995); Gustafsson &amp; Inde (2004); Nilsson,</td>
</tr>
<tr>
<td>test &amp; post-test</td>
<td></td>
<td></td>
<td>Frennesson, &amp; Nilsson (2003); Seiple, Szlyk, McMahon, Pulido, &amp; Fishman (2005);</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Vingolo, Cavarretta, Domanico, Parisi, &amp; Malagola (2007)</td>
</tr>
</tbody>
</table>

**BEST EVIDENCE**

The following studies were identified as the ‘best’ evidence and selected for critical appraisal:


Reasons for selecting these studies were:

- Studies examined populations with central scotomas exclusively
- Studies examined reading speed and used the outcome measure of words/letters read per minute
- Studies reported on the effects of eccentric viewing training programs

**SUMMARY OF BEST EVIDENCE**

**Table 2**: Description and appraisal of “Effective rehabilitation of reading by training in the technique of eccentric viewing: evaluation of a 4-year programme of service delivery” by Palmer, Logan, Nabili, & Dutton (2009).
<table>
<thead>
<tr>
<th>Aim/Objective of the Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>The aim of this study was to examine the effects of eccentric viewing training on the functioning and reading ability of adults with central scotomas due to age-related macular degeneration.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Study Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-randomized control trial – one group, pre-test &amp; post-test</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community-based setting in the United Kingdom. The specific setting where intervention took place was not specified.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 subjects were recruited for this study; however, 58 of the participants were excluded due to incomplete data. This study had a retrospective and convenience sample. The mean age of the participants was 75.4 (SD 12). 77 of the subjects were male and 165 were female. Data collected included reading speed, readable font size, maximum duration of comfortable reading, and percentage of reading comprehension. The only listed inclusion criteria is a diagnosis of age-related macular degeneration with a central scotoma.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intervention Investigated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control: N/A</td>
</tr>
</tbody>
</table>

**Experimental**

The treatment was provided by a trainer with experience in tutoring adults in the area of literacy. The training involved practicing visually fixating in a way that the scotoma does not interfere with reading (finding a suitable PRL or “steady eye strategy”) and using appropriate magnification & lighting. During each session, visual fixation is practiced by using printed fixation lines above or below the text and encouraging the subject to look in the appropriate direction in order use their peripheral vision to read. The training consisted of weekly one-on-one training sessions with the tutor. Each session was approximately one hour long and at least three to four sessions were required. The progress was reviewed throughout the training. Following each session, “homework” was given and the subjects were required to practice daily for a maximum of 20 minutes per day and in small, few minute increments. Subjects were encouraged to journal about their experience, as well.

<table>
<thead>
<tr>
<th>Outcome Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>The reading speed was determined by asking the individual to read from a prepared text for one minute and then counting the number of words that were read. The beginning sentences were at a significantly low reading level and, therefore, only required basic literacy skills. The experimenters gradually increased the level of difficulty each session and they did not repeat the same texts for assessments.</td>
</tr>
</tbody>
</table>

The font size was assessed using Keeler N Series Vision Vocational Test Chart, which contains font sizes from N48-N5 (to provide context, newspaper print is typically N10) and excerpts of music, telephone book print, and drawings. No information about the validity of this outcome measure was found.

For measuring the duration of reading, patients were asked to read as much as they were able to comfortably and the duration was recorded in minutes. They were also asked to record how long they could comfortably read at home following the training.

Degree of comprehension was estimated by asking the individuals four prepared questions on the content of the text they read. Each question was weighted 25%.

<table>
<thead>
<tr>
<th>Main Findings</th>
</tr>
</thead>
</table>
| The starting mean of words per minute read (WPM) was 48 (SD 35), which improved to 71.9 (SD
The mean improvement in reading speed was 23.9 (SD 27.6) WPM. 16 subjects did not show any improvement and 25 subjects lost between 1 and 42 WPM (p=0.000).

The mean starting Arial font size read was 14.3 (SD 7.6), which improved to 11.5 (SD 2.4) (p=0.000). Mean improvement was 3.5 (SD 6.9).

The beginning average duration of reading was 1.7 (SD 2.0) minutes. The duration improved to 15.8 (SD 14.6) minutes (p=0.000). 231 out of 242 patients were able to read for a longer period of time following training.

The mean percentage of material read that was comprehended by the subjects was 73.7% (SD 36.9%). This increased to 92.7% (SD 16.2%) (p=0.000).

**Original Authors’ Conclusions**

The statistics showed significant improvements in overall reading ability, as measured by improvements in number of words read per minute, font size, reading comprehension, and duration of reading. There was not any significant relationship between the age of the subjects and the degree of improvement found. There was also no evidence that more than five lessons improved performance. High beginning reading speeds were correlated with high finishing reading speeds.

**Critical Appraisal**

**Validity**

*External:* The inclusion and exclusion criteria were vague and limited within this study. The only clearly defined inclusion criteria were individuals with the diagnosis of age-related macular degeneration. The only background information given on the subjects was very basic including age, diagnosis, and gender. The authors did indicate the possibility of bias in the study due to the non-randomized design. Subjects were also recruited retrospectively from the same program and there was no blinding in this study.

*Internal:* There was no control group in this study. However, the sample size (n=242) is large, which increases the study’s validity. The essential components of the training program were clearly and explicitly defined, which makes this study replicable. The outcome measure for reading speed, however, was inconsistent. It was unclear whether or not each of the subjects’ reading ability was assessed using the same set of sentences or not. Further standardization on specific sentences for assessing reading speed would increase this article’s validity. Training frequency was suggested, rather than required: homework sessions for a maximum of 20 minutes per day were not monitored. The methods of data analysis were unclear and understated.

**Interpretation of Results**

The outcome of this study showed significant improvements in reading speed, as measured by words per minute. As evidenced by the p=0.000, this article shows that the eccentric viewing training program implemented was effective in improving reading speed, as well as overall reading ability.

**Summary/Conclusion**

While the overall results of this study show significant improvements in reading speed in individuals with central scotomas, there are several flaws which hinder the validity of the study. If there was more information about the inclusion and exclusion criteria, the study may have been more easily applicable. The study included important and detailed aspects of the intervention, but failed to set definite standards on training duration and frequency. There were essential background details omitted from this study that would have contributed to the validity of the study including subject demographics, the specific setting, and the method of subject recruitment. Overall, this study reports on all factors within my clinical question and provides evidence for eccentric viewing training.
**Table 3:** Description and appraisal of “A study of eccentric viewing training for low vision rehabilitation” by Jeong & Moon (2011).

<table>
<thead>
<tr>
<th>Aim/Objective of the Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>The objective of this study was to examine the effects of eccentric viewing training on reading ability in patients with central scotomas.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Study Design</th>
</tr>
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<tbody>
<tr>
<td>Non-randomized control trial – one group, pre-test &amp; post-test</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subjects were initially evaluated and trained in an out-patient setting in Korea. Subjects continued training independently and/or with their guardians in their homes.</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 patients (16 females, 14 males) with central scotomas were included in this study and recruited from a local clinic as a convenience sample. Of the 30 subjects, 18 had a diagnosis of age-related macular degeneration, 4 were post-trauma, 4 had glaucoma, 2 with macular dystrophy, and 2 with retinopathy of prematurity. The mean age of participants was 50.3 ± 17.7 years with a range of 16-86 years. The only inclusion criteria described was that all subjects must have a visual field defect in the central 10 degrees in the dominant eye. Exclusion criteria included subjects with prior experience in low vision rehabilitation, subjects with other ocular diseases affecting visual function, and subjects with multiple remaining portions of their central visual field. There were no drop-outs in this study; however, the experimenters only examined the pre and post reading speed data for the 20 participants that closely followed the 2 week training regimen. The 10 participants that did not participate in the full training process were further analyzed as the “discontinuance” group.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intervention Investigated</th>
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</thead>
<tbody>
<tr>
<td>Control: N/A</td>
</tr>
<tr>
<td>Experimental</td>
</tr>
<tr>
<td>Examiners were assigned randomly to various tests prior to the training to prevent information bias. To maintain consistency, each specific test was performed by the same single examiner. The examiners first determined the optimal direction of eccentric viewing for each patient by looking at a Feinbloom distance chart at eye level, 1 meter away. The patients were instructed to look in varying directions until the clearest image was determined. The examiners used a direct ophthalmoscope to determine the patients’ PRL, or where their eyes naturally fixated. The patients (along with their guardians) were then trained to intentionally use the determined eccentric viewing pattern while viewing a target at 40 cm and at 1 meter for 15 minutes a day at each distance. The subjects were also encouraged to use eccentric viewing in their daily life. The patients that continued to practice eccentric viewing after 2 weeks were assessed separately from those who did not. The effects measured included reading speed, patient satisfaction, and best-corrected visual acuity (BCVA).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outcome Measures</th>
</tr>
</thead>
</table>
| Reading speed was evaluated using the same conditions as listed above. The sentences contained 20 point size font and utilized the Batang style of the Korean alphabet, and therefore, speed was measured in letters, rather than words, per minute. BCVA was checked at 3 meters from a Feinbloom distance chart with a luminance of 500-600 lx and at 40 cm from a Precision Vision near chart with a luminance of 700-800 lx for near vision. No information about the validity of this outcome measure was found. The satisfaction questionnaire contained 10 items obtained from the Korean version of the Low Vision Quality of Life Questionnaire (LVQOL) and each item was graded on a 6-point scale. The subjects rated items between 5 (no difficulty due to vision) and 1 (great difficulty) or 0 (no longer performs task due to vision). The LVQOL has a high internal consistency (alpha = 0.88) and good
reliability (0.72) (Wolffsohn & Cochrane, 2000).

Main Findings

The Mann-Whitney U-test was used to compare differences between the accordance group (individuals whose naturally-occurring, preferred retinal locus coincidentally was the same as the position of visual fixation which they were trained to use) and discordance group (their preferred retinal locus was different than their trained retinal locus).

The Wilcoxon signed-rank test was used to compare changes in visual function in the group which continued eccentric viewing training.

This table shows data from the 20 participants that completed the prescribed 2 week training.

### 2 weeks post-training in continuance group

<table>
<thead>
<tr>
<th></th>
<th>Before training</th>
<th>After training</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading speed (letters/min)</td>
<td>26.0 ± 8.0</td>
<td>54.0 ± 11.0</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Far BCVA (logMAR)</td>
<td>1.02 ± 0.37</td>
<td>0.92 ± 0.45</td>
<td>0.86</td>
</tr>
<tr>
<td>Near BCVA (logMAR)</td>
<td>0.79 ± 0.36</td>
<td>0.7 ± 0.28</td>
<td>0.81</td>
</tr>
<tr>
<td>Questionnaire score</td>
<td>25.0 ± 10.0</td>
<td>30.0 ± 12.0</td>
<td>0.025</td>
</tr>
</tbody>
</table>

Original Authors’ Conclusions

This study showed that eccentric viewing training can be an effective, inexpensive method for rehabilitating individuals with central scotomas. Reading speed was found to be a better parameter than visual acuity when reporting the results of rehabilitation. Further research is needed to overcome the present limitations of the study, including the discordance and discontinuance of treatment.

Critical Appraisal

Validity

External:

The inclusion and exclusion criteria were clearly defined in this study. Limited demographic data was given on the subjects including age, gender, and diagnosis. Subjects were recruited from the same local clinic and were selected by convenience sample. There were no reports on socioeconomic status or ethnicity and there was no control group in this study, so the ability to generalize is hindered.

Internal:

This study prevented information bias by randomizing the examiners to different testing stations. This study reported on specific standardized outcome measures, which increases the validity. The testers used the same environment (lighting, magnification, etc.) during reading assessments as to maintain consistency in testing. Sources of funds were not mentioned in this study.

Interpretation of Results

The evidence reveals that reading speed increased following 2 weeks of eccentric viewing training (p = 0.001). The authors noted that for effective eccentric viewing training, a well-organized visual rehabilitation program along with environmental supports is imperative. The self-directed program may have decreased the effects of eccentric viewing training.
### Summary/Conclusion

The results of this study showed statistically significant improvements in reading speeds in individuals with central scotomas following an eccentric viewing training program. This study has discussed very specific methodology, data collection, and inclusion/exclusion criteria, which increases the validity. However, this study risked patient non-compliance by utilizing a self-directed program after initial training. This factor may diminish the internal validity. This study addresses the aspects of my clinical question and provides evidence supporting eccentric viewing training improving reading speed.

**Table 4:** Description and appraisal of “Patients with AMD and a large absolute central scotoma can be trained successfully to use eccentric viewing, as demonstrated in a scanning laser ophthalmoscope” by Nilsson, Frennesson, & Nilsson (2003).

### Aim/Objective of the Study

The objective of this study was to determine the effectiveness of eccentric viewing training in patients with absolute central scotomas and to determine whether or not these patients would be able to adopt a trained retinal locus.

### Study Design

Prospective non-randomized control trial – one group, pre-test & post-test

### Setting

Low vision out-patient setting in Sweden

### Participants

This study is prospective and reports on 20 patients selected consecutively from the Linköping University Department of Ophthalmology or referred by private practitioners. The ratio of women to men is 16:4. The mean age of the subjects was 77.4 ± 6.0 with a range of 64-86 years. The mean visual acuity of the subjects was 20/475 with a range of 20/250-20/1000. The average power of magnification used with subjects was 57.2 ± 7.6 D and a mean reading distance of 1.75 cm, due to the high power of magnification. The inclusion criteria involved patients with advanced age-related macular degeneration and an absolute central scotoma. Exclusion criteria included any previous participation in low vision rehabilitation or indications of glaucomatous changes or lens changes that could affect visual acuity. Two patients were not successful with eccentric viewing training and their data was not analyzed following training.

The mental alertness was also measured and judged prior to treatment in each patient and the mean alertness score was 3.0 ± 0.8 as rated on a 4-item scale from 1 (poor) to 4 (very good).

### Intervention Investigated

**Control:** N/A

**Experimental**

The patients initially were tested by a scanning laser ophthalmoscope (SLO) to determine the precise location of the scotoma. The patients were then asked to read a scrolled text on the SLO at a magnification level of 8-15x, depending on their visual acuity. A microphone recorded the subjects’ attempts at reading the scrolled text on the computer screen. Subjects were then trained by a low vision therapist at the out-patient clinic to use a new visual fixation (trained retinal locus), which helps them see more clearly while reading, through the use of this computer program. The patients were examined following training by the same method using the SLO. The mean number of one-hour training sessions with the low vision therapist was 5.4 ± 1.2 and the range was 3-7. These one-hour training sessions were separated by one week of homework.

### Outcome Measures
Reading speed was measured using a standardized printed text and was reported in words read per minute.

Mental alertness was evaluated and measured subjectively by the authors after an initial interview and examination. The categories for analysis included patient’s memory capacity regarding themselves and their family, ability to describe their situation, ability to understand their disease, and the ability to understand the rehabilitation program. Each item was rated on a scale from 1 (poor) to 4 (very good).

No further outcome measures are described.

**Main Findings**

18 of the 20 patients were able to learn eccentric viewing skills. One patient, after 5 hours of training, was still not able to use the TRL in order to read. The second patient was only able to complete 2 training sessions and did not have success with eccentric viewing, reportedly due to severe psychiatric problems. Both of these subjects had very extensive scotomas. The mean reading speed prior to training was 9.0 ± 5.8 words/minute for the 18 patients who successfully learned to use eccentric viewing. For all 20 patients, the mean was 9.2 ± 6.6 words/minute. Following training, the mean reading speed increased to 68.3 ± 19.4 words/minute for the 18 patients who were successful with eccentric viewing (p=<0.001).

**Original Authors’ Conclusions**

The authors found that 90% of the patients with central scotomas were able to improve their reading speed following eccentric viewing training. They noted that formal educational training by an experienced low vision therapist is an essential component to success. The SLO method is ideal because the patient’s PRL as well as TRL can be viewed on the computer monitor, thus more accurately guiding training. The authors also concluded that reading speed is a much more valuable measure of reading ability than visual acuity because it is a more direct method. Overall, the rehabilitation of patients with age-related macular degeneration and an absolute central scotoma using eccentric viewing training can be very successful.

**Critical Appraisal**

**Validity**

*External:*
The inclusion/exclusion criteria in this study are clearly defined. Although, there was limited demographic information given about subjects including only age, gender, and diagnosis. The subjects were recruited prospectively and the sample selection method was consecutive. The subjects were recruited from either the Linköping University Department of Ophthalmology or referred by private practitioners. There was no control group in this study and the sample size was relatively small. No blinding took place among examiners.

*Internal:*
The authors clearly described and monitored the methods of formal intervention; however, the authors did not monitor or describe the self-directed training the subjects participated in as “homework.” The experimenters used videotapes to record patients’ reading exercises, which can be valuable for future research or training. Funding was through grants from the Swedish Medical Research Council, the Linköping University Department of Ophthalmology, and the Östergötland County Foundation for Support of the Visually Impaired. The authors did not clearly identify specific outcome measures and the outcome measure for mental alertness was subjective, which compromises the validity of the measure.

**Interpretation of Results**

Overall, the eccentric viewing training method was effective in improving reading speed in individuals with central scotomas as evidence by p=<0.001. These results were achieved with an average number of 5.4 training sessions, which is valuable information when considering treatment costs. This study suggests cognition and mental health has a significant impact on ability to learn...
and perform eccentric viewing.

Summary/Conclusion

This study provides significant evidence on a computer-based eccentric viewing training program improving reading ability by the measure of reading speed in patients with central scotomas. The inclusion/exclusion criteria, along with methods were clearly defined, which strengthens the validity of the article. However, no control group was used and outcome measurements were not clearly defined. The validity of this article would be substantially strengthened by further monitoring and standardization of the “homework” portion of the intervention. Overall, this article applies to my clinical question and provides evidence for the use of eccentric viewing training to improve reading ability.

Table 5: Characteristics of included studies

<table>
<thead>
<tr>
<th>Study 1</th>
<th>Study 2</th>
<th>Study 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intervention investigated</strong></td>
<td>Eccentric viewing training</td>
<td>Eccentric viewing training via computer program</td>
</tr>
<tr>
<td><strong>Comparison intervention</strong></td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td><strong>Outcomes used</strong></td>
<td>Reading speed (words/min), font size (Keller N Series Vision Vocational Test Chart), duration of reading, degree of reading comprehension</td>
<td>Reading speed (letters/min), patient satisfaction (Low Vision Quality of Life Questionnaire), and near &amp; far best-corrected visual acuity (Feinbloom distance chart &amp; Precision Vision near chart)</td>
</tr>
<tr>
<td><strong>Findings</strong></td>
<td>Intervention improved reading speed, readable font size, duration of reading, and reading comprehension in patients with central scotomas due to age-related macular degeneration.</td>
<td>Intervention improved reading speed and patient satisfaction in patients with central scotomas. Best-corrected visual acuity (both near and far) did not improve significantly.</td>
</tr>
</tbody>
</table>

IMPLICATIONS FOR PRACTICE, EDUCATION and FUTURE RESEARCH

I examined evidence on eccentric viewing training and the effects on reading speed in individuals with central scotomas. In each of the three studies I reviewed, reading speed was found to improve after eccentric viewing training. Each study included varying frequencies, durations, and methods for implementing eccentric viewing training. Each of the studies included a “homework” portion of training following formal training that was not carefully monitored. Only one study reported on
patient satisfaction with their reading ability following training. These findings provide significant
evidence for eccentric viewing training and provide the foundation for further research on the topic.

**Implications for Practice & Education:**

This research indicates that eccentric viewing training improves reading speed, which is a valid
measure of overall reading ability. Eccentric viewing training can be implemented in a variety of
methods, as we’ve seen in both computer-based and paper-based methods. The basics of eccentric
viewing training transcend the different forms of intervention. In these studies, training was
provided by either a literacy tutor, low vision specialist, or self-directed showing that certification in
the area of low vision or literacy could be helpful, but not necessary for this particular type of
intervention.

Occupational therapists who are not familiar with the eccentric viewing technique should seek the
appropriate continuing education for incorporating this technique into practice. As therapists, we see
people with central vision deficits in many of our standard clinical environments and, as such, could
improve our success when reading ability is required for evaluation and intervention. Building the
use of eccentric viewing into our normal occupation-based interventions is feasible for practice.
Occupational therapy educators should seek methods of training students in eccentric viewing so our
future workforce is prepared to deliver this important and successful intervention.

**Implications for Future Research:**

Eccentric viewing training seems to lack the support of more rigorous research designs. The
frequency and duration was variable among these studies, indicating that further research on
specific dosage would be beneficial in determining exactly how much training is required to achieve
the best results. These articles often combined formal treatment sessions along with home-based
sessions that the subjects completed without monitoring by the experimenters. It would be
beneficial to have future research examining if there is a difference in outcomes between formal
treatment sessions and formal treatment combined with “homework” sessions. An important aspect
to review in the future would be the transfer of skills gained during eccentric viewing training to
other daily activities, such as phone usage, meal preparation, medication management, or other
tasks involving reading. Future research should examine these areas along with measuring patient
satisfaction with performance in order to develop strong evidence for the use of eccentric viewing in
low vision rehabilitation.

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