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Low Vision Rehabilitation: A Comparison of Traditional and Extended Teaching Programs

Judith M. Scanlan and Joan E. Cuddeford

Abstract: The purpose of the study was to determine the outcomes of a low vision service that made use of an extended period of education when assisting clients with age-related macular degeneration to use low vision devices. Extended teaching time made a significant difference to the experimental group, not only in the ability to read, but in their overall perceptions of the quality of their lives.

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Age-related macular degeneration (ARMD) is the leading cause of the loss of central vision in the elderly

(Brody et al., 2002; Daniel, 2002; Verezen, Völker-Dieben, & Hoyng, 1996). This loss of vision is irreversible and affects activities of daily living (Dahlin-Ivanoff, Klepp, & Sjöstrand, 1998). Thus, the goal of services provided to people with ARMD is not to cure ARMD, but to provide vision rehabilitation that maximizes the person's ability to use techniques, reading devices, or both to make use of his or her remaining eyesight (Rubinstein, 2001). Quality of life is perceptual, depending, in part, on the individual's ability to maintain independence (Bowling, 1995; Nolan, 2001). The inability to read and perform near-vision tasks (the consequences of ARMD) contribute to perceptions of a poor quality of life (Hinds et al., 2003; Williams, Brody, Thomas, Kaplan, & Brown, 1998). It has been estimated that about 85% of those who are visually impaired have some residual vision and can benefit from vision rehabilitation services (Hinds et al., 2003).

Since 1986, the Canadian National Institute for the Blind (CNIB), Manitoba Division, has operated an in-house Sight Enhancement Centre (SEC) for clients with low vision. Five optometrists and two vision rehabilitation workers who are registered nurses staff the SEC. On an initial visit to the SEC, clients undergo a full optometric evaluation, during which their individual goals, based on their interests and needs, are established. Instruction is given by the vision rehabilitation worker in the use of near and distant devices, lighting, filters, and nonoptical devices. The

initial educational session lasts 60 minutes. The client goes home with loaner equipment and is seen a week later to determine the suitability of the equipment. At the second visit, the vision rehabilitation worker and the client discuss whether the client ought to purchase the devices or explore other devices. Clients may return to the SEC for reassessment if their vision changes. Six months after a client's visit to the SEC, a volunteer calls him or her to determine the efficacy of the devices. Unfortunately, many of clients do not continue to use their low vision devices, and, consequently, the outcome of the educational sessions is disappointing. These follow-up telephone calls revealed that the service, while useful, could be improved, since most clients were using their near devices only for spot reading, when their original goal was to read newspapers and books.

Given the anecdotal experiences with the outcomes of the educational session, it was determined that a study that compared the traditional educational program with an extended teaching program would enable us to provide evidence to support extended practice. The vision rehabilitation workers at SEC believed that the best way to change practice and convince funders of the need for the more costly practice was to investigate the issue from an empirical perspective. Therefore, they approached the Faculty of Nursing at the University of Manitoba to seek assistance in the process, and the first author became the leader of the research team.

A review of the literature determined that only a few studies have evaluated the outcomes of a low vision rehabilitation program (Hinds et al., 2003; Leat, Fryer, & Rumney, 1994; McIlwaine, Bell, & Dutton, 1991; Raasch, Leat, Kleinstein, Bullimore, & Cutter, 1997; Shuttleworth, Dunlop, Collins, & James, 1995; Virtanen & Laatikainen, 1991). The difficulty with these studies is there are few similarities among the methodologies in either the vision rehabilitation service or the study design. Measurement of "success" is wide ranging, with a variety of different types of interventions (Leat et al., 1994; Raasch et al., 1997) and outcome measures (Brody et al., 2002; Hinds et al., 2003). In addition, there has been growing interest in the impact of ARMD and the use of low vision devices on the quality of individuals' lives (Gutierrez et al., 1997; Raasch et al., 1997; Stein, Brown, Brown, Hollands, & Sharma, 2003; West, Rubin, Broman, Muñoz, Bandeen-Roche, & Turano, 2002; Williams, et al., 1998). In particular, the ability to read is highly associated with the perception of a higher quality of life (Hazel, Petre, Armstrong, Benson, & Frost, 2000). No studies were located that examined the effects of extended teaching time on the ability to read with low vision devices and perceived quality of life.

The study

Purpose

The overall purpose of the study was to determine the outcomes of a low vision service that made use of an extended period of education when assisting clients with ARMD to use low vision devices. Historically, clients with ARMD have not continued to use low vision devices over long periods. It was hypothesised that with greater education and support, clients would use low vision devices and be better able to read 1M print, thereby enhancing their ability to participate in activities and improving the overall quality of their lives. Specifically, the study was designed to ascertain the results of a low vision service that focused on extended client education in the use of microscopes (plus lenses mounted in a frame—strength 6D–40D) with individuals with ARMD.

Research design

A study was conducted to compare the effects of two teaching methods for training individuals with ARMD to read with microscopes. The teaching methods were the two dependent variables. The short or traditional teaching session, used with the control group, lasted one hour. The experimental group participated in an extended teaching program that consisted of five one-hour sessions. The outcome measures were reading speed and accuracy and quality-of-life measures. Participants who met the criteria for eligibility and agreed to participate in the study were randomly allocated using a concealed assignment to the control or experimental group. Only the vision rehabilitation

worker who conducted the training program and administered the outcome measures was aware of the teaching method that the participants received. Ethical approval for the study was obtained from the Ethical Review Committee, Faculty of Nursing. Participants who agreed to participate signed a consent form at the initial teaching session.

Two instruments were used to collect the data. The National Eye Institute Visual Function Questionnaire (NEI-VSQ) is a vision-targeted tool that assesses the influence of visual impairment on health-related quality-of-life issues. It contains a total of 25 questions with 14 subscale items. Reliability estimates vary from $r = 0.68$ to $r = 0.91$ for all scales (Mangione et al., 1998). Previous studies demonstrated that the NEI-VSQ is a reliable and valid tool for group-level comparisons of individuals with ARMD (Clemons, Chew, Bressler, & McBee, 2003).

The Pepper VSRT provides the vision rehabilitation nurse with an accurate and reliable estimate of the reader's ability (reading speed and accuracy). It is widely used in the field of low vision treatment and research (Watson, Whittaker, & Steciw, 1995; Watson & Wright, 1995). Three forms of the test enabled the administration of different versions at Time 1 (Week 1), Time 2 (5 weeks), and Time 3 (12 weeks).

Both groups (32 participants per group) completed the NEI-VSQ and Pepper VSRT test at Time 1 (admission

to the study). The control group received the usual or traditional one teaching session, completed a second Pepper VSRT test at Time 2, and completed a third version of the Pepper VSRT test and repeated the NEI-VSQ at Time 3. The experimental group completed both the NEI-VSQ and Pepper VSRT at the same times as the control group. However, they received five teaching sessions.

Sample

A total of 64 individuals, 23 men and 41 women, aged 65–89 (mean age 81), participated in the study, equally divided between the control and experimental groups. Participants were recruited from new clients at the CNIB in a western Canadian city who were referred to the low vision clinic by either an ophthalmologist or an optometrist. Clients were screened during an intake interview to determine whether they met the inclusion criteria: (1) diagnosis of ARMD, (2) best-corrected visual acuity in the better eye of 20/60 to 20/400, (3) relatively good health, and (4) sufficient motivation to participate in the study. Those who agreed to participate were randomly assigned to either the control or experimental group. Participants who suffered a significant vision loss during the study were removed from the study, and additional clients were recruited to ensure that there were 32 participants in each group.

Data collection protocol

Initial visit

The following activities were completed by both the control and experimental groups at Time 1: administration of the NEI-VSQ, clinical examination by an optometrist, teaching session with the vision rehabilitation worker, administration of the first version of the Pepper VSRT, the loan of optical and nonoptical devices, and reading exercises.

Weeks 1–4 (experimental group)

Although the teaching sessions for the experimental group in Weeks 1–4 focused on similar activities to those conducted at the initial visit, the vision rehabilitation worker met one on one with the participants, which allowed the worker to individualize each teaching session according to the needs of each client. In the teaching sessions, the worker carried out the following activities: reviewed reading techniques (eccentric viewing, focal distance, scrolling, and lighting), corrected poor skills, assigned increasingly difficult reading exercises, and answered participants' questions.

In addition, during Week 5 (Time 2), both the control and the experimental group completed the second version of the Pepper VSRT. During Week 12 (Time 3), both groups completed the third version of the Pepper VSRT and repeated the NEI-VSQ.

Data analysis

Univariate and multivariate analyses were conducted on the data. More specifically, descriptive statistics, cross tabulations, repeated measures, and multiple pairwise comparisons were used. Repeated measures of analysis of variance (ANOVA) were fitted to the data of the Pepper test. Instead of using the original percentage-correct scores and reading rates, both of which yielded highly skewed statistical distributions, the statistician applied the arc-sine transformation to the percentage-correct scores and the square-root transformation to the reading rates to stabilize the variance and produce a distribution that was closer to normal. The statistician conducted the transformation to produce data that would fit a normal distribution so as to proceed with the statistical procedures that meet the assumption of normality. Such transformations better satisfy the underlying distributional assumptions in the ANOVA, which, in turn, produces more statistically valid inferences. The results of the ANOVA for both the transformed percentage-correct scores and the reading rates produced the same set of conclusions that there is a significant interaction effect between time and the experimental and control groups. As the result of the statistically significant interaction, the Bonferroni multiple comparison method with a family-wise error rate of .05 was applied to the Pepper-test data to determine further the nature of the differences between the experimental and control groups over time (Hazard Munro, 2001).

The data from the NEI-VSQ (Time 1 and Time 3) were examined with the Monte Carlo exact test in cross tabulations. The two groups were compared on each question at Time 1 and Time 3. The Monte Carlo exact test is an unbiased estimate of the exact significance level, calculated by repeatedly sampling from a reference set of tables with the same dimensions and row and column margins as the observed table. This test was the most appropriate, given the small sample size (McDonald, DeRoure, & Michaelides, 1998; Smith, Forster, & McDonald, 1996).

Results

No statistically significant differences were found between the control and experimental groups on sociodemographic characteristics, including age, gender, marital status, and living cirumstance (alone or with someone else). The participants in the control and experimental groups were also similar in their visual acuities and strength of reading devices used (see Table 1). Nonparametric Mann-Whitney *U* tests were used to determine whether there were significant differences between selected baseline characteristics of the control and experimental groups that may have affected the results. Descriptive statistics on age, number of years with a diagnosis of ARMD, self-rated health, and self-rated eyesight (rated on a scale of 1–10) and scores on the Pepper test for both reading rate and percentage correct showed no significant

differences at the baseline (see Table 2).

Pepper VSRT tests

As illustrated in Figure 1 and Figure 2, there were no significant mean differences on percentage correct and reading rates between the control and experimental groups at Time 1. There were significant mean differences between the two groups at Times 2 and 3 (p = .000 and p = .003, respectively). These differences suggest that the intervention (extended teaching) had a positive effect (shown at Time 2) that was maintained seven weeks later at Time 3. Figures 1 and 2 also demonstrate that there were no significant differences over time in the control group on both mean percentage correct and reading rate. Significant mean differences in percentage correct and reading rate (p = .000 and p = .003, respectively) were found between Time 1 and Time 2 in the experimental group, but no differences were found from Time 2 to Time 3. These figures indicate a difference between the groups over time that is supported by the results of the ANOVA and Bonferroni tests. Furthermore, these findings suggest the positive effects of the intervention for the experimental group.

NEI-VSQ questionnaire

Cross tabulations between the two groups on individual items in the NEI-VSQ at Time 1 using the Monte Carlo exact test showed no significant

differences between the control and experimental groups. Statistically significant results were noted between the two groups at Time 3 (Week 12) in which the experimental group (1) rated their eyesight as higher, (2) expressed less difficulty reading smaller print (newspapers, telephone books, and labels on medicine bottles), (3) expressed less difficulty deciphering whether bills they received were accurate, (4) expressed less difficulty seeing how others reacted to things they said, and (5) perceived that they needed less help from others (see Table 3).

A more interesting finding was that there was a statistically significant difference ($p = .001$) for the NEI-VSQ item between the two groups in relation to mean reported eyesight (see Figure 3). At Time 1, there were no significant differences in mean rated eyesight, but at Time 3, there was a significant difference ($p = .000$) for the participants in the experimental group.

Discussion

The findings of this study are encouraging for those who work in the field of low vision rehabilitation. Extended teaching time made a significant difference, not only in the participants' ability to read, but in the participants' overall perceptions of the quality of their lives. These findings are similar to those of Goodrich (2002), who compared three models of reading training (brief, moderate, and extended teaching periods) using handheld magnifiers, stand magnifiers, and closed-

circuit television. Regardless of the low vision device used, extended teaching time is necessary to achieve the desired outcomes—continued use of reading devices—for clients with ARMD. Use of the traditional approach is questionable, given the outcomes achieved in this study. Methods that achieve desired results are more effective in the long term, and not to use more efficacious methods could be considered unethical. There is concern that it is unethical to withhold treatment of demonstrable value to a client (Goodrich, 2002).

The usefulness of quality of life as an outcome measure of the effectiveness of a program was borne out in this study and echoed the findings of others (Brody et al., 2002; Hazel et al., 2000; Hinds et al., 2003; Stein et al., 2003). Perusal of these studies indicates that a variety of tools were used to measure the quality of the lives of clients with low vision. However, despite different tools, the results of these studies are similar and support the notion that the ability to read with low vision devices contributes to enhanced perceptions of one's quality of life. In turn, this ability to read leads to enhanced self-rated eyesight (see Figure 3), despite no actual improvement in visual acuity. The extended educational sessions enabled the participants in the experimental group to maximize their remaining vision. This improvement in reading enabled them to be more independent in tasks of daily living, such as reading a newspaper and telephone book and deciphering bills, crucial tasks that enhanced

the quality of their lives.

This study can serve as a model for vision rehabilitation workers who are interested in evidenced-based practice. Although many vision rehabilitation workers may “know” intuitively that another educational strategy will work better, it is difficult to convince funding agencies that engaging in more costly practices is necessary. Partnering with faculty at a local university is beneficial to all participants. The results of this study were so compelling to the SEC that it changed its educational program to the experimental model as soon as the study was completed. Since the goal of any ARMD educational program is to help clients manage their decreasing vision, it is not cost-effective, in terms of human resources, materials, and client outcomes, if an educational strategy is not leading to the intended outcomes.

Teaching the use of a low vision device goes far beyond the principles of optics; encouragement and positive reinforcement are as important as fluid reading and word recognition. After a certain point in the educational sessions, the commitment and continued interest of the vision rehabilitation worker encouraged the participants in the experimental group to continue. It is difficult to know how much this interaction between the worker and the participants influenced the outcomes of the study because it is impossible to account for all aspects of the educational enterprise in a study of this nature. One client commented, “I would

like to express my appreciation for the help I have received in overcoming the difficulties and frustrations caused by my deteriorating vision."

Evidence suggests that interaction is most effective in changing health behavior in relationships that are characterized by mutual trust, respect, and shared power and decision making (Lewis, DeVellis, & Sleath, 2002). A study that examines the nature of the relationship between the educator and the client may shed light on the dynamics of this process.

Conducting research with this group of participants also led to some lessons learned that should be considered when planning studies with similar populations. Clients who met the criteria for inclusion were advised of the time commitment required, and some were not interested in participating because of it. Once clients were admitted to the experimental group, however, they were willing to practice and rarely missed an appointment. They reported that they enjoyed the challenge of increasingly complex reading materials.

Conversely, it was difficult to get the participants in the control group to return at Week 12 for the administration of the third Pepper test and the NEI-VSQ. Many of these clients had stopped using their low vision devices. At the end of Week 12, extended teaching sessions were offered to the control group, but by this point, many were not interested and had given

up trying to read. The concept of self-efficacy (Bandura, 1977) may explain some of the reluctance of this group to try again. According to Bandura, self-efficacy is the belief that one has the capability to enact the desired behavior—in this case, the use of low vision devices. While there are several sources of self-efficacy, the most powerful source is performance accomplishments (Bandura, 1997). Undoubtedly, the participants in the experimental group enjoyed enhanced self-efficacy related to their mastery of the use of low vision devices. However, those in the control group would not have performance accomplishments to strengthen their self-efficacy in this task. In the health-education literature, the concept of self-efficacy has been demonstrated empirically to be the best predictor of continued efforts, even in the face of failure (see, for example, Bandura, 1997; Dilorio, Dudley, Soet, Watkins, & Maibach, 2000; van de Laar & van der Bijl, 2001). Two studies (Brody et al., 2002; Dahlin-Ivanoff et al., 1998) discussed the concept of self-efficacy in relation to the use of low vision devices by individuals with ARMD, but only Brody et al. examined self-efficacy as an outcome measure. Given the positive outcome found by Brody et al. and others in health education, further research on self-efficacy and how educational programs can develop an individual's self-efficacy in the use of low vision devices is warranted.

In addition, two other factors were crucial to the study: the loaner system and transportation. Although these

factors were not part of the study design, it was apparent as the study progressed that these factors contributed to continued participation in the study. These often-overlooked factors are integral to completing a study with an elderly population.

The loaner system allowed all the participants the opportunity to practice with the appropriate microscope in their homes at no cost. At Week 12, more than twice as many participants in the experimental group (78% versus 37%) purchased their low vision device, which suggests their intent to continue to use it.

Transportation to educational programs can be difficult for many elderly people and was a challenge for both groups of participants. In particular, the control group was reluctant to return at Week 12 to complete the NEI-VSQ and Pepper tests. Provision of transportation facilitated their completion of this component of the study. For the experimental group, it was important to maintain the data collection protocol, and transportation was provided to ensure the timeliness of the protocol. Since the completion of the study, with a more flexible schedule related to the educational sessions, clients are able to arrange their transportation independently.

The results of this study must be interpreted with caution, given the limitations of the study (small sample size and limited geographic area). All the

participants were volunteers. As a consequence, those who were the most highly motivated to learn to read with low vision devices may have participated, while others who were not interested may have declined to participate.

Most of the studies that have examined the outcomes of an ARMD educational program (such as Brody et al., 2002; Hazel et al., 2000; Hinds et al., 2003; Raasch et al., 1997; Stein et al., 2003), including this one, have been cross sectional in design, and there is no way to know whether the participants in the experimental group continued to use their low vision devices after the study ended. Therefore, issues that arise following the completion of educational programs should be examined to determine how successful the programs are in fostering the long-term use of low vision devices.

Conclusion

> My family is taking me to the CNIB clinic to learn how to use my remaining vision so I can read again.

This client's expectation of learning how to maximize his remaining eyesight by learning how to use low vision devices is not unrealistic. With a shift in philosophy and extended teaching time for clients, true vision rehabilitation can take place. Clients with ARMD can receive the best optimal educational services available, and their expectations can be met.

ARMD is the leading cause of low vision in the

Western world (Hazel et al., 2000), and it is estimated that 28% of those aged 75 and older are affected (Dahlin-Ivanoff et al., 1998). Given the aging of the population, significant increases in those with ARMD can be expected in the future. The next generation will be well informed and demand more services than their predecessors. It behooves all involved in low vision rehabilitation to deliver best-practice educational services to truly meet the needs of individuals with ARMD.

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Judith M. Scanlan, R.N., Ph.D., *associate dean, Graduate Program, Faculty of Nursing, Helen Glass Center for Nursing, University of Manitoba, Winnipeg, MB Canada, R3T 2N3; e-mail: <judith_scanlan@umanitoba.ca>.* ***Joan E. Cuddeford, R.N., C.L.V.T.****, vision rehabilitation worker, Sight Enhancement Center, Canadian National Institute for the Blind, Manitoba Division, 1080 Portage Avenue, Winnipeg, MB, Canada, R3G 3M3; e-mail: <joan.cuddeford@cnib.ca>.*

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