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Teaching memory strategies to persons with multiple sclerosis

Daniel N. Allen, PhD; Gerald Goldstein, PhD; Rock A. Heyman, MD; Tiziana Rondinelli, BS

VA Pittsburgh Healthcare System, Highland Drive Division, Pittsburgh, PA 15206; the School of Medicine and the Western Psychiatric Institute and Clinic, University of Pittsburgh, Pittsburgh, PA 15261

Abstract--A memory-training program previously used effectively upon persons with head-injury (HI) was conducted upon eight subjects with multiple sclerosis (MS). The program involved computer-assisted teaching of imagery-based mnemonic strategies for recall of lengthy lists of words, and for associating names with faces. Results were similar to those found in individuals with HI, but the MS subjects learned the strategies quickly, and did not appear to require the lengthy training needed by persons with HI. It was concluded that memory training of those with MS may sometimes only require teaching of mnemonic strategies without extensive practice.

Key words: *cognitive rehabilitation, memory, multiple sclerosis.*

INTRODUCTION

While the specific nature of cognitive deficits in multiple sclerosis (MS) may vary greatly, a common complaint is poor memory. Individuals with MS do not typically have amnesic syndromes, but may be forgetful, often failing to keep appointments or not doing well at learning new information; in many ways, their memory failures appear to resemble those often found in individuals with histories of closed-head injury (HI). These people are also often forgetful, and learning is difficult for them, but they are not densely amnesic. In our work and that of others, it has been shown that individuals with HI may benefit from formal memory training, at least to the extent of learning to effectively use strategies and mnemonics that can assist in new learning and subsequent retrieval of information. Goldstein et al. (1) showed that persons with histories of closed HI and evidence of persistent memory failure could benefit from imagery-based training to aid in remembering long lists of items and in associating names with faces. The list-learning method was based on a method originally described by Kovner, Mattis, and Goldmeier (2), in which individuals are taught to embed a list of words into high-imagery humorous stories. The face-name technique was adapted from a procedure described by Moffat (3), in which an image is formed linking a distinctive feature of the individual's face with the individual's name. Both of these methods were found to promote learning in HI individuals (1) and, with technological modifications, were replicated in a subsequent study (4).

The present study was stimulated by a report (5) that the training methods initially developed for subjects with HI proved to be very effective in a single case of a person with MS. We attempted to apply these methods to a larger sample of persons with MS who were experiencing memory failures in everyday life. They all had self-reported and clinical suggestions of impaired memory. They were relatively stable medically, and, while they were known to have a progressive disorder, it did not appear that the progression would be cancelling possible benefits of the training. Further, if the training proved to be effective, the age levels for these relatively young persons and their prognoses suggested that they were likely to have many years of productive functioning, during which they could benefit from what they had learned.

METHODS

Subjects

Ten individuals with MS were entered into the study; eight completed training. They all met criteria for the clinically definite category of MS as proposed by Poser et al. (6): abnormal neurological findings, evidence that at least two separate lesions have developed, symptoms of more than 24-hour duration, suggestive of white matter disease, and no alternative explanation for the symptoms. The mean Expanded Disability Status Scale (7) score was 4.00±1.71, reflecting a mild-to-moderate degree of disability. All were under the care of a neurologist at a specialty clinic for MS. Demographic data are contained in **Table 1.**

Table 1.
Psychometric and demographic baseline data for the NIS subjects.

Test	Mean ± SD
Age (Yrs.)	39.6 ± 8.71
Education (Yrs.)	14.0 ± 2.45
WAIS Verbal IQ	102.5 ± 1.17

WAIS-R Performance IQ	87.36 ± 9.48
WAIS-R Full Scale IQ	95.36 ± 9.62
Mattis Dementia Rating Scale	141.27 ± 2.52
WMS-R Verbal Memory Index	94.33 ± 12.67
WMS-R Visual Memory Index	96.07 ± 19.44
WMS-R General Memory Index	93.00 ± 17.38
WMS-R Attention-Concentration Index	96.53 ± 13.71
WMS-R Delayed Recall Index	89.73 ± 2.52
Rivermead Behavioural Memory Test Profile Score	19.44 ± 2.55
Screening Score	8.89 ± 2.55
Beck Depression Inventory	18.71 ± 12.30
Beck Anxiety Inventory	17.29 ± 13.31
Memory Questionnaire	78.57 ± 44.14

The head-injury group studied in Goldstein et al. (1996) had a mean age of 36.4 ± 10.8 and a mean educational level of 12.5 ± 2.6 years. The Verbal, Performance, and Full-Scale IQ scores were 102.9 ± 11.5, 94.0 ± 8.5, and 88.9 ± 11.3; the mean WMS-R General Memory Index was 85.4 ± 16.5; and the mean Mattis Dementia Rating Scale score was 134.4 ± 132.3.

Several could not ambulate and required wheelchairs, but their sensory or motor disabilities did not prevent their use of a standard computer, so they were included in the study. Subjects were given a psychological assessment including neuropsychological tests, the Beck Depression Inventory (BDI; 8) and a Memory Questionnaire (MQ; 9), which contains 27 items on which the subject rates memory failures (e.g., "Completely forgetting to take things with you, or leaving things behind and having to go back and fetch them.") on a scale ranging from "Not at all in the last 3 months" to "More than once a day." The results of this pretraining assessment are presented in **Table 1.** The data indicate that the sample had mean scores reflecting average general intelligence. The Mattis Dementia Rating Scale (MDRS; 10) mean score was not in a range significant for dementia. The mean memory test scores for the Revised Wechsler Memory Scale (RWMS; 11) were in the low average range, except for the Delayed Recall Index (DRI), which was over two-thirds of a standard deviation below the normative sample mean. On the Rivermead Behavioral Memory Test (RBMT; 12), both the screening and profile scores fell into the "poor memory" category, which lies between "normal" and "moderately impaired." The mean score on the BDI was in the mild-to-moderate depression range. The mean score on the MQ was higher than the comparable score for persons with HI reported by the authors of the procedure (9). The BDI and MQ were readministered after training. The BDI was also administered approximately 1 mo before training was started.

Training

The training procedure was accomplished with computer assistance, using a Macintosh Model IIcx, as described in Goldstein, et al. (1,4). The list-learning, ridiculously imaged story (RIS) method took place over 15 sessions lasting about 30 min, scheduled two to three times a week. At the first session, the subject was introduced to the RIS method. A story was presented on the screen with the 20 words to be remembered printed in bold face. The subject was asked to read the story, and then to type into the computer as many of the bold-faced words as possible. A spelling check was developed to permit the word to be counted as an accurate recall even if not spelled entirely correctly. A two-step cuing system was used for the missed words. First, the part of the story in which the word appeared was displayed on the screen. Next, a category cue was given. For example, if the word was hammer, the computer provided the cue word "tool." The same story was used for sessions 1-4 and a new story was provided for sessions 5-8. After that, a new story was used at each session. Initially, the trainer provided both the list and story. At subsequent sessions, the trainee was given a list in advance and asked to make up a story at home. At the last two sessions, the trainee made up both the list and the story. At the end of the session, a report was printed summarizing the trainee's progress. A trainer was always present, and may have intervened at any time, but the procedure is essentially self-administering. The score for each session was number of words correct on a free recall trial performed immediately after training.

Face-name Method

This training was initiated by coaching the trainee to associate names with either physical characteristics of pictures of people or with the person's resemblance to an acquaintance or a celebrity. For example, a picture of a person named Harry might have a great deal of hair, or a picture of a person named John may have some resemblance to John Wayne or John Lennon. To promote generalization, entirely different face-name pairs were presented at each session. A presentation of the face-name pairs was given prior to training with the RIS method, thereby permitting a delayed recall trial for the face-name method. A library of videotapes of faces and names was created and read into the computer. Separate files were created for faces and names such that any face could be randomly paired with any gender-appropriate name. The faces appear on the computer screen as both a full face and profile along with the name. A voice also says the name (e.g., "My name is John."). Coaching is required to help the trainee to associate the name with either a physical characteristic of the face, a familiar person, or in some other way that produces an associative image. For each face, the method used is entered into the computer by the trainee along with a brief statement of the actual associative image (e.g., Familiar person--"Looks like John Wayne."). This material is used later for cuing. Following a delay of about 20 min, in our case time used to do the RIS training, the faces are again presented, but without the names. The trainee is asked to type in the name. Cuing for incorrect answers is a three-step process. The first step asks for the method of association used. If the trainee does not remember the name or the method, the second cue of naming the method (e.g., famous person) is provided onscreen.

Third, the content of the method is given (e.g., "Looks like ____ Wayne."). After initial coaching, the procedure is essentially self-administering. The training took place over 10 sessions, utilizing 10 faces in each face-name set. The score for the session was the number of correct names given after cuing.

Treatment of Data

The RIS and face-name data were plotted across sessions. Each trainee provided a list of 100 words before training. Free recall of one of these lists was obtained before and after training and the results were compared using a paired-comparison *t*-test. Pre- and post-training comparisons were also made for the face-name training utilizing *t*-test comparisons between number of trials required to learn a new set of 10 names. Paired-comparison *t*-tests were also used to evaluate changes in the BDI and the MQ before and after training.

RESULTS

The RIS Method

Figure 1 contains plots of the number of words recalled correctly across sessions for the subjects with MS, along with comparable data for those with HI, reported in Goldstein et al. (4). Unlike the latter, the MS subjects appeared to learn the method very quickly. Using the 100-word list provided by the subject, free recall of a randomly selected sublist of 20 words obtained prior to the start of training resulted in a mean of 14.56±4.00 words correctly recalled. After training, mean words recalled from a different randomly selected list was 16.78±2.39. This difference was not statistically significant ($t(8)=1.15$, $p>0.05$).

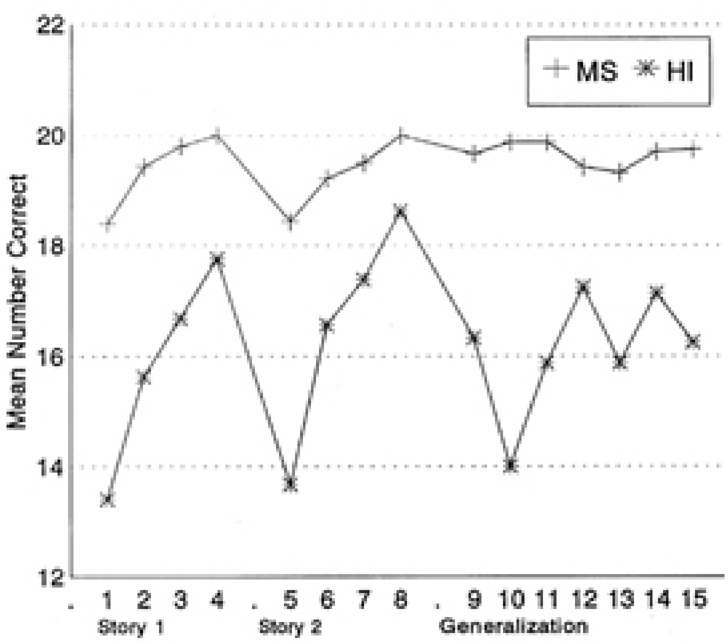

Figure 1.
Story method: Number of correct free recall responses following training over sessions for one group of subjects with MS and another with HI.

Face-name Learning

The learning curve data for number of names correctly given following cuing by MS and HI subjects are presented in **Figure 2.** It may be noted that the learning curve for the MS group is relatively flat because of high level performance from the beginning of the training: these subjects consistently recalled over 90 percent of the names. Prior to training, the MS group required a mean of 4.63±2.56 trials to successfully make a complete set of 10 face-name associations. After completion of training, 4.75±2.32 trials were required. The difference was not statistically significant ($t(7)=-0.08$, $p>0.05$).

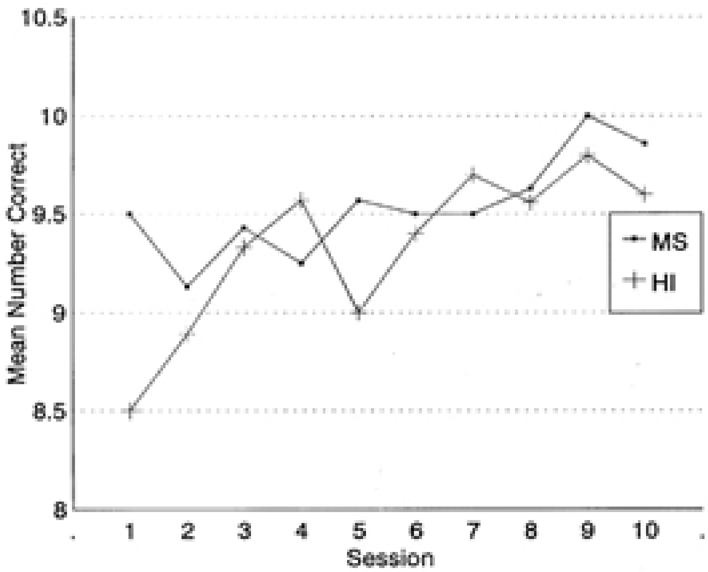

Figure 2.
Face-name method: Number of correct delayed responses following cuing over sessions for one group of subjects with MS and another with HI.

The Beck Depression Inventory and the Memory Questionnaire

There was a borderline significant reduction in reported difficulties with memory after training. The initial mean score was 78.57±44.14 and the post-training mean score was 53.14±30.39. ($t(7)=1.91$, p=0.10). Thus, the mean score went from the reported memory failures occurring once a month range to the range of once in the past 3 months, but less than once a month. There was a highly significant reduction in depression, ($t(7)=4.62$, $p<0.01$). The before-training mean score of 17.25 was in the mildly-to-moderately depressed range, while the post-training mean of 9.38 ±9.44 is in the normal range. In order to evaluate whether this reduction in depression was attributable to the training rather than to passage of time without a specific intervention, we compared the BDI scores obtained at screening, which occurred about 30 days before initiation of training, with scores obtained after training, which also took about 30 days to complete. The difference in mean BDI scores obtained before initiation of training was nonsignficant ($t(6)=1.99$, $p>0.05$), but the difference between the mean BDI score obtained at screening and after training, as indicated above, was highly significant.

DISCUSSION

This study replicates the RIS and face-name learning data obtained by Allen, Longmore, and Goldstein (8) for a single MS subject, who also achieved optimal performance levels very quickly and maintained a high performance level across generalization trials. It also supports the earlier results of Jønsson et al. (13) who found that persons with MS who underwent a cognitive rehabilitation program experienced a significant decrease in depression. The findings are also consistent with results reported for those with HI, attesting to the efficacy of these methods in promoting new learning. However, the pattern of learning by the MS subjects was quite different from that of the HI subjects, who learned the assistive techniques in a gradual, incremental manner, with relatively small gains at every session. Apparently, the persons with MS acquired a good grasp of the mnemonic strategies at the first session, and produced an optimal level performance thereafter. In the case of list learning, when a new list and story were introduced, cuing served to elicit almost a perfect performance at the first session of its introduction, followed at subsequent sessions by a flat learning curve representing optimal performance.

This finding has implications for the conduct of memory rehabilitation in different diagnostic groups. In the case of persons with brain trauma, it seems important to train over an extended series of sessions, based on our finding that close to perfect performance can be achieved ultimately but is reached by small increments. In the case of this sample of MS subjects, whose general level of cognitive function was very comparable to that found in the HI sample, strategy learning was much more rapid. This rapidity was demonstrated by the achievement of a near optimal performance on the story method at the first session, as well as by a remarkably rapid improvement with cuing when a new set of materials to be learned is presented. Note in **Figure 1** that on Session 5, at which a new list and story are presented, there is a decrement in performance by both the MS and HI subjects, but the former make a rapid recovery to near optimal performance after cuing, while the latter showed more incremental changes.

Based on these considerations, it would appear that while those with HI, and perhaps with other brain disorders, may benefit from an extended series of training sessions at which incremental learning takes place, those with MS may be equally well served by teaching them to use strategies at a single session or two, without the necessity of repeated sessions. In this study, extended training did not appear to add increased skill. The utility of learning such new skills may have been reflected in the drop in the MQ score before and after training. This change in scores indicates that memory problems occurring, on the average, about once a month went to an occurrence of more than once in the last 3 months but less than once a month. There was a significant reduction in depression, as evaluated by the BDI. It would appear that their perceived benefits from the program were focused on improvement in memory in everyday life tasks, and on reduction of distress. Enthusiasm for the program was attested by spontaneous remarks made during the training and particularly through the excellent attendance at training, despite significant mobility difficulties for several. Asked to comment on how the memory training benefitted them, subjects reported improvements in memory and concentration, often providing specific examples, such as " . . . helped me in memorizing speeches in my Effective Speech class," and "when I meet people now I am more aware of the features like markings, height, and voices that stand out to help me remember their names." Some wrote comments to the effect that the training gave them a sense of alertness, and that it helped them on bad days when they were having trouble concentrating.

Despite numerous reports in the literature regarding failure of recent memory in persons with MS (14), our group did not demonstrate substantial impairment on any of the standard memory tests administered prior to training. As Rao et al. (14) pointed out, only varying portions of their MS sample demonstrated substantial impairment on various components of their test battery, and it is possible that our sample was not heavily loaded with such subjects. Perhaps application of lengthy training procedures should be limited to those with strong evidence of memory failure at baseline. A limitation of the present study is the lack of inclusion of MS subjects with memory dysfunction more comparable to that of the HI subjects. Nevertheless, the results obtained may have been worth achieving even in the absence of pre-existing significant impairment, particularly when one considers that even nonimpaired individuals may benefit from memory training (15). It should be noted that the point of the training was teaching the mnemonic strategies rather than teaching specific contents of the training materials. In the case of the MS group, the training appeared to produce learning of the strategies despite the fact that recall of these materials was substantially better than was observed previously in persons with HI.

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