Memory training improves cognitive ability in patients with dementia

Stephanie Moore, Curt A. Sandman, Katie McGrady, and J. Patrick Kesslak

University of California, Irvine, USA

Clinical symptoms of Alzheimer's disease (AD) include a variety of progressive cognitive deficits, particularly memory. Twenty-five patients with mild to moderate AD and their caregivers, who served as controls, participated in a 5 week memory training programme, with a 1 month follow up. Participants were taught strategies that included name–face rehearsal, effortful recall, and a significant event technique. Intervention efficacy was assessed on task specific tests, administered on a weekly basis, and general cognitive measures obtained at the first and last sessions of the intervention. During the memory training programme patients showed improved performance on the recall of names and faces, recognition memory after effortful processing of information, and significant events ($p < .05$). Controls consistently performed better than the AD group, making few errors. Standardised measures for the AD group improved on the Kendrick Digit Copy and had lower scores on the Geriatric Depression Scale ($p < .05$). Caregivers also rated patients higher on the Memory Function Questionnaire (MFQ) ($p < .05$). Thus, a memory training programme can be beneficial for patients with mild to moderate AD to improve some aspects of memory and behaviour. Ultimately, behavioural interventions in conjunction with pharmacological therapies may optimise functional ability and provide a framework to further enhance cognitive function in patients with dementia.

Patients with Alzheimer's disease (AD) can be characterised as having quantitative and qualitative deficits in the acquisition of new information, memory, language, and orientation to time and place, which progressively declines as the

disease progresses (Cummings & Benson, 1992). As a result of these cognitive deficits patients show deficits in normal activities of daily living skills that can have a detrimental impact on careers, finances, family, and social interactions. Memory deficits are one of the early and prominent symptoms of AD that can result in frustration, depression, and withdrawal. Daily interactions are affected by diminished capacity for name–face recognition, ability to convey information, and recollection of daily events. Behavioural strategies may be helpful in compensating for some of these cognitive deficits.

The development of behavioural and pharmacological interventions for AD can have a significant impact on patient care. Currently in the US cholinesterase inhibitors are the primary pharmacological intervention for the treatment of AD. The benefits of these compounds are modest and may not be effective for all patients. Behavioural strategies, alone or in conjunction with drug interventions, should also be considered for the treatment of dementia. Early attempts to apply behavioural strategies for individuals with AD have had limited success in improving memory. Many procedures for retraining memory and language are designed for healthy volunteers (Cermak, 1975; Lorayne & Lucas, 1974; Minninger, 1984), aged individuals (Poon, 1980; Poon, Fozard, & Treat, 1978; Smith, 1980; Zarit, Cole, & Guider, 1981), and patients with head trauma (Berrol, 1990; Van der Linden & Van der Kaa, 1989; Wilson, 1987). These strategies rely heavily on semantic or phonemic association to facilitate the organisation and manipulation of material. The limited success of these methods in AD may be due to their inability to make associations which is vulnerable in this patient population (Craik & Watkins, 1973; Miller, 1975; Morris & Kopelman, 1986; Rabinowitz, 1984).

Since AD patients are not totally amnesic, particularly in the early to moderate stages of the disorder (Cummings & Benson, 1992), researchers continue to explore compensatory mechanisms that rely on functional neural circuits to sustain cognitive abilities. Unlike healthy elderly patients, Alzheimer's patients do not respond to comprehensive memory enhancement programmes (Mohs et al., 1998). However, by engineering the environment, cognitive support through experimental manipulation can improve memory (Bäckman, 1996). Improvement is particularly powerful if the training focuses on relatively preserved skills that may utilise functional neural circuits.

Hofmann, Hock, and Muller-Spahn (1996) have trained patients to use computers to access personally relevant information at different stages of the disease. This computer-assisted cognitive training requires scanning photographs of each patient's personal surroundings and entering autobiographical data into the computer. With the use of an interactive monitor, performance of patients from mild to advanced stages improved in a variety of behavioural functions. Patients in different stages of AD showed improvement negotiating in a social environment. For example, mildly impaired subjects demonstrated improvement in shopping, moderately impaired subjects improved in

orientation, and those severely impaired indicated an enhanced emotional status after treatment (Hofmann, Hock, Kuhler, & Muller-Spahn, 1996). Although patients became faster and made fewer mistakes with practice in using the computer, there was no significant cognitive improvement on standardised measures (Hofmann et al., 1996).

Highly individualised assistance at encoding and at retrieval has been shown to enhance episodic memory (Bäckman, 1996). Organisational strategies that utilise spaced retrieval and/or the use of external memory guides have been especially successful (Bäckman, 1996). For example a calendar that has one page per day is less confusing than multi day calendars for patients with dementia. Other memory aids include post-it pads, beepers, alarm clocks, and tape recorders. These are paired with verbal instructions and physical demonstrations (Bäckman, 1996). Wilson and Moffat (1992) report improved learning when the patient is not allowed to make mistakes ("errorless" learning).

Implicit memory (learning without conscious awareness) and procedural (motor) learning have also been utilised to enhance performance in activities of daily living for AD patients (Zanetti et al., 1997). Mild to moderately impaired AD patients have been trained to perform tasks such as brushing teeth, preparing coffee, and writing a cheque. Each task is paired with verbal support, including prompts and cues and 15 individualised sessions. Improvement was noted in non-trained activities of daily living as well as target areas.

Camp et al. (1997) have developed an intergenerational programme based upon the belief that cognitive abilities deteriorate in reverse order from which they developed in childhood. Developmental sequencing of cognitive events through Montessori techniques is believed to involve implicit memory. As with other programmes, immediate verbal feedback and structured repetition or practice is paired with Montessori-based tasks involving cognitive, sensory, and motor functions. Elderly demented adults are paired with a child to work on skills that are preserved in the adult and new to the child. While serving as mentors to the children, the adult's social skills demonstrated no apathy or agitation. Montessori skills learned by the child were implicitly evident to the adult, who was then able to guide the child through the various tasks.

Initial results from our memory rehabilitation intervention (Kesslak, Nickoul, & Sandman, 1997; Sandman, 1993) suggest that in AD patients, memory can be improved through persistence and specificity of an intervention. The most effective procedures, consistent with enrichment strategies, assumed that performance in AD patients could be enhanced by alteration of the environment (Hirst, 1988; Renner & Rosenzweig, 1987) rather than teaching sophisticated cognitive strategies that required substantial emotional and intellectual resources. The current study was designed to extend the initial study by adding a motor component to the name–face recognition, testing for generalisation of training to external measures of memory, attention and

mood, and long-term retention of the information learned in the training sessions.

The memory-training programme was developed with a focus on recall of names, faces, places and events. Procedures designed to "amplify" sensory information were employed with an emphasis on effort, rehearsal and arousal/interest and by engineering the interaction between the patient and the environment. In response to training, patients with dementia showed increased ability to perform situation-specific tasks that addressed the materials covered in the programme and there was general improvement in a set of standard cognitive measures.

METHODS

Subjects

Twenty-five individuals with mild to moderate dementia (mean age 72.5, ±8.04 years SD) and their caregivers (age matched controls with a mean age 70.0, ±10.5 years SD) were recruited from the University of California, Irvine (UCI) Alzheimer's Disease and Aging Clinic and the UCI Health Assessment Program for Seniors. Diagnosis of dementia was determined according to NINCDS-ADRDA guidelines for AD (McKhann et al., 1984). All patients were given a complete diagnostic evaluation by a neurologist or geriatrician and neuropsychologist. Routine laboratory tests were given, such as CBC, chemistry panel, B12, folate, MHA-TP serology, thyroid function, chest X-ray, electrocardiogram, VDRL, urinalysis, and magnetic resonance imaging. Diagnosis was made based on the consensus of the clinical team.

Each patient and his or her caregiver, who acted as an aged-matched control, participated in the memory-training programme. All participants received the same evaluation, instruction and homework. All of the memory training exercises required interaction between the patient, caregiver and instructor and both groups were exposed to approximately the same environmental conditions.

Memory Training Programme

The Memory-Training Programme (MTP) (Kesslak et al., 1997; Sandman, 1993) was devised from common strategies to increase both learning and memory. Our 5-week programme included key concepts in problem solving such as effort, arousal, and interest. The primary training methods such as the Significant Event Technique and other problem solving skills were introduced in the initial sessions and followed up and elaborated on in subsequent sessions. Standardised cognitive tests were administered at week 1 and 5 and included the Kendrick Digit Copy, Geriatric Depression Scale (GDS), Memory

Function Questionnaire (MFQ), Blessed Dementia Scale (BDS), and Relative Stress Scale (RSS). Task specific tests were administered weekly to assess individual performance relative to caregivers. Each member was given immediate feedback. There was enough flexibility in the programme design to aid each participant in his or her specific memory or learning impairment. This application of individualised techniques was considered to enhance the success of the programme. Each strategy was assessed weekly by objective tests administered at the start of each session. The tests covered materials to be learned in each of the following strategies of the training programme.

Lecture.   Each session began with a standardised lecture on memory and an outline of the explicit goals for that week. A review of how memory works was illustrated during the first week. The group was given information on the biological processes of memory as well as the different types of memory problems. Basic information on the brain, aging and behaviour was discussed regularly, explaining biological and psychological aspects of the MTP and its potential benefits. An analogy was made that learning and memory takes effort today just like when first memorising the multiplication tables in primary school. Before introducing and applying each technique the background and implications of the various techniques was discussed.

Name−Face Rehearsal (picture test).   During the first session, a Polaroid picture was taken of each person. Photocopies of individual members were placed on a sheet of paper, four to a page and distributed to every participant. The students were instructed to introduce themselves by name, including a short biography of themselves. To facilitate "deeper processing", relevant details, such as hobbies, interests, accomplishments, children, grandchildren and other pertinent details were told to the group. Each member of the group took notes under the appropriate pictures as the participants spoke. After introductions, the students asked questions of other participants to clarify details. Members also chose a particular motor movement that matched their interest, such as carving a piece of wood, swinging a tennis racket, or flying an airplane.

Pantomiming personal motor movements along with repeating the person's name was practised routinely during each group session and at home with the caregiver. Additional sheets of photos were given to participants if needed to rehearse the names, faces and motor movements during the week. Each couple was given a daily log to keep track of practice time and instructed that there would be a test on names, faces, and motor movements on subsequent weeks. Weekly sessions required all participants to write the first and last names and motor movements of each participant on a sheet of photos similar to the one given in class. After this, a verbal recognition test was administered to group members. Participants were given immediate feedback on their progress during the group sessions. Any failures to name members and/or motor movements

were accompanied with encouragement to recall the person's hobbies, interests, and accomplishments. Graphs were presented to participants to determine individual progress immediately after the task. Participants returned a weekly log of how much time each day they practised and rehearsed at home.

Significant Event Technique (SET).   The SET involved planning an event that was novel, unique and unusual. Couples were requested to *plan* this event together. Often older people become isolated and confined by a routine. Creating something unusual to do can thus be fun and fairly easy. Sample activities have included a picnic to an important place with foods never eaten such as exotic fruits and visiting either a new shopping centre or a museum. The next step was to execute or "*do*" the event or activity. Members were asked to *discuss* the activity after participation. To determine how much each participant could recall, a series of objective questions about the SET were asked. In contrast, objective questions were also asked about another day in which there was no planning or novelty (a non-SET or control day). Results of the planned versus non-SET days were graphically displayed for immediate feedback and discussion by the group.

Effortful Recall.   The group was given a video with four television sitcoms of about 20 min each. Instructions were given to watch one sitcom per week and the group was tested weekly on details of the programme. A 10-item-free-recall and 10-item-recognition test was administered on each successive week beginning with the second week of MTP. Additionally, after the recognition test, the group was primed and then took the 10-item-recall test once again. On the third week, participants were asked to develop five questions to ask group members about the video. For the fourth and fifth weeks participants were requested to make up 10 questions about the video, similar to the tests they had taken in the group. Participants then questioned their peers, using the questions that they had developed, during priming. The intention was to activate attention in a high-effort condition. As with other results, test scores were graphically presented to the individual participants immediately after testing.

Support intervention

Support interventions were also included since caregivers have a significant incidence of illness compared to the general population. Caregiver support included education, emotional support and some stress relief. All participants were encouraged to share their experiences and any coping strategies. The influence of the support intervention was not documented in this study, but was examined in an earlier report that treated the support as a separate component (Kesslak et al., 1997).

Long-term follow up

Approximately 1 month after the fifth training session, AD patients and controls returned to the clinic. At this time their ability to recall names and faces was assessed and they were asked for a subjective evaluation of the programme.

Weekly test battery

Brief psychometric tests such as the Geriatric Depression Scale, the Kendrick Digit Copy and the Activities of Daily Living from the Blessed Dementia Rating Scale, and the Memory Functioning Questionnaire (MFQ) were administered at the beginning of sessions one and five. This battery measured attention, cognition and mood (i.e., depression) and was given to both patients and controls. Caregivers were asked to rate the patient's abilities on the Activities of Daily Living (Blessed Dementia Rating Scale). Because patients and caregivers often have different views on the patient's cognitive ability and rate of depression, caregivers were also asked to answer the Geriatric Depression Scale and the Memory Functioning Questionnaire in reference to the patient.

RESULTS

Task specific measures

Ability to recall names on the "picture test" was analysed separately for recall of one name (first or last), both names, and the motor movement associated with a name. Repeated measures analysis of variance (ANOVA) was used to determine if recall of names improved over the weeks of practice after the AD patients and controls were instructed in the name recall strategies. As expected, the control group performed better than did the AD patients in recall of names and motor movement. Performance improved across weeks of training, with the control group reaching asymptotic performance early in the training, while the AD group showed improvement with practice (Figure 1). For the verbal recall of one name there was a significant difference between groups, $F(1, 31)$, $p = .02$; improvement over time, $F(3, 93)$ $p = .0013$; and an interaction, $F(3, 93)$, $p = .04$. Similar results were observed for the ability to recall both the first and last names with a significant difference between groups, $F(1, 31)$, $p = .0002$; improvement over time, $F(3, 93)$, $p = .0003$; but a non-significant interaction, $F(3, 93)$, $p = .08$. Recall of the motor movement associated with the names and faces differed between groups, $F(1, 31)$, $p = .0002$; improved across weeks of training, $F(3, 93)$, $p = .001$; and had a significant interaction, $F(3, 93)$, $p = .007$. When subjects were tested 1 month after the completion of the memory training programme information for name recall and motor
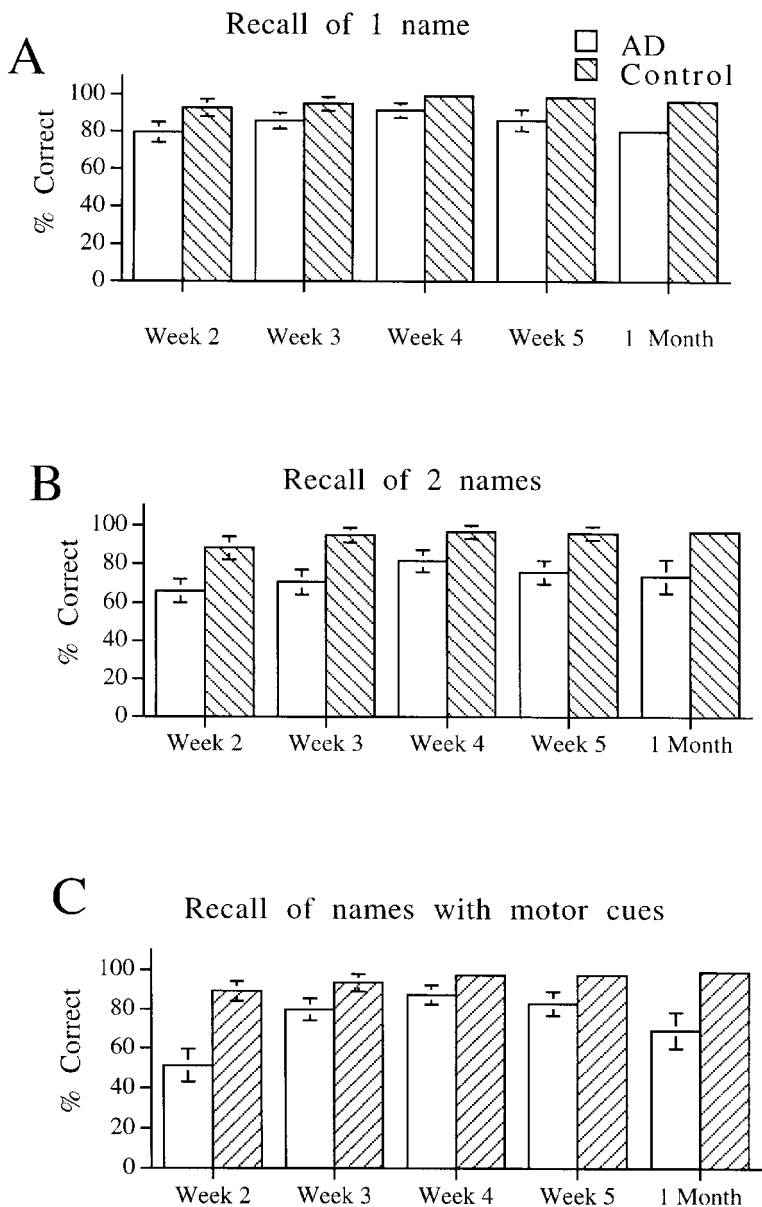
A

Recall of 1 name

□ AD
◨ Control

B

Recall of 2 names

C

Recall of names with motor cues

Figure 1. Recall of either one name (A), two names (B), or a motor cue associated with the name (C) all improved across the 5 weeks of memory training for the demented patients. Age-matched controls rapidly learned the names and motor cues during the memory training programme, consistently maintaining a high level of performance for recall. Ability to recall the names and motor cues was retained for at least one month after the completion of the memory training programme.

movements was maintained and did not differ from the level of performance during the last training session ($p < .01$).

The ability to recall information in temporal proximity to a significant event (SET) was assessed relative to a non-SET day. On days when a SET occurred the AD group recalled significantly more information than on a non-SET day, but never attained the same high level of performance as the control group. There was a significant difference between groups on both SET and non-SET days, $F(1, 51)$, $p < .01$; however, the AD group significantly improved on the SET days relative to the non-SET day, $F(2, 92)$, $p = .0017$. Control recall of information on set and non-SET days was typically very good, while the AD group showed marked improvement after planning and executing a significant event (Figure 2).

In the effortful recall tests groups were examined after viewing a video programme during the week and given tests on the programme content that first required free recall, followed by a recognition test and then a second test of free recall. Comparisons were made between weeks when participants were asked to take notes on the programme and to construct their own test questions (high effort) or just view the programme (low effort). On the first free recall tests, the AD group consistently recalled fewer items than the controls, $F(1, 21)$,
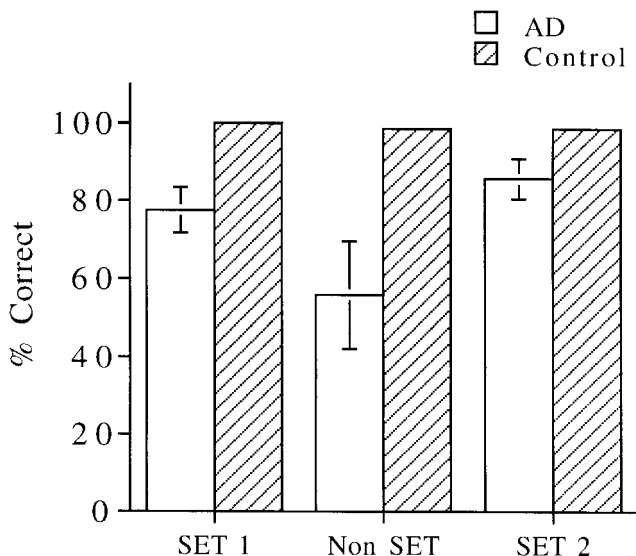

Figure 2. The planning and execution of a significant event (SET) by patients and caregivers improved performance on an objective test pertaining to the SET day. Recall of information on the SET day for patients significantly improved compared to the non-SET day, and approached the performance levels of the control group.

$p = .008$; and both benefited from increased effort to improve performance, $F(3, 63), p < .0001$; with no interaction, $F(3,62), p = .48$. Recognition memory and level of effort showed a similar pattern of differences between groups, $F(1, 21), p = .037$; with both groups benefiting from increased effort $F(3, 63)$, $p = .0007$; and no interaction, $F(3,62), p = .37$. After discussion of the programme a second free recall test was administered. Even after the discussion the AD group had significantly fewer correct answers than the control group, $F(1, 21), p = .005$; but the AD group did improve with increased effort, $F(3, 63), p = .001$; and there was a significant interaction, $F(3, 63), p = .0018$. The significant interaction after the second free recall testing was most likely due to the controls having a ceiling effect in correctly answering the questions after reviewing the programme in both the low and high effort conditions; while the AD group benefited from the review more in the high effort condition compared to the low effort condition (Figure 3).

Standardised measures

The standardised measures of cognitive change showed variable and modest effects for the memory training programme, similar to our previous report (Kesslak et al., 1997). AD patients' scores on the Kendrick Digit Copy, $t = 2.952$, $p = .006$, and Geriatric Depression Scale, $t = 2.071$, $p = .04$, improved between the first and last week of the memory training. Patient scores on the MFQ, BDS, and RSS did not show any significant change between the two test sessions. Controls indicated that the AD patients improved in their perceived functional ability as rated on the MFQ, $t = 2.125$, $p = .04$. Controls did not have any significant changes between the first and last weeks of training on any of the other measures including the Kendrick Digit Copy, GDS, BDS, or RSS. Thus, the most significant improvements in response to the memory-training programme appear to be more specific to the types of strategies, rather than generalised cognitive functions. However, the tests of cognitive function in this study are very general and may be insensitive to the modest benefits observed on the task specific measures.

DISCUSSION

In the early stage of AD patients exhibit multiple cognitive deficits that include difficulty with recall of names and faces, and daily events. It may be possible to reduce these symptoms through strategies that utilise the patients' retained capacity to learn new information, as indicated by improved performance during participation in a 5-week memory-training programme. Furthermore, the improved capacity to remember information is sustained for at least 1 month after the completion of the memory retraining.
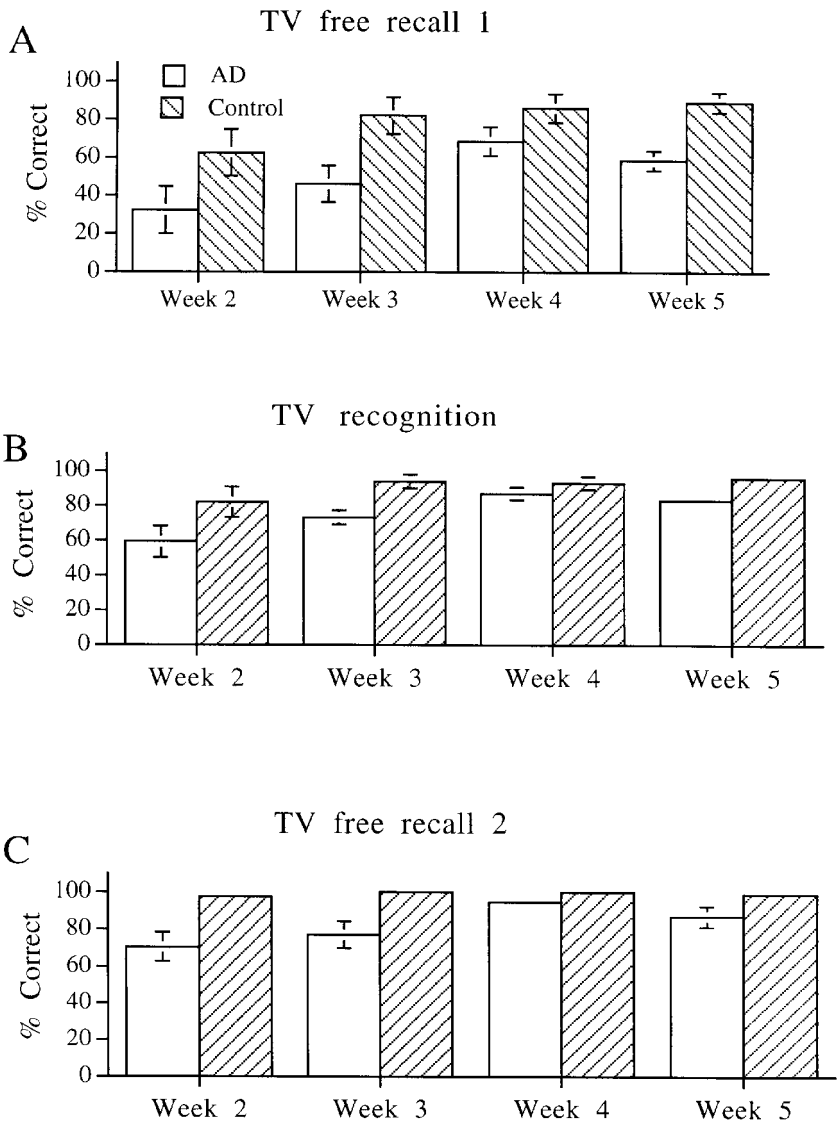
Figure 3. To increase the amount of effort in processing new information patients and controls were instructed to view a television programme, take notes and construct a test on the programme content. Ability for recall (A) and recognition (B) of information after viewing an assigned television programme improved across the weeks of training. Review of the programme content in class further enhanced the ability to recall information (C). By the end of the training programme performance on the recognition and recall after review tests did not differ for the patient and control groups.

As in our earlier study (Kesslak et al., 1997), enhanced cognitive function showed minimal generalisation to increase performance on standardised tests of general functional ability. No significant changes were seen for caregiver ratings on the Blessed Dementia Scale, Relative Stress Scale, and Geriatric Depression Scale. However, caregivers did rate patients higher on the MFQ, suggesting a slightly higher level of function. On the standardised measures, patients with AD did show improved performance on the Kendrick Digit Copy test, similar to our previous report (Kesslak et al., 1997), which may be due to enhanced attention and/or speed of processing. Patients also rated themselves as less depressed, which may interact with attentional processes to improve performance on the Digit Copy task. There were no changes in the AD patients' ratings on the MFQ, Blessed DRS or RSS. Overall, the results of the standardised tests scores did not show any consistent pattern of improved function; however, the value of these retraining procedures is most likely situation or task dependent and can vary considerably among individuals.

Consistent with our other studies (Sandman, 1993; Kesslak et al., 1997), there were three principal findings. First, task specific activities improved for name–face recall and recognition, and for recall of an event-specific task in patients with dementia. Second, as mood was lifted through the intervention, there were modest generalized effects in measures of attention. Third, our task specific interventions may also have improved generalised behavioural measures, although this effect is also modest. Overall the memory training programme was viewed as beneficial by both patients and caregivers. Examination of retention of material learned during the memory training course one month after completion indicated that information, such as people's names, can be retained for extended periods of time. The skills learned from the individual strategies in the memory training course can also be applied outside of the clinical setting to increase patient function.

Among the first and most distressing symptoms of AD is an inability to recall names and faces (Howard & Patterson, 1989; Nebes, Martin, & Horn, 1984). This often leads to isolation and depression. By rehearsing names and faces in association with visual cues, such as photographs and personal characteristics, including hobbies, occupation and family history, the identification of a specific individual can significantly improve. By engaging "automatic" processing through effortful procedures, such as rehearsal and esprit de corps, AD patients were able to learn and recall the names of group members. Consistent with our other studies (Sandman, 1993; Kesslak et al., 1997) AD patients' recall of one or both names significantly improved during the five-week intervention. In addition, this ability to recall the names and associated motor movements was maintained for over a month after the course was completed. Although there was significant improvement, the dementia patients never reached the same level of performance as the controls, who were able to identify the majority of group members throughout the memory-training

programme. The flexibility of recalling a single name, either Mary or Mrs. Jones, allows for versatility of response and places fewer demands on the memory system. Facilitation of memory for names and faces may have been enhanced through semantic elaboration (Scogin & Prohaska, 1993) such as the integrating historical data about group members with their names and faces over time. As the disease progresses compensatory mechanisms become necessary to counteract the now decaying ability for consolidation of new memories. These methods, such as practising the elaboration of details about the group members, may have promoted recall of names and faces. Chaining these cues to new names and faces provides additional information with which to stimulate name recall (Murdock, 1991). Providing immediate feedback or correction during rehearsal and practice strengthened associations, either at home with the caregiver or during group sessions. With the addition of "errorless learning" AD patients will maximise their encoding abilities, without confusing group members' names and faces (Wilson & Moffat, 1992). An increase in ability to identify names and faces may reduce isolation and related stress and facilitate social interactions. It is important to note that these skills can be maintained and the information stored in long-term memory, retained for an extended period of time, as exhibited by the participants' ability to recall names when tested one month after completion of the course.

An inability to recall a movie just seen or information just read is another common complaint of AD patients. From one study to the next (Sandman, 1993; Kesslak et al., 1997), we have had mixed results on the ability to recall information previously presented. Our first study indicated significant improvement in memory when encoding information required effort, such as preparing a 10-item objective test (Sandman, 1993). The results of the second study (Kesslak et al., 1997) were not as promising, patients did not improve in either recall or recognition of facts after the effortful production of a 10-item test. In this study, healthy controls recalled and recognised more information about the video than AD patients. The recognition memory for AD patients did improve with training using effortful recall, although they never reached the level of performance comparable to the healthy controls. The AD patients' memory for facts slightly improved with practice. Compliance appears to be a critical component of these findings. On several occasions throughout the sessions either the AD patients did not create the test questions or did not watch the video, which could significantly impair their test performance. Motivation is a key factor and is often reduced with the progression of dementia. Additionally, interaction between caregiver and patient should be encouraged to facilitate the use of strategies such as effortful recall, with the realisation that additional effort may be required on their part.

Our third strategy utilised a procedure for improving memory through the application of the Significant Event Technique (SET). This has been our most successful method to improve memory. Patients and caregivers are required to

discuss, plan and execute an event that is out of their normal routine. By engineering the environment to optimise memories, using activities tinged with emotion, novel events are enhanced, and thus, more easily recalled (Brown & Krulik, 1977; Levin, 1990; Sandman, 1993). In addition, encoding of information may be enhanced by increased information processing during the event due to the planning and discussion of the event. This could also increase anticipation, orientation or awareness during the time of the event and increase attention to various stimuli. Consistent with our previous research (Sandman, 1993; Kesslak et al., 1997) there was significantly improved recall of information in close temporal proximity to the significant event. The effectiveness of the SET days eliminated differences in recall between healthy controls and AD patients. These "flashbulb" memories, memories that are vivid and coloured by emotion, persist long after the significant event (Brown and Krulik, 1977; Levin, 1990; Sandman, 1993). This strategy was first developed using vivid words in laboratory studies (Brown & Krulik, 1977) where it was discovered that provocative or unusual words elicit "flashbulb" memories. These memories are strengthened by unexpected events, which illuminate the context of the information, such that even minor information surrounding the event can facilitate memory for that event.

In contrast to traditional literature that recommends routine management of patients, our studies confirm that novelty may actually enhance memories. A regimented lifestyle may avoid placing demands on memory. Yet, that same routine may actually dim differences in memory across time, such that days, followed by weeks and months are no longer discrete. This threading of uninterrupted time may ultimately contribute to one's memory impairment. By requiring variety, diverse activities not done before, interest is captivated, greatly improving the recollection of routine facts. The utility of the SET for long-term memory enhancement is unknown with AD patients (Berrol, 1990; Levin, 1990). However, for the short-term, we have found nothing with this patient population that leads to greater improvement. Both patients and caregivers self-efficacy is improved as relationships are enhanced through better recall of events. By stimulating the information, through either positive or negative arousal (LeDoux, 1994; McGaugh et al., 1993) encoding is facilitated. As the pathology progresses, particularly to the amygdala and frontal cortex (Braak & Braak, 1991; Hyman, Van Hoesen, & Damasio, 1990), we anticipate decay in the arousal and memory systems, which will impact the success of the SET. Because of the pathological processes it is also necessary to consider the types of events, a balance must be maintained where the activities involve the individual without overwhelming him or her.

Despite the enhancement of event-specific memory noted from pre and post memory-training tests, it is apparent that the interventions reveal only a modest generalised influence. Intervention response by patients suggests that they perceived themselves as less depressed. As a consequence there was an

improved performance on tests of psychomotor speed. There is mild evidence of improved mood; clinically, patients adapted and responded to lectures and assessment more readily as the weeks progressed. It may be that the stimulation through group assignments and social interaction improved higher cognitive or attentional processes.

Consistent with reports in the literature (Sohlberg & Mateer, 1989), primarily tasks that were specific to the memory training were facilitated by the training paradigm. This may be due to insensitivity of the tests used to assess generalisation, or facilitation of function may be restricted to the types of cognitive functions or processes directly manipulated by the memory strategies taught during the course. Regardless, the improved performance on the tasks specifically related to the materials learned during the memory training indicates that new information can be learned and retained for an extended period of time. The challenge will be to adapt and apply these techniques in everyday living to optimise patient function and increase self-esteem. Examples of how the techniques can be incorporated into the daily environment include reducing the daily routine to add stimulating new activities, and review of photo albums of friends, family, and important persons. These seemingly simple processes can serve a two-fold purpose, to improve the memory of the patient and increase the positive interactions between patients and caregivers. It should be noted that these procedures may be time-consuming and require patient–caregiver interaction. The caregiver must be willing and capable of committing to these procedures and share responsibility with the patient. Although not examined in this study, the combination of behavioural and pharmacological interventions in other types of pathology, such as depression, can be more beneficial than either intervention alone. A combination of pharmacological and behavioural interventions, that include a memory training programme, may promote increases in the level of function and provide a framework to develop more effective treatment strategies for dementia.

REFERENCES

Bäckman, L. (1996). Utilizing compensatory task conditions for episodic memory in Alzheimer's disease. *Acta Neurologica Scandinavica*, Suppl, 165, 109–113.

Berrol, S. (1990). Issues in cognitive rehabilitation. *Archives of Neurology*, *47*, 219–220.

Black, J.E., Polinsky, M., & Greenough, W.T. (1989). Progressive failure of cerebral angiogenesis supporting neural plasticity in aging rats. *Neurobiology of Aging*, *10*, 353–358.

Braak, H., & Braak, E. (1991). Neuropathological staging of Alzheimer-related changes. *Acta Neuropathologica*, *82*, 239–259.

Brown, R., & Krulik, J. (1977). Flashbulb memories. *Cognition*, *5*, 73–99.

Camp, C., Judge, K.S., Bye, C.A., Fox, K.M., Bowden, J., Bell, M., Valencic, K., & Mattern, J.M. (1997). An intergenerational program for persons with dementia using Montessori methods. *Gerontologist*, 37, 688–692.

Cermak, L.S. (1975). *Improving your memory*. New York: W.W. Norton.

Craik, F.I., & Watkins, M.J. (1973). The role of rehearsal in short-term memory. *Journal of Verbal Learning & Verbal Behavior*, *12*, 599–607.

Cummings, J.F., & Benson, D.F. (1992). *Dementia: A clinical approach* (2nd ed.), Stoneham, MA: Butterworth-Heinemann.

Hirst, W. (1988). Improving memory. *Perspectives in memory research* (pp. 219–244). New York: MIT Press.

Hofmann, M., Hock, C., & Muller-Spahn, F. (1996). Computer-based cognitive training in Alzheimer's disease patients. *Annals of the New York Academy of Sciences*, 777, 249–254.

Hofmann, M., Hock, C., Kuhler, A., & Muller-Spahn, F. (1996). Interactive computer-based cognitive training in patients with Alzheimer's disease. *Journal of Psychiatric Research*, *30*, 493–501.

Howard, D., & Patterson, K. (1989). Models for therapy. In X. Seron, G. Deloche, (Eds.), *Cognitive approaches in neuropsychological rehabilitation*. *Neuropsychology and neurolinguistics* (pp. 39–64). Hillsdale, NJ: Lawrence Erlbaum Associates.

Hyman, B.T., Van Hoesen, G.W., & Damasio, A.R. (1990). Memory-related neural systems in Alzheimer's disease: An anatomic study. *Neurology*, *40*, 1721–1730.

Kesslak, J.P., Nickoul, K., & Sandman, C. (1997) Memory training for individuals with Alzheimer's disease improves name recall. *Alzheimer's Research*, *3*, 151–157.

LeDoux, J. (1994). Emotion, memory and the brain. *Scientific American*, *June*, 50–57.

Levin, H.S. (1990). Cognitive rehabilitation: Unproved but promising. *Archives of Neurology*, *47*, 223–224.

Lorayne, H., & Lucas, J. (1974). *The memory book*, New York: Ballantine.

McGaugh, J.L., Introini-Collison, I.B., Cahill, L.F., Castellano, C., Dalmaz, C., Parent, M.B., & Williams, C.L. (1993). Neuromodulatory systems and memory storage: Role of the amygdala. Special Issue: Emotion and memory. *Behavioral Brain Research*, *58*, 81–90.

McKhann, G., Drachman, D., Folstein, M., Katzman, R., Price, D., & Stadlan, E.M. (1984). Clinical diagnosis of Alzheimer's disease: A report of the NINCDS-ADRDA work group under the auspices of Department of Health and Human Services Task Force on Alzheimer's Disease. *Neurology*, *34*, 939–944.

Miller, E. (1975). Impaired recall and the memory disturbance in pre-senile dementia. *British Journal of Social and Clinical Psychology*, *14*, 73–79.

Minninger, J. (1984). *Total recall—How to boost your memory power*. Easton, PA: Rodale Press.

Morris, R.G., & Kopelman, M.D. (1986). The memory deficits in Alzheimer-type dementia: A review. Special Issue: Human memory. *Quarterly Journal of Experimental Psychology: Human Experimental Psychology*, *38*, 575–602.

Mohs, R.C., Ashman, T.A., Jantzen, K., Albert, M., Brandt, J., Gordon, B., Rasmusson, X., Grossman, M., Jacobs, D., & Stern, Y. (1998). A study of the efficacy of a comprehensive memory enhancement program in healthy elderly persons. *Psychiatry Research*, *77*, 183–195.

Murdock, B.B. (1991). Serial organization in a distributed memory model. In A.F. Healy, S.M. Kosslyn, & R.M. Shiffrin (Eds.), *Essays in honor of William K. Estes, Vol. 1: From learning theory to connectionist theory; Vol. 2: From learning processes to cognitive processes* (pp. 201–225). Hillsdale, NJ: Lawrence Erlbaum Associates.

Nebes, R.D., Martin, D.C., & Horn, L.C. (1984). Sparing of semantic memory in Alzheimer's disease. *Journal of Abnormal Psychology*, *93*, 321–330.

Poon, L.W. (Ed.) (1980). *Aging in the 1980s*. Washington, DC: American Psychological Association.

Poon, L.W., Fozard, J.L., & Treat, N.J. (1978). From clinical and research findings on memory to intervention programs. *Experimental Aging Research*, *4*, 235–253.

Rabinowitz, J.C. (1984). Aging and recognition failure. *Journal of Gerontology*, *39*, 65–71.

Renner, M.J., & Rosenzweig, M.R. (1987). *Enriched and impoverished environments*. New York: Springer Verlag.

Sandman, C.A. (1993). Memory rehabilitation in Alzheimer's disease: Preliminary findings. *Clinical Gerontologist*, *13*, 19–33.

Scogin, F., & Prohaska, M. (1993). *Aiding older adults with memory complaints*. Sarasota, FL: Professional Resource Press.

Smith, A.D. (1980). Age differences in encoding, storage and retrieval. In L.W. Poon, J.L. Fozard, L.S. Cermak, D. Arenberg, & L.W. Thompson (Eds.), *New directions in memory and aging: Proceedings of the George A. Talland Memorial Conference* (pp. 23–46). Hillsdale, NJ: Lawrence Erlbaum Associates.

Sohlberg, M.M., & Mateer, C.A. (1989). Training use of compensatory memory books: A three stage behavioral approach. *Journal of Clinical and Experimental Neuropsychology*, *11*, 871–891.

Van der Linden, M., & Van der Kaa, M.-A. (1989). Reorganization therapy for memory impairments. In X. Seron, & G. Deloche (Eds.), *Cognitive approaches in neuropsychological rehabilitation. Neuropsychology and neurolinguistics* (pp. 105–158). Hillsdale, NJ: Lawrence Erlbaum Associates Inc.

Wilson, B.A. (1987). *Rehabilitation of memory*. New York: Guilford Press.

Wilson, B.A., & Moffat, N. (Eds.) (1992). *Clinical management of memory problems* (2nd ed.). San Diego, CA: Singular Publishing Group.

Zanetti, O., Binetti, G., Magni, E., Rozzini, L., Bianchetti, A., & Trabucchi, M. (1997). Procedural memory stimulation in Alzheimer's disease: Impact of a training programme. *Acta Neurologica Scandinavica*, *95*(3), 152–157.

Zarit, S.H., Cole, K.D., & Guider, G.L. (1981). Memory training strategies and subjective complaints of memory in the aged. *Gerontologist*, *21*, 158–164.