## Research Digest Column

# Normal aging, mild cognitive impairment or dementia?

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## Introduction

Dementia and Alzheimer's Disease in particular have been getting increased publicity during the last several decades. Given the general increased awareness, it is more common for people to seek help from their general practitioners or go to memory clinics with complaints of memory loss. More people are asking for help and advice about memory problems, however, such individuals are less likely to accept the dismissal "It's your age, what do you expect?" (Burns & Zaudig, 2002). According to Burns & Zaudig (2002), complaints about memory may be based in psychiatric, psychological and physical conditions and are almost always an early symptom of dementia. Indeed, this problem is quite prevalent. The world that we live in is aging. The "baby boomers" are now certainly what is considered middle age and many are reaching the outer range of being "senior citizens". In addition, with the advances in medicine people are living longer, increasing the number of elderly to unprecedented levels.

There are many factors which can affect memory. According to Bäckman, Jones, Small, Agüero-Torres & Fratiglioni (2003), these factors can be as simple as age, gender and education. In a population-based study, Bäckman et al. (2003) found that increasing age and low education are related to both lower cognitive performance amongst non-demented older adults and an increased risk for Alzheimer's Disease (AD). They also found evidence that showed an increased risk of late-onset AD in women as opposed to men. More complex issues can also affect memory. A poor social network is associated with an increased risk of AD, as is depression (deficits in cognitive performance as well as an increased risk of AD have been linked to depression). Low vitamin levels, blood pressure problems, thyroid function, substance abuse, as well as genetic background (apolipoprotein E or APOE genotype) have all been shown to adversely affect

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memory. Many medications such as anticholinergic drugs, antihypertensives and digitalis have serious effects on cognitive performance among older adults (Bäckman, et al., 2003).

As Occupational Therapists (OTs), we get many referrals of clients with complaints about their memory. How are we to determine if they really do have a cognitive decline and if so, to what degree? Are there ways that we, as OTs, can help them to function better? Cognitive decline is often a gradual process and it may take years before one reaches the diagnostic criteria for AD (Geerlings, Jonker, Bouter, Ader & Schmand, 1999). What is the difference between Alzheimer's disease and dementia? These are some of the questions that will be reviewed in this article to assist therapists in their clinical practice.

## Dementia

If we were to examine cognitive decline on a continuum of deterioration, dementia would be the most extreme scenario. Indeed, dementia is defined as cognitive impairments that are serious enough to disrupt normal daily living. There are different forms of dementia presenting with similar basic symptoms. The two predominant types are widely believed to be Alzheimer's Disease (AD) and vascular dementia (VaD), with smaller subgroups that also show symptoms of dementia, such as frontal-type dementia, Lewy body, Parkinson's and Huntingdon's diseases (Voss & Bullock, 2004). Progressive amnesia can occur as well, which becomes indistinguishable from dementia as individuals have the inability to learn new information or to recall previously learned information (Bozoki, Giordani, Heidebrink, Berent and Foster, 2001).

AD is the most common cause of dementia, accounting for over 65% of all types. The onset of AD is often first detected by the individual or family members and is usually manifested by changes in personality. The prevalence of the disease in the general population is correlated with chronological age, with AD rarely occurring in the fourth decade and then logarithmic increases over subsequent decades. The rate of cognitive decline is slower in preclinical stages of AD as compared to clinical AD (McDonald, 2002).

Boise, Neal & Kaye (2004) performed a cross-sectional cohort study and found the following symptoms suggestive of dementia: difficulties in language, reasoning, spatial ability or signs of poor memory, including repetitiveness. Behavioral signs such as putting things in the wrong place (like keys in the refrigerator), dressing inappropriately, failing to appear for scheduled appointments or failing to follow instructions, may also serve as triggers for an assess-

ment of dementia. Other triggers for investigating cognitive decline include an increase in falls and excessive emergency room visits. In addition, 38% of these patients have a history of medication or treatment non-compliance.

## Mild Cognitive Impairment

At the next level, we see clients with mild cognitive impairments. Bäckman et al. (2003), Bozoki, Giordani, Heidebrink, Benet & Foster (2001), Burns & Zaudig, (2002) and Rapoport (2003) all agree there is a pre-clinical Alzheimer state which they term Mild Cognitive Impairment. Graham, Rockwood, Beattie, Eastwood, Gauthier, Tuokko & McDowell (1997) classify this stage as cognitive impairment, no dementia (CIND). At this stage, some elderly individuals exhibit significant memory deficits but cannot be classified as having dementia because their general intellect is intact and they have no impairments in everyday activities. Symptoms of mild cognitive impairment include complaints of memory that are preferably corroborated by the individual. This is by far the largest group of referrals to OT clinics for screening. However, there are those who disagree with the above classification. According to Graham et al. (1997), 49.1% of people with CIND show a severe restriction on functional activities and need institutional care. We see this in OT clinics when families limit loved ones' functioning out of fear that they will hurt themselves.

It is of value to screen individuals with mild cognitive impairments since these people have twice the risk of falling as those without impairments due in part to changes in equilibrium and limb coordination (Boise, Neal & Kaye, 2004). These individuals also tend to inappropriately contact their doctors and clinics. At the beginning of a decline in executive functioning, these people are anxious about their situation and this anxiety produces excessive worries. Anxiety and other intrusive thoughts essentially compete for resources in the brain and thus executive functioning is diminished. Burns & Zaudig (2002) describe mild cognitive impairment as benign senescent forgetfulness which is often associated with depression. These individuals also have an awareness of memory problems, an inability to recall remote rather than recent events and have trouble recalling minor details. These memory loss indicators are often a precursor to AD but sometimes dementia does not occur, even after many years of observation (Bozoki, et al., 2001).

Over the years, there has been much discussion as to how long one can stay in this stage of mild cognitive impairment. Bäckman, et al. (2003) found in a previous study that clear pre-clinical memory deficits can occur up to six years

before the AD diagnosis, although precipitous decline did not occur until the last three years preceding diagnosis. Bozoki et al. (2001) feel that after two years one will pass into a mild AD state. Others mention seven years, and as stated previously some remain in this stage for many years.

## Normal Aging

Given the scenarios described above, what then is normal aging? One concept of aging is that general cognitive decline comes with age. However, Meguro, Shimada, Yamaguchi, Ishizaki, Yamadori & Sekita (2001) concluded that screening cognitive test performance scores of non-demented older adults' over a five year period declined very slightly, and therefore was not affected by the aging process. In fact, at the mid-point of this five year period, they found no decline at all in test performances. They believe that dementia is just one extreme in a continuum of cognitive decline and not part of the normal aging process. Bäckman, et al. (2003) concur that in the typical senior citizen there is a very slight decrease in cognitive ability. The typical senior citizen will show visuo-spatial and memory deficits but these deficits are limited to no more than one standard deviation (SD) below young people's norms.

According to Geerlings et al. (1999), elderly people may be aware of a decline in cognitive functioning at a time when mental status tests are still unable to detect a decline from premorbid functioning. Their research showed that some normal aged individuals develop a clear-cut memory impairment in later life but maintain this same memory deficit without dementia throughout many years. One must also take into account the number of recent diseases these people have had, as this is one of the strongest predictors of cognitive decline and mediated the effect of age.

## Evaluations

Results of previous studies suggest that memory complaints may predict cognitive decline and dementia among the elderly when cognitive impairment is already apparent. However, as mentioned above, cognitive decline is often a gradual process, and elderly people may notice that their memory deteriorates before mental status tests are able to detect any change in cognitive functioning (Geerlings, et al., 1999). Even though this might be the case, we as OTs are expected to evaluate individuals with complaints of memory loss and other cognitive decline, and then come up with a treatment plan to help them function better.

Burns & Zaudig (2002) quantified the degree of memory impairment. They defined two categories:(1) mild cognitive impairment, considered a decline of one SD below the scores of younger adults and (2) a more severe form of impairment (late life forgetfulness) which they defined as between one to two SDs below age adjusted scores. All research reviewed agree that in order to have a diagnosis of dementia, one must have a decline in at least one other cognitive domain in addition to memory loss (Bäckman, et al., 2003; Boise, et al., 2004; Geerlings, et al., 1999; Meguro et al., 2001; Sliwinski & Buschke, 1997; Voss & Bullock, 2004; Wetherell, Reynolds, Gatz & Pederson, 2002). Another important point made by Bozoki et al. (2001) is that testing other cognitive domains can significantly improve the predictive value of testing in non-demented patients with a memory complaint.

The most standard universally used test to determine cognitive decline is the Mini Mental State Examination (MMSE). This test is a quick screening tool which has very good reliability. Bozoki et al. (2001) and Geerlings et al. (1999) report that a score between 23 and 26 would indicate mild cognitive impairment. Meguro et al. (2001) found that adults with normal aging memory loss had very little change in their MMSE scores over a 5 year period. Their scores only declined in general 1.3 SD over the 5 year trial. In addition, Voss & Bullock (2004) report that it is possible for patients with very mild dementia to score 30 on the MMSE while still showing neurological evidence of dementia.

Since most research shows that someone with dementia will not only have a memory loss but will also have a cognitive decline in at least one other domain, we need to evaluate other areas. Bäckman et al. (2003) suggest assessing memory, visuo-spatial and function domains while Boise et al. (2004) suggest evaluating memory, language, reasoning and spatial ability. Bozoki et al. (2001) recommends testing for memory impairment, language, attention, motor-visuo-spatial function and verbal fluency. Still, Sliwinski & Buschke (1997) test memory, word recognition and arithmetic processing with an emphasis on comparing speed while being tested. Voss & Bullock (2004) tested many executive function domains such as planning, sustained attention and purposive action as well as tests of verbal fluency and those that assess conceptual inflexibility and abstract ability. It is interesting to note the variety of tests used to complement memory testing. Some clinicians/researchers may find comfort in this flexible approach which others may be confused be the range of options available.

Indeed, a wide variety of tests have been used in addition to the MMSE. Bozoki et al. (2001) found good reliability with the following tests. The tests they used for attention included the Blessed Orientation-Memory-Concentration Test (BOMCT) and the Digit Span Forward Test. Tests for language most often include the Boston Naming Test which evaluates implicit memory and semantic memory. The motor-visuo-spatial function test they used was the WAIS-R Block Design and for verbal fluency they used the controlled Oral Word Association Test. For their testing purposes, they considered a person impaired if their performance was worse than the fifth percentile or 2 SD lower than the age-adjusted mean. Their results showed that of those patients who after two years were shown to have moved from MCI to AD, 42% of them (as opposed to 14% of those who stayed at the MCI level) had abnormal results in the Bostom Naming Test. They also report that there were many individuals from both groups (MCI and AD) who had abnormal results on the Block Design Test.

Voss & Bullock (2004) investigated the incidence of executive function decline as a core feature of dementia as well as to determine the difference in test results between AD, VaD, and the controls. In order to do this, they used a battery of tests. The tests they used were ones that evaluated different types of memory such as episodic, declarative, working, semantic, and implicit memories. Other tests focused on attention such as span problems, speed of processing and attentional functioning. Other areas evaluated included visuo-spatial processing, perceptual organization and verbal learning tests determining language production and auditory comprehension. Last but not least, they evaluated higher level cognitive functioning which included abilities such as decision-making processes and frontal lobe function such as planning, volition, purposive action, and effective performance.

Results of the above research revealed a number of interesting facts. Firstly, the recall portion of this test assesses true memory deficits associated with right hemisphere damage. Neuropsychological findings using figure copy have indicated that people with frontal lobe lesions have difficulty copying the figure accurately. Individuals with right-sided lesions tend to have difficulty recalling the design immediately and after a delay. In addition, they found that executive functioning is a controlling factor in cognitive function and cognitive deficit in dementia, with definitive cognitive functions that are unrelated to memory. In their study, they found that executive functioning impairment clusters independently from memory cognition. When looking at the difference between AD, VaD, and controls, they found that AD and VaD individuals both had executive function

impairment. In the information processing section of the test that tests only executive functions, the two group's results are indistinguishable. On the other hand, people with AD performed more poorly than those with VaD on the memory test sections. The controls tested at a higher level on both executive function tests and memory tests. These results might assist in the evaluation and treatment of those referred to our clinics.

In order to get a full picture of an individual with memory complaints one must also assess their ADL performance to determine if their memory loss or executive functioning decline is interfering with their functioning. Again, there are numerous other factors affecting memory decline and the clinician would be well-advised to ensure that the individual has undergone a complete workup, including an evaluation for depression.

## Treatment

A growing body of research supports the protective effects of late-life intellectual stimulation on dementia. Recent research shows that neural plasticity endures across the lifespan, and that cognitive stimulation in the environment is an important predictor of enhancement and maintenance of cognitive functioning even in old age. Moreover, sustained engagement in cognitively stimulating activities has been found to impact the neural structure in both older humans and rodents (Ball, Berch, Helmers, Jobe, Leveck, Marisiske, Morris, Rebok, Smith, Tennstedt, Unverzagt & Willis, 2002).

Ball et al. (2002) performed a randomized controlled trial which tested the effectiveness and durability of 3 distinct cognitive interventions in improving the performance of elderly persons on basic function. They measured the effects of cognitively demanding daily activities such as food preparation, driving, medication use and finance management. Participants in their study were aged 65-94 years and had a score of 23 or more on the MMSE but had not previously been diagnosed with AD. Those that needed moderate assistance in BADL functioning or had other medical conditions that might affect their functioning (stroke within the last 12 months, cancer, vision or hearing problems, etc.) were eliminated from their study.

The three treatment interventions the authors chose were memory training, reasoning training and speed of processing training in group sessions. Each group received a 10 session intervention with the first five sessions focusing on strategy instruction and then individual and group exercises to practice the strategy. The last five sessions provided additional practice but no new strategies.

Eleven months after the completion of the trial, a randomly selected group was given review sessions in the original intervention they had received in four sessions.

Trial results revealed that the effect on functional outcome was generally small (below 0.10) and did not differ significantly between testing right after the training and at one or two year intervals, although improvement in cognitive ability remained. After the booster training, they found that there was an improvement in testing performance on the one year interval test for the reasoning and speed performance groups. The memory group showed no effect from the booster training. In summary, it is clear the training improved the cognitive skills of the individuals but this had no real effect on functioning. Ball, et al. (2002) pose the question "Will this training affect the functional ability of these individuals five or 10 years hence?"

Zarit, Femia, Watson, Rice-Oeschger & Kakos (2004) present a different form of treatment. They held a 10-session group program for individuals with memory loss who can still participate in decision making, and their care partners. The group sessions were designed to provide information about memory loss and resources for coping. Unlike typical AD support groups, these groups seek to help both partners to manage current problems and plan for the future. Some of the group sessions were with the couple together and others were separate. Individuals with memory loss were chosen not necessarily by their MMSE score (although most had a score of 25 and over) but according to the patient's awareness of memory loss.

The participants were given an open-ended questionnaire both before and after the 10 session program. These questionnaires showed the following results. Most dyads found they liked the opportunity to learn and share from those in a similar situation. A number of care partners felt their partner had become more aware and accepting of their memory problems. One important element after completion of these sessions is that many care partners chose to seek continued support groups on their own and many of those with memory loss chose to be a participant in their future. For example, they had a greater tendency to articulate their preferences, such as leaving their job, joining in early stage day problems or even realizing that they needed to stop driving. This program showed that those with early stage dementia can participate in planning for their own future.

## Conclusion

The studies reviewed reflect the many levels of cognitive decline in the older adult. There is also a wide variety of ways we can evaluate these people in order

to determine the level of decline and its effect on functioning. We, as OTs, need to take all of this information and try to come up with appropriate treatment options to improve the functioning of older adults while it can still be effective.

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