Dementia sufferer mental

Introduction

Dementia is a loss of mental function in two or more areas such as language, memory, visual and spatial abilities, or judgment severe enough to interfere with daily life [3] . Dementia is not a disease itself, sufferers show a broader set of symptoms that accompany certain diseases or physical conditions [3] . Well known diseases that cause dementia include Alzheimer's disease, Creutzfeldt-Jakob disease and multi-infarct dementia [3] .

Dementia is an acquired and progressive problem that affects cognitive functions, behavior, thinking processes and the ability to carry out normal activities. Vision is one of the most important primary senses, therefore serious or complete sight loss has a major impact on a individuals ability to communicate effectively and function independently. Individuals who suffer from both dementia and serious vision loss will inevitably be subject to profound emotional, practical, psychological and financial problems. These factors will also influence others around the sufferer and will extend to family and the greater society. As we get older both dementia and visual problems inevitably become much more prevalent. Current demographic trends show the increase of the number of very old in our population. Therefore it is inevitable that dementia and serious sight loss either alone or together, will have important consequences for all of us [3] .

The vast majority of people are aware that dementia affects the memory. However it is the impact it has on the ability to carry out daily tasks and problems with behavior that cause particular problems, and in severe cases can lead to institutionalization. In the primary stages of dementia, the

patient can be helped by friends and family through ‘ reminders’. As progression occurs the individual will loose the skills needed for everyday tasks and may eventually fail to recognize family members, a condition known as prospagnosia. The result of such progression is that the individual becomes totally dependent on others. Dementia not only affects the lives of the individual, but also the family [9] .

Dementia can present itself in varying forms. The most common form of dementia in the old is Alzheimers disease, affecting millions of people. It is a degenerative condition that attacks the brain. Progression is gradual and at a variable rate. Symptoms of Alzheimer’s disease are impaired memory, thinking and changes in behaviour. Dementia with Lewy bodies and dementias linked to Parkinsons disease are responsible for around 10-20% of all dementias. Dementia with Lewy bodies is of particular interest as individuals with this condition not only present confusion and varying cognition, but also present symptoms of visual hallucinations [9] . Another common conditions that causes dementia is multi-infarct dementia, also known as vascular dementia. It is the second most common form on dementia after alzheimers disease in the elderly. Multi infarct dementia is caused by multiple strokes in the brain. These series of strokes can affect some intellectual abilities, impair motor skills and also cause individuals to experience visual hallucinations. Individuals with multi infarct dementia are prone to risk factors for stroke, such as high BP, heart disease and diabetes. Multi infarct dementia cannot be treated, once nerve cells die they cannot be replaced. X3

In most cases the symptoms of dementia and serious sight loss develop independently. However some conditions can cause both visual and cognitive impairments, for example Down syndrome, Multiple sclerosis and diabetes. Dementia is most prevalent in the elderly, as is sight loss. Therefore it is inevitable that a number of people will present dementia together with serious sight loss.

There have been many studies into the prevalence of dementia in the UK. An estimate for the prevalence of dementia in people over 75 years of age is 15% of the population [9] . The Alzheimer's society suggest that 775, 200 people in the UK suffer from dementia (figures taken 2001). The Alzheimer's society also calculates that the prevalence of dementia in the 65-75 years age group is 1 in 50, for 70-80 years 1 in 20 and for over 80 years of age 1 in 5. Estimates suggest that by 2010 approximately 840, 000 people will become dementia sufferers in the UK. Estimates suggest that around 40% of dementia sufferers are in residential institutions. One study from 1996 showed that dementia sufferers are 30 times more likely to live in an institution than people without dementia. At 65 years of age men are 3 times more likely than women to live in an institution and at 86 men and women are equally likely to be institutionalized [10]

Visual impairments are not associated general diagnostic features of dementia. However recent research has shown the change in visual function and visual processing may be relevant. Alzheimer's disease patients often present problems with visual acuity, contrast sensitivity, stereo-acuity and color vision. These problems are believed to be more true of cognitive

dysfunction rather than any specific problems in the eye or optic nerve [9] . Early diagnosis is essential to both dementia and sight loss patients, as drug treatments are becoming more and more available. Therefore maximizing the treatment and care for the individual. On the other hand early diagnosis of visual conditions is also essential, so that progression is slowed and treatment is commenced, therefore further progression is prevented if plausible [9] .

The Mini-Mental State examination MMSE, is the most commonly used cognitive test for the diagnosis of dementia. It involves the patient to undertake tests of memory and cognition. It takes the form of a series of questions/answers and uses written, verbal and visual material. Poor vision or blindness is the most common cause of poor performance on this test other than dementia itself [9] . Research, development and investment in the future will help to contribute to improved care for dementia and sight loss sufferers. A better understanding of the daily lives and experiences of these people will give us a greater insight into the problems faced and will help to improve the quality of care available [9] .

Alzheimer's disease

The aim of this paper is to provide information about current knowledge on the topic on visual function & dementia. With regards to Alzheimer's disease there will be an inclination to several main foci of research, namely anatomical/structural changes, functional visual changes, cognitive brain changes and other changes such as the effects of diagnostic drugs on Alzheimer's disease patients.

Alzheimer’s disease is the most common cause of dementia amongst older adults. The Alzheimer’s research trust estimates that 700, 000 individuals in the UK currently are afflicted. This number will inevitably increase exponentially in the near future with the trend of an increasingly aging UK population. Therefore it must be of the utmost of importance worldwide to have an understanding all behavioral, anatomical and physiological aspects of this disease.

Alzheimer’s disease is a degenerative disease that attacks the brain, it begins gradually and progresses at a variable rate. Common signs are impaired thinking, memory and behavior. Health professionals and care givers agree that the memory deficit is usually the initial sign of the disease. However researchers have long known that Alzheimer’s disease is characterized by impairments of several additional domains, including visual function [11] .

However these findings have not yet appeared in the diagnostic guides consulted by healthcare professionals, for example the most recent addition of the Diagnostic & Statistical manual of mental disorders states that few sensory signs occur in early Alzheimer’s disease [2] . Therefore we still have a limited understanding of the true extent to which visual impairments affects Alzheimer’s disease. The current web site of the Alzheimer’s association [1] and National Institute of Aging [4] make no mention of the topic of sensory changes in Alzheimer’s disease. It has even been said that patients with Alzheimer’s disease report visual problems to their healthcare professionals less frequently than do healthy elderly individuals [5] . Nevertheless visual

function is impaired in Alzheimer's disease [6] . In terms of cognitive changes, the neuropathology of this disorder affects several other brain areas which are dedicated to processing low level visual functions as well as higher level visual cognition and attention [11.] These neuropathological cognitive changes are more dominant however in the visual variant of Alzheimer's disease known as posterior cortical atrophy, however visual problems are also present in the more common Alzheimer's disease.

Alzheimer's disease begins when there are deposits of abnormal proteins outside nerve cells located in the brain in the form of amyloid. These are known as diffuse plaques, and the amyloid also forms the central part of further structured plaques known as senile or neurotic plaques [3] . Buildup of anomalous filaments of protein inside nerve cells in the brain can also take place. This protein accumulates as masses of filaments known as neurofibril tangles. Atrophy of the affected areas of the brain can also occur as well as the enlargement of the ventricles [3] . There is also a loss of the neuro transmitter Serotonin, Acetylcholine, Norepinephrine and Somatostatin. Attempts have been made to try to slow the development of the disease by replacing the neurotransmitters with cholinesterase inhibitors, such as donepezil (Aricept), rivastigmine (excelon), galantamine (Reminyl) and memantine (Namenda) [3] . These drugs work by increasing the levels of transmitters between cells, which otherwise become lacking in Alzheimer's disease. The National Institute for Clinical Excellence NICE conducted a review of these drugs in March 2005 and concluded that none of these drugs provided sufficient enough advantages to the patient in order to justify their

cost. They recommended against the use of such drugs in the Nhs, though the Department of Health later overturned this ruling.

Visual Changes in Alzheimer's Patients

Loss of vision is a key healthcare dilemma amongst the elderly. By the age of 65 approximately one in three people have a vision reducing eye disease. Dementia, Alzheimer's disease patients and elderly patients, consequently have many visual conditions in common.

Alzheimer's disease impairs visual; function early in the course of the disease and functional losses correlate with cognitive losses. There are several common visual functional deficits that are frequently identified in Alzheimer's disease. There is evidence for deficits in Motion perception [32, 33] contrast sensitivity [31] colour discrimination of blue short wavelength hues [34] and performance on backward masking tests [31] In Alzheimer's disease the secondary point of damage is usually the visual association cortex and other higher cortical areas as well as the primary visual cortex [35, 36.]

Some of the main changes that occur in the eye with aging inlclude [7] :

- The crystalline lens increases in thickness, therefore decreasing its transparency and elasticity; therefore there is a tendency for cataracts to appear.
- The conjunctiva can become thicker and wrinkled, therefore is subject to deposits such as pinguecela.

- The iris can atrophy, therefore pupils become constricted and their response to light becomes sluggish. The eyes ability to dark/light adapt is affected.
- Refractive index of the cornea decreases and it becomes less transparent. Arcus senilis can appear.
- The ocular globe and eyelids can shrink leading to conditions such as entropian, ectropian and trichiasis. Also while the lachrymal production is reduced the puncta lachrymalis can become stenosed and provide less drainage which gives rise to chronic watering of the eyes
- Anterior chamber usually becomes more shallow and the sclera more rigid, increasing the prospects of glaucoma.

These changes summed together not only diminish the quality of vision, but many of them also make the examination of the eye much more complicated. In conjunction with the general visual symptoms of aging, Alzheimer's patients can also experience visual disturbances caused by the brain rather than the visual system alone. This means that they can have problems and difficulties perceiving what they see rather than how clearly they see it [3] . Difficulties are usually experienced in the areas mentioned earlier, namely depth, motion, color, and contrast sensitivity. Visual hallucinations are also a common problem with linked to loss of vision in Alzheimer's disease patients [38] . Another common disorder linked to patients with Alzheimer's disease is a variant of motion blindness. The patient can appear to be confused and lost; the individual will see the world as a series of still frames [8.]

Visual changes in Alzheimer's disease may also be dependent upon which brain hemisphere is more severely damaged; this factor can often be overlooked. An individual with Alzheimer's disease could have damage to a greater extent on their left brain hemisphere from plaques and tangles. This would therefore cause subsequent retinal changes in only the left hemi-retinas of each eye i. e. the right visual fields. The right eye visual field would be affected in the temporal side (right) and the left eye visual field would be affected nasally (right) [51] . When only half the retina is impacted, smaller regions of the optic nerve and nerve fiber layer show losses. The left eye with affected temporal retina would show optic nerve damage in differing regions of the nerve than the right eye with nasal retinal damage. [51]

Alzheimers patients commonly show selective degeneration of large ganglion cell axons located in the optic nerves. This suggests that there would be impairment of broadband channel visual function. Conversely studies have shown that broadband visual capabilities are not selectively impaired in Alzheimer's disease. The magnocellular and parvocellular neurons are greatly affected in Alzheimer's patients, this has been proved by studies of the dorsal Lateral geniculate nucleus(LGN) [3.] The geniculostirate projection system is split both functionally and anatomically into two sections. They include the parvocellular layers of the Lateral geniculate body and also incorporates the magnocellular layers. These systems are mainly divided in the primary visual cortex and go through further segregation in the visual association cortex. They conclude in the temporal and paritetal lobes [3.]

The parvocellular layers contain smaller, centrally located receptive fields that account for high spatial frequencies (acuity), they also respond well to color. On the other hand these cells do not respond well rapid motion or high flicker rates. The magnocellular cells have larger receptive fields and respond superiorly to motion and flicker. They are however comparatively insensitive to color differences, the magnocellular neurons generally show poor spatial resolution, although the seem to respond better at low luminance contrasts. To summarize the parvocellular system is superior at detecting small, slow moving, colored targets placed in the centre of the visual field. Meanwhile the magnocellular system has the ability to process rapidly moving and optically degraded stimuli across larger areas of the visual field [3.]

The parvocellular system projects ventrally to the inferior temporal areas, which are involved in visual research, pattern recognition and visual object memory. The magnocellular system projects dorsally to the posterior parietal and superior temporal areas. These are specialized for motion information processing. The cerebral cortical areas to which the parvocelluar system projects receives virtually no vestibular afferents. Alternatively the cerebral areas to which the magnocelullar system projects receives significant vestibular and other sensory inputs. These are believed to be involved in maintaining spatial orientation. Research shows shows that the magnocellular system is more involved in Alzheimer’s disease [3.]

Oddly, many individuals experience difficulties at low spatial frequencies instead of high frequencies as in old age. This suggests that areas controlling

the low spatial frequency processing in the primary visual cortex would be affected more than those for higher frequencies processing [39] After neuropathilogical studies in 1997 by Hof et al were carried out on brains with visual impairments they concluded that cortical atrophy dominated on the posterior parietal cortex and occipital lobe [40]

Glaucoma is also a neurodegenerative disease that has similar effects on the visual system. Lower spatial frequencies in the contrast sensitivity, deficits in the blue short wavelength color range as well as reductions in motion perception are all linked to glaucomatous patients [16] . When patients diagnosed with Alzheimer's disease also have glaucoma, the deterioration of vision related to glaucoma is much more rapid and progression is more aggressive than in people with glaucoma solely and not Alzheimer's disease as well. [19]

Glaucoma is different from Alzheimer's disease in that it affects the visual function at the early sites of neural activity, namely, the retinal ganglion cells. Glaucoma destroys the afferent axons at the nerve fiber layer in the retina. This loss of axons ultimately leads to added atrophy further up the visual pathway due to decreased neuronal input. Alternatively Alzheimer's disease impacts the cells that are located terminally or intermediary in the visual pathway of the brain. The result is again reduced neuronal input due to loss of nerve fibre connections and atrophy along the visual pathway. When the two diseases exist in the same individual together it can be seen that there is likely to be a greater disruption to the visual system [20] , one key difference between the two diseases is that they affect the visual pathway at

different points. Glaucoma is a degenerative disease starting at the beginning of the visual pathway, whereas Alzheimer's disease is a degenerative process starting relatively late in the visual pathway. When the two diseases coexist then the neuronal and functional losses of vision are cumulative.

Optometric examination of dementia patients

Dementia patients present special problems for optometrists. A standard eye test can be an audile to even the best of us. The patient is placed in an unfamiliar environment surrounded by unusual equipment, machinery and is subjected to probing questions about he medical history which will inevitably tax their already flawed memory. Dementia patients are most likely to be from the elderly. Therefore several difficulties are presented while conducting an ocular examination. The patient is required to maintain a position and has to maintain concentration throughout the testing procedures, which can be very difficult. Subjective examination requires responses from the patient, they are expected to remember and follow complex instructions given to them by the optometrist as well as make many precise discriminatory judgments in a short space of time. The multiple tasks required to be completed during the examination are often beyond dementia patients as they are limited by the disease. Therefore it is common that patients with even a minor degree of dementia fail to provide valid answers, provide unpredictable responses to the subjective examination and retreat into an apathetic state [3, 9].

During the visual examination of Alzheimer's disease patients, several key visual problems can be detected. Moderate dementia patients will often

experience problems such as topographic agnosia, alexia without agraphia, visual agnosia and prospagnosia [3] . Such patients often cannot describe individual components of photos and routinely fail to recognize family members. The degree to which such problems are experienced is consistent with the level of cytochrome oxidase deficits in the associated cortical area. In conjunction with these problems dementia patients often have problems with texture discrimination and blue violet discrimination [3] .

During examination of the elderly dementia patients there are two contradictory requirements, firstly is ‘ assurance’. The patient’s responses will be delayed and the patient may feel anxious in such an unfamiliar situation, therefore constant reassurance is required and they cannot be rushed. Alternatively time constraints are important, a dementia/elderly patient is likely to have a short attention span. Therefore the two factors above much be considered and balanced. The examination must be thorough yet carried out as quick as possible. Often when examining a dementia patient a family member of the carer must be present in order to aid the communication between optometrist and patient, for example difficulties are likely to occur when recording history and symptoms without a carer present. All factors need to be considered such as family history, medication, eye treatment and knowledge of any medical conditions and if so how long they have suffered from them.

In terms of an external examination firstly, gross observations should be recorded for example does the patient have an abnormal head position or is there any lid tosis. Many external observations can also be detected with the

aid of pupil reflexes. Upon carrying out the external examination the optometrist must be carful to explain exactly what each procedure will involve so as not to intimidate the patient.

Internal examination

Internal examination of an elderly patient often presents many problems. Older patients tend to have constricted pupils and often opacities in the media such as cataract. Patients with dementia also show poor fixation as well as lack of concentration. Pupil dilation is often used to aid external examination however many older patients can have a poor response to the insertion of mydriatic eye drops.

There have been many studies into the affects of diagnostic mydriatic and miotic drugs. Many studies have shown excessive mydriatic pupil response to trompicamide (a pupil dilating drug) in patients with Alzheimer's disease when compared to control individuals.))) on the other hand studies into the use of Miotic drops, particularly Pilocarpine have shown an increased response of pupil constriction in Alzheimer's disease patients in comparison to normal control patients. These findings suggest a defect in pupillary innervation with Alzheimer's disease individuals. Studies of post mortem individuals with exaggerated mydriatic pupil responses to Tropicamide found a definte disruption to the Edinger-Westphal nucleus. The Edinger-Westphal nucleus is one of the key structures of the brain involved in the autonomic nervous system, it mediates the sympathetic and para-sympathetic pupil responses. Research by Scinto et al found amyloid plaques and neurofibrillary tangles in all individuals tested with excessive mydriatic pupil

responses. The conclusion was that the Edinger-Westphal nucleus is targeted early in the progression of Alzheimer’s disease.

In terms of intraocular pressures use of the goldman an Perkins tonometers will be limited for the elderly dementia patients, due to health an safety reasons. Sudden movements whilst carrying out pressure tests on such equipment may be dangerous. Therefore this can be overcome to a degree by the use of handheld instruments such as the pulseair. However even with the pulseair problems can still be faces with uncooperative patients.

Objective examination

With uncooperative and awkward patients objective refraction through retinosopy may be difficult. Factors such as opacified media, miotic pupils, and poor fixation will influence the accuracy of the refraction. The recent introduction of hand held optometers has contributed to somewhat overcoming such problems. Instruments such as thee Nikon Retinomax are excellent for obtaining an objective refraction of the elderly patient with miotic pupils and cloudy media.

When presenting the Snellen chart to a patient, the quality of their response will inevitably depend upon the degree of their dementia. Depending on which stage of dementia they are suffering from, responses could range from routine reading of the chart to no response at all. The later presents the optometrist with greater problems; however a visual acuity can still be measured via other techniques.

Treatment of Alzheimer's disease

Alzheimer's disease is often widespread and a prevalent problem, however it is often an untreated disorder. A reason for this impairment to be overlooked could be that visual function is typically only measured in terms of visual acuity in the majority of cases, which in Alzheimer's patients is often normal. However, studies have shown that up to 60% of people with Alzheimer's disease show deficits in on or multiple visual areas such as depth perception, motion perception, color discrimination or contrast sensitivity [31, 32] . Therefore detection and treatment of Alzheimer's patients must include these other visual capacities and not only visual acuity tests.

Deficits in depth perception have accurately been demonstrated in Alzheimer's individuals [33-37] . Decline in this visual capacity is even seen at the early stages of Alzheimer's disease, independently of the other visual capacities [36] . Impaired depth perception will inevitably cause problems in performing everyday tasks [33, 36] eg walking, cleaning and stair climbing. Motion perception is also a common deficit seen in Alzheimer's disease [41-45] . Studies have shown that individuals with Alzheimer's take significantly longer to identify stationary objects that can be identified by motion cues [41, 43] . A study by Rizzo et al [42] found that 33% of Alzheimer's patients had car accidents when put through a set of driving scenarios in a virtual simulator, compared to 0 accidents with non demented age match participants. The decreased ability of Alzheimer's patients to accurately process visual motion cues was a significant factor in avoiding accidents.

Contrast sensitivity can be defined as the smallest difference in intensity that a person can resolve between an object and its immediate surround. Most elderly patients are impaired at high spatial frequencies. However Alzheimer's sufferers are impaired at low spatial frequencies as well [46, 47, 48, 49-51] . Problems with contrast sensitivity will have a subsequent impact on how a person with Alzheimer's disease perceives their environment, and will adversely affect their ability to perform many everyday tasks such as dressing, washing and eating to name but a few. Contrast sensitivity problems cannot be cured or overcome by means such as optical correction through spectacles, medication or surgery. However individuals can be helped by environmental modifications.

We will now go on to discuss a handful of simple environmental modifications that can be made for dementia patients in order to increase their quality of life. Firstly there are several key simple principles relating to colour and light that should always be considered when modifying a living area for a dementia individual.

Color	Light
Use sharply contrasting color betwee	Always have even distribution of light

n back ground and foregro und.	within a room.
Use solid colors rather than stripes or multi color pattern s.	Good to have as much natural light as possibl e.
Do not use ‘ like’ colors next to each	Minimi se glare

other	
	Task lighting when applicable
	Place light behind reading or television on chair to enhance vision.

In the bedroom the main point of concern is not to bump into objects and not to fall out of bed. Caregivers can also find it problematic to get the patient into their bedroom at the end of the day. Enhancing the contrast of objects in the bedroom will help patients to recognize areas of their room and intern make care givers jobs much easier during care. In order to draw the patient into a room in a common technique many institutions or caregivers use is to

paint the furthest most wall in the bedroom in a contrasting color to the rest of the room, for example in a light colored room (magnolia) it would be advantageous to paint the far wall in a dark contrasting color such as brown. This will provide a depth cue for the patient and will encourage them to enter the bedroom. Once in the room dementia patients can often have problems locating the bed. Again this problem can be aided by a simple modification of using a bed spread that is of high contrast when compared to the surrounding walls and floor of the room. This simple modification will draw the patient towards the bed and help prevent them from tripping or stumbling over the bed. Other simple tips can be to modify appliances within the bedroom such as telephones, clocks and radios with different colored buttons to encourage independence.

The bathroom is another frequently used area within the household and there are many simple modifications that can be made within this area to aid the user. Firstly placing a fixed bath mat of the same color as the floor is a simple useful modification. The matt with low contrast to the floor will decrease any depth perception problems and will aid the user when getting in and out of the bath tub. Also a fixed mat can be placed inside the bath tub, however in this case the matt should be of a contrasting color to the tub. The reasoning behind this is that the contrasting bath mat will provide a excellent depth cue for the user who would other wise would be unsure to about how deep the floor of the bath tub is. The bathroom can be a hazardous place for a dementia individual as there are many risks within this room especially the risk of hot water. Therefore an extremely important modification in the bathroom is to ensure all taps have different colored

knobs on the hot and cold components. The colored taps will provide a color cue and help the user to distinguish between the two.

The kitchen can be a dangerous place, especially for the elderly and dementia su