National University of Medical Sciences

Osteopathy and Memory loss

Preventing Cognitive Decline:

The Role of the Venous Sinuses Osteopathic Technique in Brain Haemodynamics.

Doctor of Osteopathy

Thesis

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15th November 2024

Acknowledgements

I would like to express my deepest gratitude to my family for their unwavering support and encouragement throughout the years of my thesis proposal(s), setbacks, research and writing journey.

To my wonderful wife - thank you for your endless patience, love, and for being my rock throughout this journey.
Your support and understanding have been my greatest strength.

To my daughter - thank you for your guidance and for your proofreading help.
Your words of encouragement have meant the world to me.

This thesis would not have been possible without your collective support and patience.
I am forever grateful for your presence in my life.

To Dr.Viola Frymann, DO., my respected mentor:

“I was so lucky to walk by the shoulders of giants!”

TABLE OF CONTENTS

INTRODUCTION

Dementia, as an umbrella term referring to conditions impacting cognitive function and therefore an individual's ability to perform activities of daily living, represents one of the most devastating and costly diagnoses among the elderly population.[1]

The most commonly diagnosed types of dementia are as follows:

- Alzheimer's disease (AD) is first observed as a mild cognitive impairment (MCI) in terms of memory loss or decline in other cognitive functions. Studies suggest that the rate of conversion of MCI to AD is 41% over a period of 1 year and 64% over a period of 2 years [2].
- Vascular Dementia is caused by a reduction in blood flow to the brain. It can happen after a stroke or if blood vessels in the brain become damaged.
- Dementia with Lewy bodies, discovered by Dr. Frederic Lewy, presents typically as memory loss, hallucinations, and parkinsonian movement disorders.
- Frontotemporal Dementia, originally discovered by Dr. Arnold Pick, is common in people between the age of 45-65 and can affect language, personality, and behaviour.[3]

In terms of the prevalence of dementia in the UK, an estimated 982,000 people are currently living with dementia in 2024, a number forecast to grow up to 1.4 million by 2040 as the population ages.[4] One in 14 people over the age of 65 [5] and one in 3 people over 85 years old live with AD.[6] Furthermore, approx. 70,800 people under 65 years old have dementia in the UK.[7] To put these figures into context, women over the age of 60 are twice as likely to develop dementia as breast cancer.[8]

Impact of Dementia in the UK

It is therefore unsurprising with these incidence rates that dementia costs the UK economy £34.7 billion per year.[9] That is twice that of cancer, three times the impact of heart disease, and four times that of stroke.[10] Yet the estimated combined government and charitable investment in dementia research is 12 times lower than spending on cancer research; £590 million is spent on cancer research annually, heart disease research receives £169 million per year and stroke research £23 million, while just £50 million is invested in dementia

research.[11] In fact in 2012, for every £1 million in care costs for the disease, £129,269 was spent on cancer research, £73,153 on heart disease research, £8,745 on stroke research and just £4,882 on dementia research.[12]

Caring for each person with dementia has an economic impact of £27,647 per year which is more than the UK median salary (£24,700). By contrast, for people with cancer, the figure is £5,999, stroke £4,770, and heart disease £3,455 per year. [11] 25 million people, or 42% of the UK population, know a close friend or family member with dementia. [14]

Impact of Dementia Worldwide

Worldwide, there is a new case of dementia every three seconds.[15] More than 55 million people are currently estimated to have dementia and just under 10 million new cases are diagnosed each year.[1] The idea that dementia is a disease of wealthy developed nations is a ungrounded – 60 % of people with dementia live in developing countries and this figure is projected to increase up to 71% by 2040. [16] While the rate of dementia is expected to double between 2001 and 2040 in developed countries, it is forecast to increase by more than 300 % in India and China.[16]

As can be seen by these statistics, dementia poses a considerable burden to society both in the UK and globally. However, several modifiable risk factors have been identified and pose a tangible way to influence the diseases' presentation (please refer to Appendix for full details). In fact, by addressing these risk factors, research has indicated that up to 50% of Alzheimer cases could be delayed or even prevented.[17]

BACKGROUND

(A) Dr Alzheimer: Initial Dementia Research

Dr. Alois Alzheimer (1864–1915) was a German psychiatrist and neuropathologist whose groundbreaking work led to the identification of the first published case of "presenile dementia," which would later be recognized as Alzheimer's disease and thus pioneer dementia research.[18]

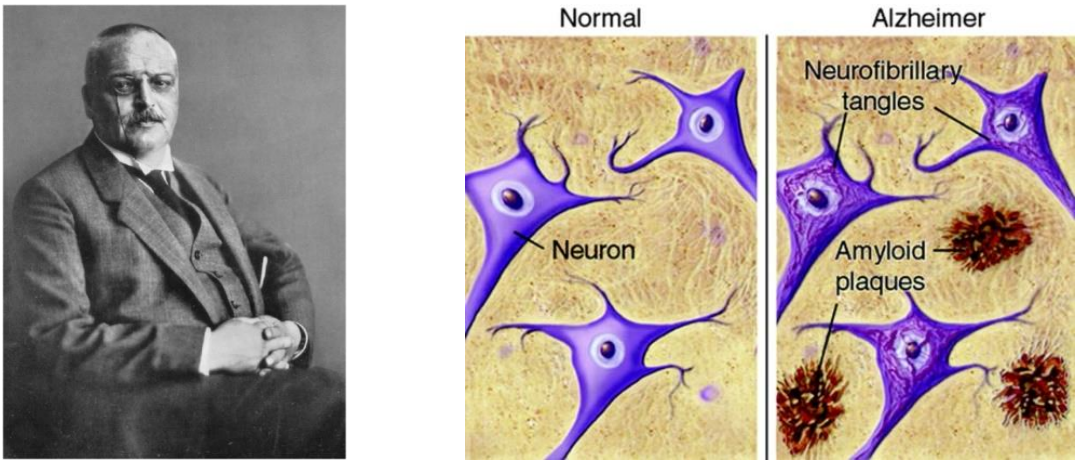


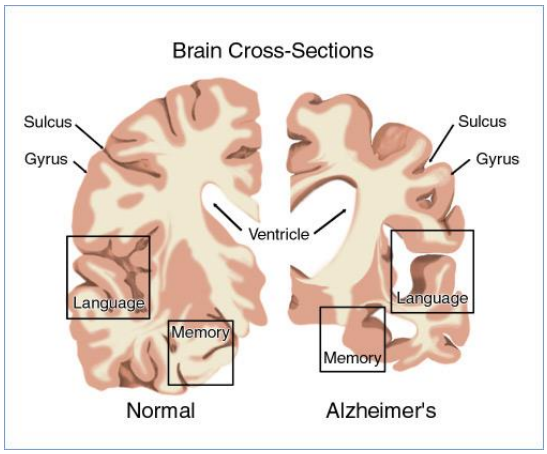
FIG 1: Dr. Alois Alzheimer (1864–1915) and his discovery in 1906 (American Health Assistance Foundation, 2012)

He collaborated with neurologist Franz Nissl on initial research relating to the nervous system's standard pathology, particularly the cerebral cortex, and consequent abnormal presentations.[19] Following this in 1906, Dr. Alzheimer identified brain 'deposits', twisted bands of fibres and β-Amyloid proteins, whilst dissecting the brain of a 56 years old female patient who had presented strange behavioural symptoms including short-term memory loss for 6 years prior to her death.[20] Dr. Alzheimer used the newly developed Bielschowsky stain to identify these amyloid plaques and neurofibrillary tangles in this patient's brain.[21]

In 1910, Dr. Kraepelin named the disease (that Dr. Alzheimer had previously described as "pre-senile dementia") as Alzheimer's disease. Dr. Alzheimer's research laid the foundation for understanding neurodegenerative disorder and their impact on memory and cognition, and even now 120 years later, his academic contributions continue to guide our understanding of dementia and inspire ongoing research in the field.

(B) Professor Love *et al*: Dementia and Cerebral Blood Flow

Research in the 1960s discovered a link between cognitive decline, brain shrinkage, and the number of so-called ‘tangles’ in the brain.



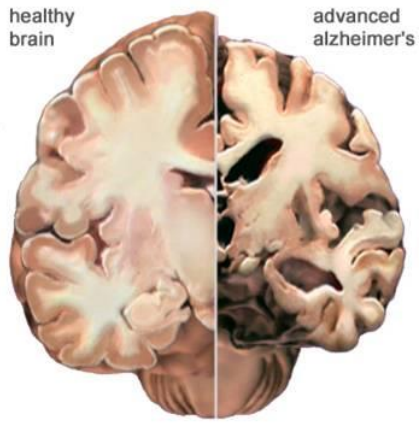


FIG 2: Brain structural changes in Alzheimer’s disease (American Health Assistance Foundation, 2012)

Using this knowledge, Professor Seth Love, Dr. Patrick Kehoe and Professor Julian Patron investigated the dysfunction of blood vessels in the brains of people with Alzheimer’s and demonstrated that there exists a correlation between the onset of symptoms associated with cognitive decline and a reduction of blood flow inside the brain.[22]

In Alzheimer’s disease, cerebral blood vessels do not adequately adjust in response to changes in brain activity and in blood pressure. Furthermore, the vessels become too hardened and permeable, allowing potentially harmful substances to leak into the brain from the bloodstream.[23] Although it was thought that vascular dysfunction is a symptom of Alzheimer’s disease rather than a cause, Professor Love *et al* proved that a drug compound called Zibotentan (originally evaluated by AstraZeneca for the treatment of prostate cancer) could delay, or even reverse, the progression of Alzheimer’s disease by improving blood flow through the brain which in turn would help improve brain function. [23]

(C) Professor Yuri Moskalenko: Osteopathy's Role in Brain Fluid Dynamics

Professor Yuri Moskalenko, a fellow of the Russian Academy of Science and the International Academy of Astronautics, [Figure 4] was a world-recognized pioneer in cerebral circulation and a space physiologist who dedicated his life's work to studying the dynamics of cerebral spinal fluid (CSF), cerebral circulation, and cranial bone mobility.

In 1962, he founded the laboratory of space physiology at the Sechenov Institute of Evolutionary Physiology and Biochemistry at the Russian Academy of Sciences in St Petersburg where he investigated the physiological mechanisms of blood supply to the brain, the flow of cerebrospinal fluid within the skull, cranial compliance, and studied the biomechanical properties of the skull on Earth and in space. As a natural progression of his research endeavours, he collaborated with renown American osteopath: Dr.Viola Frymann, DO. FAAO. FCA [Figure 3].

FIG 3: Dr. Viola Frymann, DO.

FIG 4: Prof. Moskalenko teaching the Venous sinuses drainage.

Professor Moskalenko's pioneering work illuminated the intricate relationship between brain fluid dynamics, skull biomechanics, and cognitive functioning. Moskalenko and his associates carried out several studies which evidenced cranial bone motion. One of his studies utilised NMR tomograms to show cranial bone motion varies between 380 microns to 1 mm, leading to an increase in cranial cavity volume by 12-15 mL, with a rhythm of 6-14 cycles per minute.[24] In this same paper, he demonstrated that these oscillations were of intracranial origin and were related to the mechanisms of regulation of the blood supply to and oxygen consumption by cerebral tissue, as well as with the dynamics of CSF circulation.[24] Professor Moskalenko and Dr. Frymann drew on this discovery to formulate a

theory that explains the physiology of the primary respiratory mechanism (PRM). In summary, Professor Moskalenko's dedication to understanding cerebral circulation had unprecedented implications for age-related cognitive decline and major illnesses like dementia and Alzheimer's disease by underscoring the potential beneficial role of cranial osteopathy and in particular the Venous sinuses technique in influencing brain fluid dynamics.[25]

RESEARCH QUESTION

As demonstrated above, there is ample evidence to suggest that alternations in cerebral structures and function are intimately tied to cognitive decline. However, the complexity of both neural and cognitive functions has rendered exact mapping between the brain's function and presented behaviour challenging, and so these relations have thus far remained largely speculative. Furthermore, it is necessary to consider that age-related changes in cognition are not uniform across all cognitive domains or all older individuals. Attentions and memory are the basic cognitive functions most affected by age and "evidence suggests that some aspects of attention and memory hold up well with age while others show significant decline".[26] Yet, if we could delay the onset of dementia such as Alzheimer's disease by five years, we could halve the number of people who die with the condition.[27]

Research on the general efficacy of osteopathy in the UK is ongoing, with many studies strongly supporting its effectiveness for a variety of health conditions. While the evidence base in favour of osteopathy continues to grow, patients throughout the UK anecdotally report positive outcomes and improvements in their health through osteopathic treatment.[28] As alluded to in earlier discussions, the scope of osteopathic practice in the UK extends beyond musculoskeletal conditions as osteopaths recognise the interconnectedness of different bodily systems and consider the impact of structural imbalances on overall health.

This begs the question as to what exactly is osteopathy's role in influencing cerebral fluid dynamics in the remit of cognitive decline, and which osteopathic techniques are best suited for this. Therefore, this project will address the following research questions: is the process of dementia-related cognitive decline reversible through osteopathic intervention and if so, which osteopathic techniques may be implemented to achieve this prior to a formal diagnosis of dementia?

METHODOLOGY

This thesis will firstly review relevant research pertaining to osteopathic interventions and philosophies which have a direct role in assessing and influencing cerebral fluid dynamics. More generalised research on the topic of strategies to promote cognitive health (for example: physical activity, mental activity, social engagement, nutrition) shall be placed in the Appendix.

Once the literature review has been completed, a pilot study shall be conducted, employing one of the highlighted techniques with patients presenting with cognitive decline yet without a formal diagnosis of dementia.

(A) Literature Review

(i) Osteopathic Techniques and Interventions:

The CV4

In 2019, Michael McAree *et al* published research on Alzheimer's disease prevention in the *Journal of Osteopathic Medicine* where they identified relationships between Alzheimer's disease and blood-brain barrier (BBB) breakdown, the response of the BBB to increased cerebral blood flow and shear stress, and the impact of osteopathic cranial manipulative medicine on cerebrovascular hemodynamics.[29] The osteopathic cranial manipulative technique they chose to focus on was the CV4 which, according to their research, could be used to modulate cerebrovascular hemodynamics and potentially mediate sympathetic and parasympathetic autonomic activity, as they demonstrate through measurable means. [29]

The CV4: To perform this technique, the osteopath cradles the patient's head in such a way that the thenar eminences are in direct contact with the squamous area of the patient's occipital bone. While applying a soft medial pressure on the lateral angles of the occiput, he evaluates the flexion and extension of the cranial bones and then encourages the extension phase of the PRM. This technique influences the volume of the fourth ventricle and redistributes the cerebrospinal fluid within it, ultimately leading to a downstream increase in CSF flow.

However, due to study limitations, McAree *et al* conclude that further studies are required to explore the CV4 technique as a means of prevention in those with a family history of or predisposition to Alzheimer's disease [29].

Cranio-Sacral Techniques

Michael Morgan LMT, CST-D is a leader in the neurophysiology of 'transformation-using mind-body' processes to change the mental, emotional, spiritual, and physical states of an individual to attain a state of balance and health.[30] He spent an extensive amount of time investigating how a reduction of CSF (found to occur naturally through the aging process and accelerated with Alzheimer's disease) and neuroinflammation can be addressed with Cranio-Sacral techniques (CST).[31] CST, a light touch, non-invasive, manual therapy technique which was developed by osteopath Dr. John Upledger, has shown to demonstrate positive effects in the reduction of agitation and improvement of memory, even to those with mid- to late stage of dementia.[32]

Most recently, Morgan has pioneered and coordinated research in the application of CST for dementia and Alzheimer's disease, and was instrumental in publishing research in the *American Journal of Gerontological Nursing*, as well as ongoing research in this area for the treatment of dementia.[30] His theory is that Alzheimer's disease is the result of long-standing inflammation:

> "When it comes to the health of the brain, you might be surprised to hear that the gut and the immune system are major players. The entire craniosacral system is in a dynamic relationship with the gut and the immune system […]. Processed foods cause gut inflammation as food particles pass through the gut wall and enter the circulatory system […]. Since the food is not where it is supposed to be, it is spotted by the immune system and believed to be an invader […]. Inflammation starts and causes stress throughout the body, and this stress is going to lead to <u>less</u> health as resources are drained from the immune system and the resilience of the one suffering declines […]. The key players in the brain are neurons, synapses, glial cells or the glymphatic system, cerebral spinal fluid, and plaques such as amyloid beta (a protein toxin that clogs the brain) […]. The glial cells surround all the cells in the body to provide a way for waste to move out […]. When this plaque increases, inflammation increases, and the CSF flow becomes constricted […]. This means the CSF cannot wash through all the places of the brain to refresh and renew […]. One chief result is memory loss, from simple decline all the way to Alzheimer's".[33]

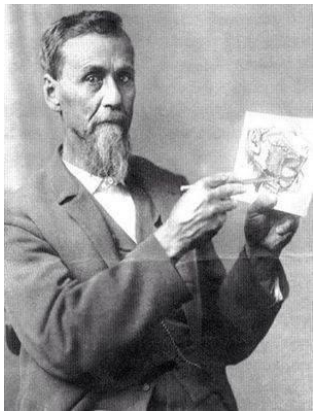
He designed a program that combines CST, diet and exercise to help prevent and even reverse the effects of early- to mid-stage dementia.[34] His main CST treatment protocol involves a "still point technique" (equivalent to a CV4) but, although this technique may feel

effective upon palpation, its efficacy cannot be fully validated without verification through measurable and objective means; without such empirical evidence, the perceived effectiveness remains subjective and cannot be substantiated scientifically.

The Venous Sinuses Drainage Technique

Figure 5 :

Figure 6 :



Dr. William Garner Sutherland, DO. [Figure 5] was an American Osteopath who founded the cranial mechanism concept and developed the Venous Sinus Drainage technique (VSD).
Dr. Sutherland has maintained that Dr. Andrew Taylor Still [Figure 6], the founder of osteopathic medicine, was the original source for the cranial mechanism concept, with Dr. Sutherland merely further extending Dr. Still's concepts to the cranial structures. Dr. Sutherland, like Dr. Still, based his concepts on systematic observation integrated with the published science of the times typical of the scientific endeavour of the early 1900s.

The VSD technique is used to enhance blood flow through the venous sinuses and is commonly employed in osteopathic cranial manipulative medicine and craniosacral therapy. By optimizing the circulation of venous blood within the cranium, this technique aims to improve the drainage of venous blood flow, facilitate the reabsorption of cerebrospinal fluid (CSF), and prevent accumulation.

Anatomy:

The venous vascularization of the skull does not overlap with the arterial one. These veins cross the subarachnoid spaces to join the venous sinuses, which are contained within a double fold of the dura mater.

The intracranial membranes, such as the falx or the tentorium, insert onto the bones on each side of a groove, forming the cranial venous sinuses. The cranial veins and sinuses are valveless, inelastic, inextensible, and non-contractile. Their drainage thus highlights the presence of a pumping mechanism, and the relaxation of the intracranial membranes has a direct impact on the venous sinuses.

There is also a suction mechanism due to pressure differences during the inspiratory phase. During thoracic inspiration, the pressure in the superior vena cava decreases, causing a suction effect that draws blood from the jugular veins to the right atrium of the heart. This implies that people, who have an inefficient thoracic breathing, or those with thoracic overpressure, potentially lose the benefit of this suction. For this reason, the work of the thoracic diaphragm, and more generally that of the three diaphragms, will have a positive impact on cranial venous drainage.

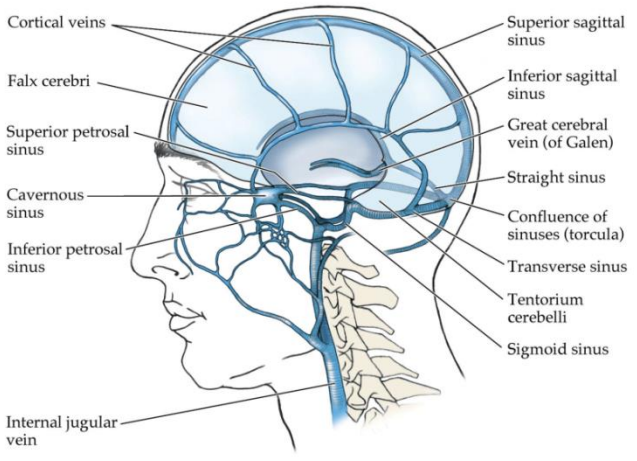


Figure 7:

The role of these sinuses is not only to transport deoxygenated blood but also to serve as a reserve function in case of emergency, especially through the deep venous system.

The venous sinuses also play a crucial role in fluid balance and also have a role in the fluctuation of CSF. CSF circulates in the subarachnoid space which is located between the

pia mater (which lines the convolutions of the brain) and the arachnoid. It is formed by filtering blood plasma at the level of the choroid plexuses located in the ventricles.

CSF allows the elimination of harmful metabolites in the body, lymphatic drainage, hormonal transmission, maintenance of homeostasis, as well as the protection of brain matter. The pressure of the CSF is controlled by the secretion/absorption mechanism. CSF is distributed during inspiration whilst, during expiration, arachnoid villi known as the Pacchionian granulations, located on the walls of the superior longitudinal venous sinuses, allow the unidirectional passage of CSF to the veins by osmosis or active transport. The venous sinuses thus contribute to maintaining the balance of the intracranial pressure gradient.

These sinuses drain 95% of the cranial venous blood which exits the skull through the posterior Jugular foramen emptying into the internal jugular veins. The dural venous sinuses, located between the periosteal and meningeal layers of the dura mater, are part of the central nervous system's venous drainage system.

The venous sinuses drainage technique: according to Dr.Sutherland, VST involves a gentle manual, cranial osteopathic manipulation in 7 distinct stages to open the sinus tracts, thereby promoting enhanced venous blood flow and optimizing the physiological processes associated with CSF reabsorption.[35]

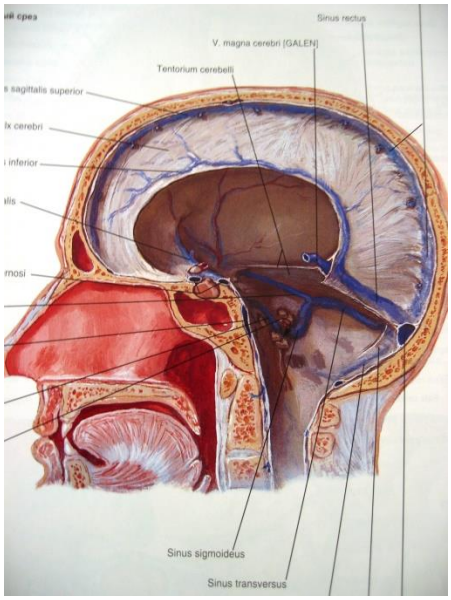


Figure 8 (Netter Atlas of Human Anatomy)

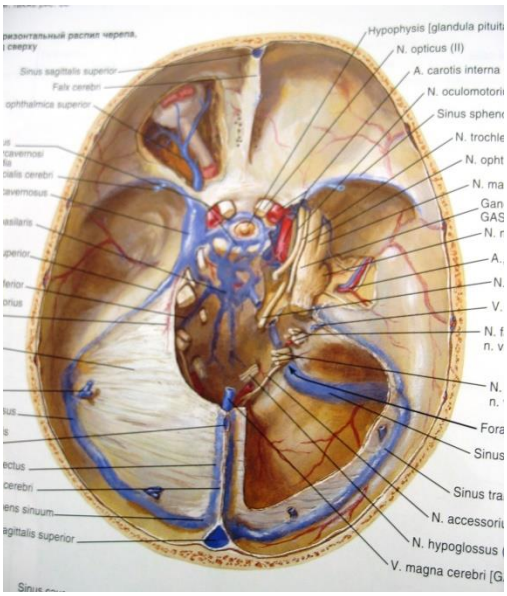
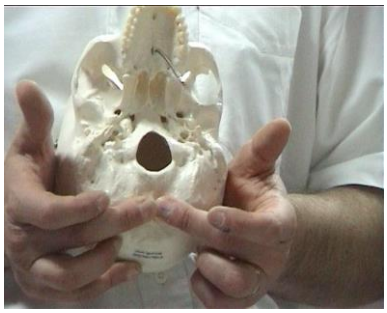


Figure 9 (Netter Atlas of Human Anatomy)

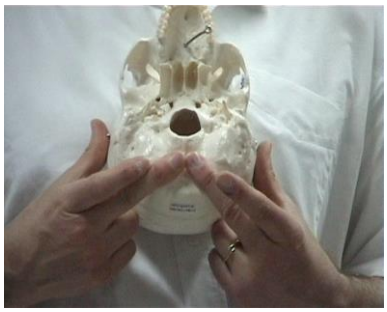
The seven stages of Dr. Sutherland's venous sinus drainage technique are:

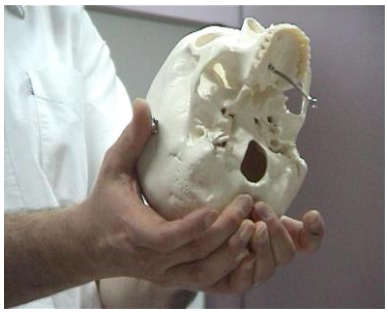
1. **Confluence of Sinuses Drainage**: Two fingers are positioned (end to end, perpendicular and close to the midline) at the inion (the external occipital protuberance) and gentle lateral pressure is applied to facilitate drainage. The tissues will "unwind" under the fingers until they find a point of "balance". At that point, waiting is important until, eventually, a softening occurs. When this release is palpated, move your fingers to the next stage.

2. **Occipital Sinus Drainage**: The practitioner places their fingers again along the midline of the occiput, now closer to the foramen magnum, and applies again a gentle lateral pressure in a similar manner as previously done to encourage drainage.

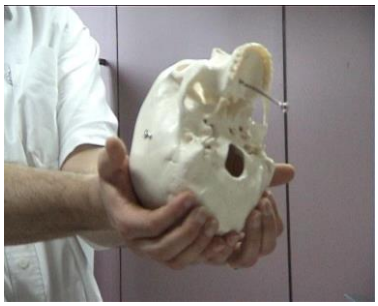


3. **Decompression of both occipital condyles:** The practitioner places the fingers still along the midline of the occiput, in a "chevron" manner, now creating a gentle posterior traction whilst approximating his wrists. This is the *most important part of the VSD* and the key is to wait until both condyles release as anecdotally, the left side usually releases first.

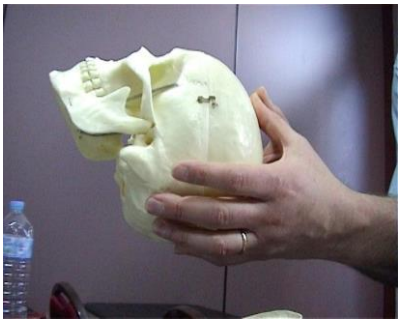




4. **Transverse Sinus Drainage**: The practitioner places their fingers along the superior nuchal line (the base of the skull) and applies gentle pressure until a softening or warmth is felt.

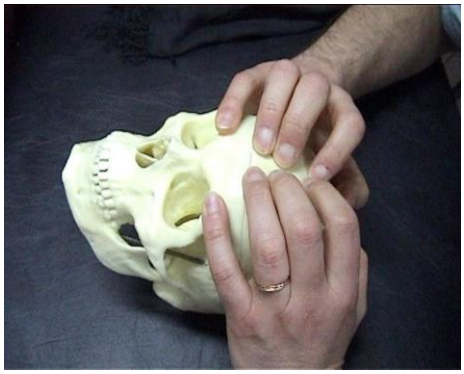


5. **Straight Sinus Drainage**: The practitioner places their fingers at the bregma and applies gentle fluid drive from the patient's bregma towards his inion to facilitate drainage along the straight sinus.



6. **Superior Sagittal Sinus Drainage**: The osteopath's thumbs are crossed and placed along the midline of the skull, starting from the inion and moving in distinct steps towards the bregma, applying gentle pressure, again until a softening or warmth is felt.

7. **Metopic Suture Drainage**: The fingers are positioned along the metopic suture (the midline of the forehead) and gentle pressure is applied to encourage drainage.



Each stage is performed in sequence, with the practitioner maintaining pressure until a softening or warmth is felt under their fingers.

(ii) Evaluation Tools

Unlike CV4 and CST, the Venous Sinus Drainage (VSD) technique has been objectively assessed and proven to have a positive impact on cerebral blood flow using a reliable and accurate reference device.[36, 37]

French osteopath Dr. Yannick Huard, DO, PhD published research in 1996-7 about clinical trials he conducted under the supervision of Dr. Lebar, a radiologist, where Dr. Huard used the VSD technique on 39 patients, whilst 39 other patients received sham light touch therapy, and another group of 39 patients received no touch at all. Only the 39 patients who received the VSD technique had dramatic effects on their blood- brain perfusion, measured and recorded with an "Encephaloscan" [Figure 10] which at the time was a new radiological procedure that utilized ultrasound technology to record blood flow in the brain. [36, 37] His work objectively demonstrated that the VSD osteopathic technique is effective and has an immediate and significant effect on the surrounding tissues, including improving the hemodynamics of the brain, balancing membranous tensions, and allowing improved venous return, which consequently rebalances the local blood flow, allowing a greater capacity of brain perfusion. Moreover, this research emphasized the importance of a measurable validation method in confirming the efficacy of a technique.

What is the "Encephaloscan"?

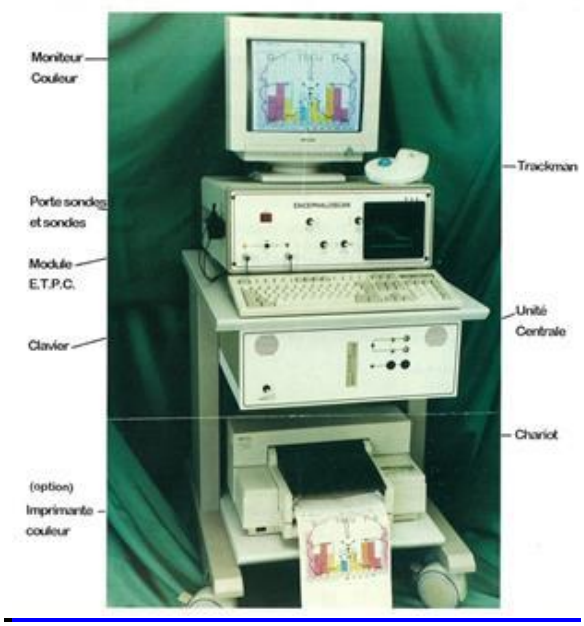


Figure 10: Encephaloscan

Ultrasonic cerebral tomosphygmography (UCTS), also known as "Encephaloscan", is an ultrasound-based technique for both functional and anatomical brain imaging investigations in terms of assessing intracerebral tissue pulsations.[38] It was invented by French oncologist Dominique Belpomme, MD and, when compared to classical imaging, made it possible to locate precisely the spontaneous brain tissue pulsations that occur naturally in the temporal lobes. Recent scientific publications have validated the scientific interest of UCTS, yet its lack of financial support (as opposed to other purely scientific or technical reasons) has led to a decline in its clinical use and industrial development in France.[39]

UCTS differs from transcranial Doppler ultrasonography (TDU); although TDU also uses pulsed ultrasounds, it aims at studying the *velocity* of blood flow in the cerebral arteries by using the Doppler effect, especially in the middle cerebral artery of both hemispheres. Instead, UCTS has the technical advantage of measuring and locating spontaneous brain tissue arterial pulsations in temporal lobes.

Scientific work has shown the possibility of making an objective diagnosis if reduced blood flow is a possible cause of cognitive impairment (MCI) in patients. Since classical CT scans and MRI are usually not appropriate for the diagnosis and are poorly tolerated by these patients, UCTS should therefore be considered as one of the best imaging techniques to be used for the diagnosis of MCI disorders and the follow-up of patients.

Example of Poor brain Haemodynamics:

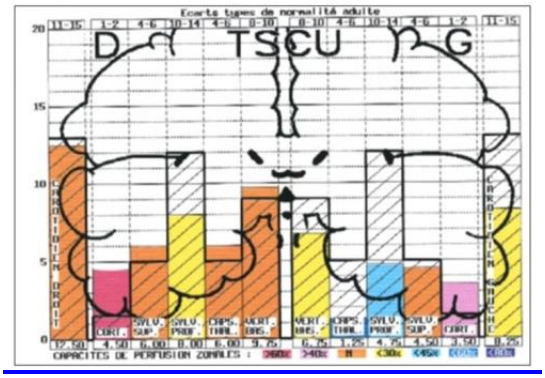


Figure 11 [39]

The poor blood flow is clearly visible in the above diagram (Figure 11) by the yellow i.e. ‘poor flow’ and orange (restricted flow worse on the G [left] hemisphere) in this patient diagnosed with Alzheimer’s.

***Example of Good brain Haemodynamics following treatment**:*

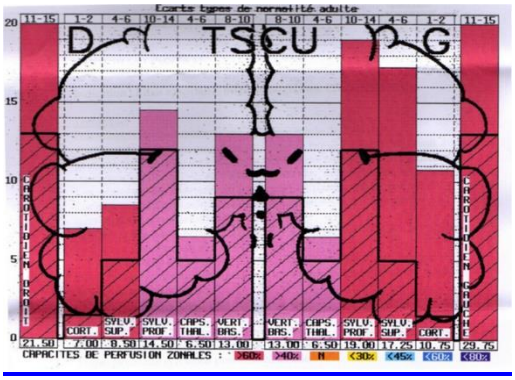


Figure 12[39]

In this diagram [Figure 12], the arterial blood flow is denoted as ‘normal’ through pink and red columns.

B) Case Study

Having completed the literature review, I had hoped to conduct my own pilot study using Dr.Sutherland's Venous Sinuses Drainage technique on a randomly assigned group of patients with symptoms of mild cognitive impairment (MCI) and to assess whether their symptoms could be improved in a significant way. The intervention was a series of 6 VSD techniques to be conducted over a determined period of a few weeks and I aimed to enrol enough participants to have a control group of individuals who would only receive sham, light-touch therapy as outlined in Huard's research,[36] administered in the same way as the experimental treatment to maintain consistency. Results were to be measured using a cognitive function test conducted pre- and post-intervention; the chosen tool was from the 'Food for Brain' Foundation and was the "first free online cognitive function test developed by leading mental health experts to accurately assess [an individual's] risk of memory decline".[40]

Unfortunately, under the UK's GDPR rules, several patients who initially consented and received treatment did not allow me to publish their history and memory tests results (for a number of personal or family reasons) despite their improved test results.

However, one patient allowed me to share his results, and therefore my pilot study transformed into a case study:

Mr. X is an 80-year-old male in generally good health without a formal dementia diagnosis but with marked short-term memory issues which were both self-reported and highlighted by family members. For example, he would place different items in his kitchen in unusual places, and would not remember where they were when he or his partner needed them. In January 2024, his first test results using the 'Food for Brain' Foundation's cognitive function test indicated he had a 55.89% 'red zone' dementia risk [Figure 13]. He then went on to receive my 6 VSD techniques experimental protocol with no adverse effects at a rate of one treatment session per week between March and May 2024. In May 2024, following his second memory test, his dementia risk had reduced to 43.54% within the normal amber zone [Figure 14].

The final test report read as follows: “Your Cognitive function test showed that you performed at or above the norm for your age. This suggests that you are not showing the early cognitive function problems that can be a symptom of future mild cognitive impairment or Alzheimer’s Disease”.

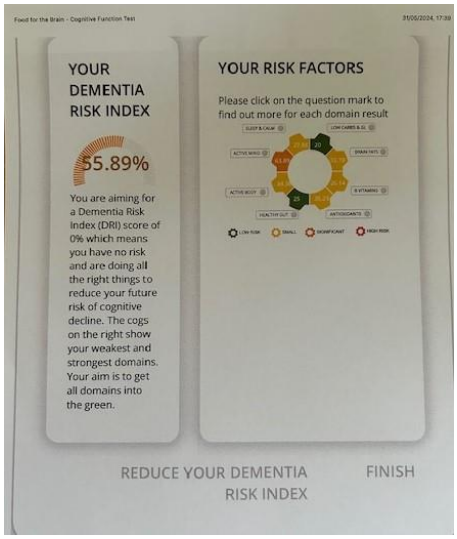


Figure 13: Pre-Intervention result

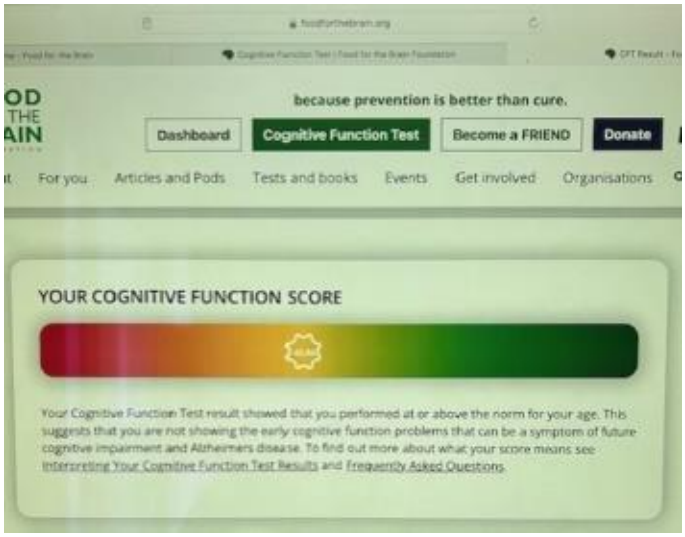


Figure 14: Post-intervention result

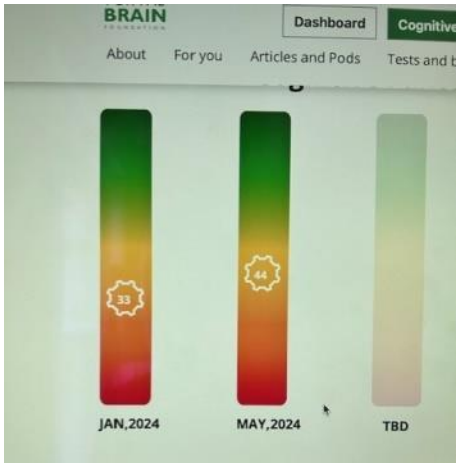


Figure 15: Comparison pre- and post-intervention

CONCLUSION

This thesis suggests that the osteopathic Venous Sinus Drainage (VSD) protocol represents a safe and potentially effective therapeutic option for the alleviation of symptoms associated with a mild cognitive impairment (MCI) without a formal dementia diagnosis.

The review synthesizes the most recent evidence available on the clinical efficacy of VSD in MCI populations, drawing from both this study and existing literature in relevant databases. However, the methodological quality of the studies reviewed has shown limited improvement over the past decade.

Several limitations are acknowledged in this review, including the absence of a large control group, the small sample sizes across studies, and the scarcity of robust data, particularly concerning the diverse clinical presentations of MCI. These factors therefore constrain the generalizability of the findings.

In light of these limitations, the results underlines an urgent need for further rigorous research to better evaluate the efficacy of VSD in managing MCI symptoms and to enhance the methodological quality of future studies in this area.

REFERENCES

[1]
World Health Organization (2023) *Dementia*, *World Health Organization*. Available at: https://www.who.int/news-room/fact-sheets/detail/dementia.

[2]
Weil, R.S., Costantini, A.A. and Schrag, A.E. (2018) 'Mild Cognitive Impairment in Parkinson's Disease—What Is It?', *Current Neurology and Neuroscience Reports*, 18(4). Available at: https://doi.org/10.1007/s11910-018-0823-9.

[3]
Alzheimer's Society (2019) *Causes of frontotemporal dementia*, *Alzheimer's Society*. Available at: https://www.alzheimers.org.uk/about-dementia/types-dementia/frontotemporal-dementia-causes.

[4]
UK Dementia Care Costs Reach £42billion, Alzheimer's Society (2024) *www.dementiaresearcher.nihr.ac.uk*. Available at: https://www.dementiaresearcher.nihr.ac.uk/uk-dementia-care-costs-reach-42billion-alzheimers-society/.

[5]
NHS (2024) *Alzheimer's Disease*, *NHS*. NHS. Available at: https://www.nhs.uk/conditions/alzheimers-disease/.

[6]
National Institute on Aging (2024) *What causes Alzheimer's disease?*, *National Institute on Aging*. Available at: https://www.nia.nih.gov/health/alzheimers-causes-and-risk-factors/what-causes-alzheimers-disease.

[7]
Young onset dementia (no date) *Alzheimer's Research UK*. Available at: https://www.alzheimersresearchuk.org/dementia-information/types-of-dementia/young-onset-dementia/.

[8]
Why women are bearing more of the impact of dementia (no date) *Alzheimer's Research UK*. Available at: https://www.alzheimersresearchuk.org/news/why-women-are-bearing-more-of-the-impact-of-dementia/.

[9]
Tobin, J. (2024) *Dementia care*, *House of Lords Library*. Available at: https://lordslibrary.parliament.uk/dementia-care/.

[10]
Oxford University (2010) *Dementia costs UK economy £23 billion a year*, *Medicalxpress.com*. Medical Xpress. Available at: https://medicalxpress.com/news/2010-02-dementia-uk-economy-billion-year.html (Accessed: 17 November 2024).

[11]
Luengo-Fernandez, R., Leal, J. and Gray, A. (no date). Available at: https://www.alzheimersresearchuk.org/wp-content/uploads/2015/01/Dementia2010Full.pdf.

[12]
Dementia Strategy - Hansard - UK Parliament (2024) *Parliament.uk*. Available at: https://hansard.parliament.uk/commons/2010-03-16/debates/10031643000001/DementiaStrategy (Accessed: 17 November 2024).

[13]
Primary Care Dementia Data, September 2024 (2024) *digital.nhs.uk*. Available at: https://digital.nhs.uk/data-and-information/publications/statistical/primary-care-dementia-data/september-2024# (Accessed: 17 November 2024).

[14]
Dementia A state of the nation report on dementia care and support in England (2013). Available at: https://assets.publishing.service.gov.uk/media/5a7c5719ed915d3d0e87bba8/Dementia.pdf.

[15]
Alzheimer's Disease International (2020) *Dementia Statistics*, *Alzheimer's Disease International*. Available at: https://www.alzint.org/about/dementia-facts-figures/dementia-statistics/.

[16]
Ferri, C.P. *et al.* (2005) 'Global prevalence of dementia: a Delphi consensus study', *The Lancet*, 366(9503), pp. 2112–2117. Available at: https://doi.org/10.1016/s0140-6736(05)67889-0.

[17]
Addressing 14 health and lifestyle factors could prevent nearly half of global dementia cases - Alzheimer's Research UK (2024) *Alzheimer's Research UK*. Available at: https://www.alzheimersresearchuk.org/news/nearly-half-of-global-dementia-cases-could-be-prevented-or-delayed-by-addressing-14-health-and-lifestyle-factors-says-new-report/.

[18]
Innovative care of dementia. (2023). *Home - Innovative care of dementia*. [online] Available at: http://www.innocareofdementia.com - The History of Alzheimer's

[19]
Tadas (2022) *The History of Alzheimer's*, *Innovative care of dementia*. Available at: https://innocareofdementia.com/news/who-was-dr-alois-alzheimer/.

[20]
Ciurea, V.A. *et al.* (2023) 'Alzheimer's disease: 120 years of research and progress', *Journal of medicine and life*, 16(2), pp. 173–177. Available at: https://doi.org/10.25122/jml-2022-0111.

[21]
Ryan, N.S., Rossor, M.N. and Fox, N.C. (2015) 'Alzheimer's disease in the 100 years since Alzheimer's death', *Brain*, 138(12), pp. 3816–3821. Available at: https://doi.org/10.1093/brain/awv316.

[22]
Bristol.ac.uk. (2024). *Alzheimer's to benefit from landmark MRC-AstraZeneca compound collaboration*. [online] Available at: https://www.bristol.ac.uk/news/2012/8908.html

[23]
EL Ashby, S Love, PG Kehoe 'Assessment of activation of the plasma kallikrein-kinin system in frontal and temporal cortex in Alzheimer's disease and vascular dementia', Neurobiology *of Aging*, 2010

[24]
Moskalenko YE, Kravchenko TI, Gaidar BV, et al. Periodic mobility of cranial bones in humans. *Human Physiology.* 1999; 25(1):51-58.

[25]
The Beckley Foundation. (2017). *Beckley / Sechenov Institute Research Programme*. [online] Available at: https://www.beckleyfoundation.org/science/collaborations/prof-yuri-moskalenko-sechenov-institute-of-evolutionary-physiology-and-biochemistry-st-petersburg-russia/

[26]
Glisky, E.L. (2007) *Changes in Cognitive Function in Human Aging*, *Nih.gov*. CRC Press/Taylor & Francis. Available at: https://www.ncbi.nlm.nih.gov/books/NBK3885/.

[27]
Wilson, D. *et al.* (2011) 'Latest Advances on Interventions that May Prevent, Delay or Ameliorate Dementia', *Therapeutic Advances in Chronic Disease*, 2(3), pp. 161–173. Available at: https://doi.org/10.1177/2040622310397636.

[28]
OPEN full research report - General Osteopathic Council (no date) *www.osteopathy.org.uk*. Available at: https://www.osteopathy.org.uk/news-and-resources/document-library/research-and-surveys/open-full-research-report/.

[29]
McAree, Michael, Dunn, Alexis, Furtado, Jared, Timmerman, Clinton, Winchell, Zachary, Rani, Radhika, Farah, Jennifer and Crispino, Lauren J.. "Osteopathic Cranial Manipulative Medicine and the Blood-Brain Barrier: A Mechanistic Approach to Alzheimer Prevention" *Journal of Osteopathic Medicine*, vol. 119, no. 6, 2019, pp. e25-e28. https://doi.org/10.7556/jaoa.2019.070

[30]
About Michael Morgan - Preventing Alzheimers (2017) *Preventing Alzheimers*. Available at: https://preventingalzheimers.com/michael-morgan/ (Accessed: 17 November 2024).

[31]
Winzer, A. (2020). *Could CranioSacral Therapy Help Treat Dementia & Alzheimer's Disease?* [online] Massage Magazine. Available at: https://www.massagemag.com/could-craniosacral-therapy-help-treat-dementia-alzheimers-disease-124040/.

[32]
Gerdner, L.A., Hart, L.K. and Zimmerman, M.B. (2008) 'Craniosacral Still Point Technique', *Journal of Gerontological Nursing*, 34(3), pp. 36–45. Available at: https://doi.org/10.3928/00989134-20080301-04.

[33]
Important Connections: Brain, Gut and Immune System - Preventing Alzheimers (2017) *Preventing Alzheimers*. Available at: https://preventingalzheimers.com/important-connections-brain-gut-immune-system/ (Accessed: 17 November 2024).

[34]
Michael Morgan | HuffPost (2024) *Huffpost.com*. Available at: https://www.huffpost.com/author/media-982 (Accessed: 17 November 2024).

[35]
King, H. (no date). Available at: https://ehchiro.com.au/wp-content/uploads/2017/06/PRMresearch.pdf

[36]
Huard Y. *Proceedings of International Research Conference: Osteopathy in Pediatrics at the Osteopathic Center for Children.* Indianapolis, IN: American Academy of Osteopathy; 2005. Influence of the venous sinus technique on cranial hemodynamics; pp. 89–96

[37]
Huard Y. Osteopathe DO. De l'influence de la technique de drainage des sinus veineux sur l'hémodynamisme du crâne, http://academieosteopathie.fr/pmb/opac_css/index.php

[38]
Irigaray, P., Awaida, N. and Belpomme, D. (2024) 'Molecular biomarkers in Electrohypersensitivity and Multiple Chemical Sensitivity: How They Can Help Diagnosis, Follow-Up, and in Etiopathologic Understanding.', *Medical Research Archives*, 12(1). Available at: https://doi.org/10.18103/mra.v12i1.4771.

[39]
Greco, F. (2020) 'Technical Assessment of Ultrasonic Cerebral Tomosphygmography and New Scientific Evaluation of Its Clinical Interest for the Diagnosis of Electrohypersensitivity and Multiple Chemical Sensitivity', *Diagnostics*, 10(6), p. 427. Available at: https://doi.org/10.3390/diagnostics10060427.

[40]
foodforthebrain.org. (n.d.). - *Food for the Brain*. [online] https://foodforthebrain.org/the-cognitive-function-test/

APPENDIX

Nutrition, Supplements and Advice:

A good nutritional strategy is not only essential for general health. It is also a crucial step towards increasing longevity and brain cognitive functions.
Eating a generally healthy diet, however, is not enough. In order to have some chance of defying aging and reaching the maximum lifespan, one has to plan in advance and define a solid, scientifically proven, rigorous nutritional program, which must continually change, according to the needs of the individual.
It is the general nutritional philosophy and adequate supplementation that matters, not the occasional attempts at healthy eating, with the erratic intake of some poor-quality vitamin pills.

Dietary and Lifestyle Management Strategies

The Mediterranean Diet:

The Mediterranean diet has been shown to reduce the risk of Alzheimer's and other dementias in a host of studies: A Columbia University study examined the diets of 2148 New Yorkers aged 65 or older over four years. 253 participants went on to develop Alzheimer's disease (Yuan, 2012).

This dietary pattern: The Mediterranean Diet was significantly associated with a reduced risk of the disease. The researchers suggest a connection between lower Alzheimer's risk and higher intake of polyunsaturated fatty acids, vitamin E, and folates.

Another recent review of the literature noted a reduced risk of neurodegenerative diseases such as Alzheimer's, and mild cognitive impairment when patients were on a Mediterranean diet (Demarin et al., 2011).

Yet another review found that the Mediterranean diet reduced both the risk of Alzheimer's disease and the rate of progression from pre-dementia syndromes to overt dementia.
The researchers pointed out that the Mediterranean diet largely comprises individual foods independently proposed as potential protective factors against dementia and pre-dementia e.g., fish, vegetable oils, non-starchy vegetables, low glycaemic index fruits, and red wine +

high intakes of salad dressing, nuts, fish, tomatoes, poultry, fruits, dark and green leafy vegetables, and low intakes of high-fat dairy, red meat, offal meat, and butter (Solfrizzi, 2011).

In one study, participants who most closely adhered to the Mediterranean diet showed a 28% lower risk of developing cognitive impairment over 4.5-years than those who were less adherent. Also, highly adherent participants with some cognitive impairment at the start of the study experienced a 48% lower risk of developing Alzheimer's disease at follow-up: an average of 4.3years later. (Scarmeas, 2009).

The Mediterranean diet also appears to affect the mortality rate of Alzheimer's. For example, Alzheimer's patients whose adherence to the Mediterranean diet was greatest during a study period of 4.4 years were 76% less likely to die than those whose adherence was least. Alzheimer's patients who adhered to the Mediterranean diet to a moderate degree lived an average of 1.3 years longer than those who adhered to the diet to the least degree. Patients who followed the diet very strictly lived, on average, 3.9 years longer. (Scarmeas, 2007; Scarmeas, 2011).

Epigenetics research has identified several nutrient factors that have a powerful impact: Here are some examples:

Homocysteine-lowering by B Vitamins slows the rate of Accelerated Brain Atrophy in Mild Cognitive Impairment (Smith et al., 2010; Malouf, 2003) because deficiencies in these vitamins can develop as we age, and these deficiencies can contribute to the symptoms of dementia. Receiving intravenous or injected supplements of vitamin B-complex prevent or combat symptoms of dementia.

Vitamin D_3 is **"**promising" in preventing dementia (Alzheimer's Association International Conference, 2010). Vitamin D receptors are located in neurons and glial cells of the brain. Vitamin D protects the nervous system by stimulating the synthesis of neurotrophin and neuromodulators, maintaining intracellular calcium homeostasis, and preventing oxidative brain damage. Vitamin D supplementation increases cognitive and memory functions.

Phosphatidyl serine - Phosphatidylserine (PS) is a phospholipid that is a major component of brain neuronal membranes & has been shown in multiple studies to be another safe and effective nutrient in warding off the cognitive decline seen in aging, like MCI, by protecting brain cell membranes (Nunzi, 1987).

DMAE (2-dimethylaminoethanol) DMAE is naturally produced in the body. It's also found in fatty fish, such as salmon, sardines, and anchovies.
DMAE is thought to work by increasing the production of acetylcholine (Ach), a neurotransmitter that's crucial for helping nerve cells send signals.
Ach helps regulate many functions controlled by the brain, including REM sleep, muscle contractions, and pain responses (Lucas, 2011-12).
DMAE may also help prevent the build-up of beta-amyloid plaque in the brain.

Ginkgo Biloba. Ginkgo increases blood supply and microcirculation within capillaries to all parts of the body, including the heart, eyes, and of course, the Brain. It acts as a free radical scavenger, protecting neurons from oxidation. It also reduces platelet aggregation in the brain. (Lucas, 2011-12).
A 1997 study from *JAMA* showed clear evidence that Ginkgo improves cognitive performance and social functioning for those suffering from dementia.

Research since then has been equally promising. One study in 2006 found Gingko as effective as the dementia drug Aricept (donepezil) for treating mild to moderate Alzheimer's type dementia. A 2010 meta-analysis found Gingko biloba to be effective for a variety of types of dementia (Lucas, 2011-12) as it improves mental health, cognition, motor skills, and quality of life. It is particularly helpful for memory loss, attention, alertness, vigilance, arousal, and mental fluidity.

Vitamin E. (alpha, beta, delta, gamma tocopherols) Vitamin E has beneficial antioxidant properties, and treatment with high doses has shown initial promise in slowing the progression of symptoms in individuals with dementia associated with moderate Alzheimer's (Lucas, 2011-2012; Zandi et al., 2004).

Magnesium is well known for its calming properties in persons with anxiety symptoms, but proper amounts of magnesium are generally lacking in the average English diet. Magnesium from citrate also assists in impacting circulatory problems (Marambaud et al., 2005).

S-Adenosylmethionine (SAMe) promotes cell growth and repair and maintains levels of glutathione, a major antioxidant that protects against free radicals and reduces homocysteine levels. Alzheimer's patients have extremely low levels of SAMe in their brains.

Phosphatidylserine (PS) helps the brain use fuel more efficiently. By boosting neuronal metabolism and stimulating the production of acetylcholine, PS may be able to improve the condition of patients in cognitive decline. Studies have revealed that supplementing with phosphatidylserine slows down and even reverses declining memory and concentration, or age-related cognitive impairment, in middle-aged and elderly subjects. As we grow older, aging slows the body's manufacturing of phosphatidylserine to levels that are detrimental to our functioning at our full mental capacity.

Resveratrol is a chemical compound in plants that acts as an antibiotic to fight off both bacteria and fungi. Besides grapes and cacao, it is found in raspberries, mulberries, blueberries, and cranberries. It's also in peanuts, pine trees, and Japanese knotweed, the source of most resveratrol supplements (Vingtdeux, 2008).

Vinpocetine. Vinpocetine due to its complex mechanism of action, improved the cerebrovascular reserve capacity in both patient groups and favourably influenced the cognitive status and general condition of patients with chronic cerebral hypoperfusion. Vinpocetine is recommended for the treatment of patients with mild cognitive impairment (McDaniel et al., 2003; Hindmarch et al., 1991).

Curcumin clears Alzheimer's Plaques (Yang et al., 2005; Mishra et al., 2008).
The incidence of Alzheimer's among adults in India is about 4.4 times less than that of Americans (Pandav et al., 2000).
Researchers in Singapore suggest the reason might be curry and the spice turmeric. They looked at curry consumption and brain performance in 1,010 Asians between 60 and 93 years of age. Those who ate curry occasionally (less than once a month) and often (more

than once a month) performed better than those who rarely or never ate curry (Ng et al., 2006).

Over 30 studies in the GreenMedInfo database deal with the promise of curcumin, the active compound in turmeric, in the treatment and prevention of Alzheimer's disease. According to one study, turmeric showed remarkable results in Alzheimer's patients in just three months. A 2006 UCLA study found curcumin may help clear the amyloid plaques found in Alzheimer's disease. One way it works is by boosting the work of ***macrophages***. These cells in the immune system help the body fight foreign proteins.

Omega-3 Fatty Acids:

Ignoring its water content, over 60% of the dry mass of the brain is made from fat and a large proportion of this is omega-3 fats.

Omega-3 fats play a fundamental role in the complex network that is the brain – without them, the brain simply would not be able to function.

A typical diet has less than the recommended daily intake of docosahexaenoic acid (DHA). Like curcumin, DHA has been demonstrated to have neuroprotective properties at several metabolic sites. Omega-3 fatty acids are now recommended for a host of chronic conditions associated with aging, especially cardiovascular disease (Lim et al., 2005).

Omega-3 fatty acids should be strongly considered as a safe and potentially helpful adjunct in the prevention and management of Alzheimer's disease (Freund-Lev et al., 2006; Van Gelder et al., 2007).

N-Acetyl-L-Cysteine This amino acid protects the brain from damaging free radicals by boosting quantities of glutathione, one of the body's most powerful antioxidants (Banaclocha, 2001; Nicoletti et al., 2005; Martínez et al., 2000; Cocco et al., 2005).

L-Glutamine. Glutamine is one of the most abundant nonessential amino acids in the bloodstream. It is produced in the muscles and can pass freely through the blood–brain barrier. Once in the brain, it is converted into glutamic acid and increases GABA, a neurotransmitter essential for proper mental function. There are two types of glutamine

supplements: D-glutamine and L-glutamine. L-glutamine is the form that more closely mimics the glutamine in the body.

Acetyl-L-Carnitine (ACL). This versatile nutrient is able to permeate the blood–brain barrier to stimulate and fortify the brain's nerve cells. ACL is a type of carnitine produced naturally in the brain. It can aid in directing fatty acids to the cell mitochondria, assisting in the creation of new cell energy. A powerful antioxidant, acetyl-L-carnitine also supplements the neurotransmitter acetylcholine.

Astaxanthin and Lutein: Rising Stars in Alzheimer's Prevention (Forum Nutrition, 2009; The Alternative Medicine Review, 2011; Nakagawa, 2011).

Both astaxanthin and lutein, two powerful carotenoids found in a variety of fruits, dark green vegetables, and other foods like pumpkin, carrots & pistachios, have proven brain-boosting and cognitive-enhancing abilities. Research suggests lutein and astaxanthin may decrease the risk of various cognitive disorders and improve visual function in both young and aging adults.
Both enhance memory, reduce the risk of Alzheimer's Disease and Dementia, improve Cognitive Performance, and promote recovery from mental Fatigue, Lutein also improves age-related Macular Degeneration,…etc.

Nutrition résumé and advice:

A good strategy is not only essential for general health & longevity but also for brain cognitive functions:

- eliminating all simple refined carbohydrates;
- eliminating gluten and ultra-processed food;
- increasing vegetables, fruits, and organic, non-farmed fish;
- reducing stress with yoga and meditation;
- increasing sleep from 4-5 hours per night to 7-8 hours per night;
- taking necessary vitamins and supplements each day;
- optimizing oral hygiene;

- fasting for a minimum of 12 hours between dinner and breakfast;
- fasting for a minimum of three hours between dinner and bedtime; and
- Exercising for a minimum of 30 minutes, 4-6 days per week.

Coping Strategies:

There are some strategies for coping with the symptoms of memory loss that may be the first hallmarks of this disease. These coping strategies will help relieve the stress and tension that arise from memory problems and can help lessen the impact of such problems on day-to-day life.

- Establishing a regular routine in familiar surroundings.
- Making mental associations, such as using landmarks, to help you find things.
- Repeating names when you meet people.
- Putting important items, such as your keys, in the same place every time.
- Labelling or colour-coding doors and exits to keep from getting disoriented.
- Drawing a map for simple routes; write down directions.
- Making lists, use a calendar, and keep notes of important dates and financial matters.
- Setting realistic daily goals, & staying in frequent contact with family and friends.

BIBLIOGRAPHY

About Michael Morgan - Preventing Alzheimers (2017) Preventing Alzheimers. Available at: https://preventingalzheimers.com/michael-morgan/ (Accessed: 17 November 2024).

Addressing 14 health and lifestyle factors could prevent nearly half of global dementia cases - Alzheimer's Research UK (2024) Alzheimer's Research UK. Available at: https://www.alzheimersresearchuk.org/news/nearly-half-of-global-dementia-cases-could-be-prevented-or-delayed-by-addressing-14-health-and-lifestyle-factors-says-new-report/.

Alzheimer's Association International Conference on Alzheimer's Disease 2010: Abstract 01-06-03. Presented July 11, 2010. Arch Intern Med. 2010;170(13):1135-1141. doi:10.1001/archinternmed.2010.173

Alzheimer's Disease International (2020) Dementia Statistics, Alzheimer's Disease International. Available at: https://www.alzint.org/about/dementia-facts-figures/dementia-statistics/.

Alzheimer's Research UK (2023). Statistics about Dementia. [online] Dementia Statistics Hub. Available at: https://dementiastatistics.org/about-dementia/.

Alzheimer's Society (2019) Causes of frontotemporal dementia, Alzheimer's Society. Available at: https://www.alzheimers.org.uk/about-dementia/types-dementia/frontotemporal-dementia-causes.

Alzheimer's Society (2024). The economic impact of dementia Module 1: Annual costs of dementia. [online] Available at: https://www.alzheimers.org.uk/sites/default/files/2024-05/the-annual-costs-of-dementia.pdf.

Alzheimer’s Disease and Dementia. (2024). Research and Progress. [online] Available at: http://www.alz.org/research/overview.asp.

Arch Neurol. 2009;66(2):216-225. doi:10.1001/archneurol.2008.536.

Banaclocha MM. Therapeutic potential of N-acetylcysteine in age-related mitochondrial neurodegenerative diseases. Med Hypotheses. 2001 Apr;56(4):472-7.

BMC Neuroscience 2008, 9(Suppl 2):S6 doi:10.1186/1471-2202-9-S2-S6

Breitner JC, et al. Inverse association of anti-inflammatory treatments and Alzheimer's disease: initial results of a co-twin control study.Neurology.1994;44(2):227-232.

Bristol.ac.uk. (2024). Alzheimer’s to benefit from landmark MRC-AstraZeneca compound collaboration. [online] Available at: https://www.bristol.ac.uk/news/2012/8908.html

Brookemeyer et. al. ‘Forecasting the global burden of Alzheimer’s disease’ Alzheimer’s and Dementia 2007 Jul; 3(3): 186-91

Ceballos-Laita, L.; Ernst, E.; Carrasco-Uribarren, A.; Cabanillas-Barea, S.; Esteban-Pérez, J.; Jiménez-del-Barrio, S. Is Craniosacral Therapy Effective? A Systematic Review and Meta-Analysis. Healthcare 2024, 12, 679. https://doi.org/10.3390/healthcare12060679

Cenacchi T, et al. Cognitive decline in the elderly: a double-blind, placebo-controlled multicenter study on efficacy of phosphatidylserine administration. Aging (Milano). 1993 Apr;5(2):123-33.

Ciurea, V.A. et al. (2023) ‘Alzheimer’s disease: 120 years of research and progress’, Journal of medicine and life, 16(2), pp. 173–177. Available at: https://doi.org/10.25122/jml-2022-0111.

Cocco T, Sgobbo P, Clemente M, et al. Tissue-specific changes of mitochondrial functions in aged rats: effect of long-term dietary treatment with N-acetylcysteine. Free Radic Biol Med. 2005 Mar 15;38(6):796-805.

De La Cruz JP, et al. Effects of chronic administration of S-adenosyl-L-methionine on brain oxidative stress in rats. Naunyn Schmiedebergs Arch Pharmacol. 2000 Jan;361(1):47-52.

Demarin V. et al, Mediterranean diet in healthy lifestyle…, University Department of Neurology, Republic of Croatia, Sestre milosrdnice University Hospital Center, ZagrebActa Clin Croat 2011; 50:67-77

Dementia A state of the nation report on dementia care and support in England (2013). Available at: https://assets.publishing.service.gov.uk/media/5a7c5719ed915d3d0e87bba8/Dementia.pdf.

Dementia Strategy - Hansard - UK Parliament (2024) Parliament.uk. Available at: https://hansard.parliament.uk/commons/2010-03-16/debates/10031643000001/DementiaStrategy (Accessed: 17 November 2024).

Diagnostics 2020, 10, 427; doi:10.3390/diagnostics10060427 www.mdpi.com/journal/diagnostics

EL Ashby, S Love, PG Kehoe ‘Assessment of activation of the plasma kallikrein-kinin system in frontal and temporal cortex in Alzheimer's disease and vascular dementia’, Neurobiology of Aging, 2010

Ferri, C.P. et al. (2005) ‘Global prevalence of dementia: a Delphi consensus study’, The Lancet, 366(9503), pp. 2112–2117. Available at: https://doi.org/10.1016/s0140-6736(05)67889-0.

foodforthebrain.org. (n.d.). - Food for the Brain. [online] https://foodforthebrain.org/14584-2/.

Forum Nutrition April 2009

Freund-Levi Y, et al. Omega-3 fatty acid treatment in 174 patients with mild to moderate Alzheimer disease: OmegAD study: a randomized double-blind trial. Arch Neurol. 2006;63(10):1402-1408.

Gerdner, L.A., Hart, L.K. and Zimmerman, M.B. (2008) 'Craniosacral Still Point Technique', Journal of Gerontological Nursing, 34(3), pp. 36–45. Available at: https://doi.org/10.3928/00989134-20080301-04.

Gerry (2023). Managing Cognitive Decline - The Health Equation. [online] The Health Equation. Available at: https://www.thehealthequation.co.uk/managing-cognitive-decline/

Giulio, M. P. et al., Metabolic syndrome and the role of dietary lifestyles in Alzheimer's disease Journal of Neurochemistry DOI: 10.1111/j.1471-4159.2008.05454.x, 2008

Glisky, E.L. (2007) Changes in Cognitive Function in Human Aging, Nih.gov. CRC Press/Taylor & Francis. Available at: https://www.ncbi.nlm.nih.gov/books/NBK3885/.

Greco, F. (2020) 'Technical Assessment of Ultrasonic Cerebral Tomosphygmography and New Scientific Evaluation of Its Clinical Interest for the Diagnosis of Electrohypersensitivity and Multiple Chemical Sensitivity', Diagnostics, 10(6), p. 427. Available at: https://doi.org/10.3390/diagnostics10060427.

Harman SM, et al, Longitudinal effects of aging on serum total and free testosterone levels in healthy men. Baltimore Longitudinal Study of Aging. J Clin Endocrinol Metab. 2001;86(2):724-731.

Henderson S.T., Vogel J.L., Barr L.J., et al. Study of the keto¬genic agent AC-1202 in mild to moderate Alzheimer's disease: a randomized, double-blind, +placebo, multicenter trial. Nutr Metab 2009; 6: 31.

Hindmarch I, Efficacy and tolerance of vinpocetine in ambulant patients suffering from mild to moderate organic psychosyndromes. Int Clin Psychopharmacol 1991, Spring;6(1):31-43.

Hindmarch I, Fuchs HH, Erzigkeit H. Efficacy and tolerance of vinpocetine in ambulant patients suffering from mild to moderate organic psychosyndromes. Int Clin Psychopharm. 1991, Spring;6(1):31-43.

Hooshmand et al, Homocysteine and holotranscobalamin and the risk of Alzheimer's disease: A longitudinal study, Neurology October 19, 2010, 75:1408-1414. https://www.alzheimers.org.uk/sites/default/files/2024-05/the-annual-costs-of-dementia.pdf

Huard Y. Proceedings of International Research Conference: Osteopathy in Pediatrics at the Osteopathic Center for Children. Indianapolis, IN: American Academy of Osteopathy; 2005. Influence of the venous sinus technique on cranial hemodynamics; pp. 89–96

Huard Y.,Osteopathe DO. De l'influence de la technique de drainage des sinus veineux sur l'hémodynamisme du crâne, http://academieosteopathie.fr/pmb/opac_css/index.php

Huszár, Z., Engh, M., Pavlekovics, M. et al. Risk of conversion to mild cognitive impairment or dementia among subjects with amyloid and tau pathology: a systematic review and meta-analysis.Alz Res Therapy 16, 81 (2024). https://doi.org/10.1186/s13195-024-01455-2

Important Connections: Brain, Gut and Immune System - Preventing Alzheimers (2017) Preventing Alzheimers. Available at: https://preventingalzheimers.com/important-connections-brain-gut-immune-system/ (Accessed: 17 November 2024).

Innovative care of dementia. (2023). Home - Innovative care of dementia. [online] Available at: http://www.innocareofdementia.com - The History of Alzheimer's

Irigaray, P., Awaida, N. and Belpomme, D. (2024) 'Molecular biomarkers in Electrohypersensitivity and Multiple Chemical Sensitivity: How They Can Help Diagnosis, Follow-Up, and in Etiopathologic Understanding.', Medical Research Archives, 12(1). Available at: https://doi.org/10.18103/mra.v12i1.4771.

J Am Osteopath Assoc September 1, 2010 vol. 110no. 9 suppl 8 S16-S26

Jonas E. Geda, Caloric intake, Aging, and Mild cognitive impairment: A population-Based Study, JAD, Volume 34, Number 2/ 2013,pp501-507, December 12, 2012.

Jóźwiak S., Eric H. Kossoff Dietary treatment of epilepsy: rebirth of an ancient treatment, Katarzyna Kotulska-Jóźwiak, Neurologia i Neurochirurgia Polska 2011; 45, 4: 370–378
King, H. (no date). Available at: https://ehchiro.com.au/wp-content/uploads/2017/06/PRMresearch.pdf

Kumaran S. L-carnitine and DL-alpha-lipoic acid reverse the age-related deficit in glutathione redox state in skeletal muscle and heart tissues. Mech Ageing Dev. 2004 Jul;125(7):507-12.

Lim GP, et al. A diet enriched with the omega-3 fatty acid docosahexaenoic acid reduces amyloid burden in an aged Alzheimer mouse model. J Neuroscience. 2005;25(12):3032-3040.

Lu PH, et al. Effects of testosterone on cognition and mood in male patients with mild Alzheimer's disease and healthy elderly men. Arch Neurol.2006;63(2):177-185.
Lucas A., DO, DHom, DMTC. Lecture notes, 2011-2012

Luengo-Fernandez, R., Leal, J. and Gray, A. (no date). Available at: https://www.alzheimersresearchuk.org/wp-content/uploads/2015/01/Dementia2010Full.pdf.

Malouf R, Vitamin B6 for cognition. Cochrane Database of Systematic Reviews 2003, Issue 4. [DOI: 10.1002/14651858.CD004393]
Marambaud P, Zhao H, Davies P (November 2005). "Resveratrol promotes clearance of Alzheimer's disease amyloid-beta peptides". J. Biol. Chem. 280 (45): 37377–82. doi:10.1074/jbc.M508246200.PMID 16162502.

Martínez M, Hernández AI, Martínez N. N-Acetylcysteine delays age-associated memory impairment in mice: role in synaptic mitochondria. Brain Res. 2000 Feb 7;855(1):100-6.
Matthews F, Brayne C; Medical Research Council Cognitive Function and Ageing Study Investigators. The incidence of dementia in England and Wales: findings from the five identical sites of the MRC CFA Study. PLoS Med. 2005 Aug;2(8):e193. doi:

10.1371/journal.pmed.0020193. Epub 2005 Aug 23. Erratum in: PLoS Med. 2005 Oct;2(10):e389. PMID: 16111436; PMCID: PMC1188245.

McAree, Michael, Dunn, Alexis, Furtado, Jared, Timmerman, Clinton, Winchell, Zachary, Rani, Radhika, Farah, Jennifer and Crispino, Lauren J.. "Osteopathic Cranial Manipulative Medicine and the Blood-Brain Barrier: A Mechanistic Approach to Alzheimer Prevention" Journal of Osteopathic Medicine, vol. 119, no. 6, 2019, pp. e25-e28. https://doi.org/10.7556/jaoa.2019.070

McDaniel MA, Maier SF, Einstein GO. “Brain-specific” nutrients: a memory cure? Nutrition 2003, Nov-Dec;19(11-12):957-75.

Michael Morgan | HuffPost (2024) Huffpost.com. Available at: https://www.huffpost.com/author/media-982 (Accessed: 17 November 2024).

Mishra S, Palanivelu K. The effect of curcumin (turmeric) on Alzheimer's disease: an overview.Ann Indian Acad Neurol. 2008;11:(1)13-19.

Montgomery SA, Meta-analysis of double-blind randomized controlled clinical trials of acetyl-L-carnitine versus placebo in the treatment of mild cognitive impairment and mild Alzheimer’s disease. Int Clin Psychopharmacol. 2003 Mar;18(2):61-71.

Moskalenko YE, Kravchenko TI, Gaidar BV, et al. Periodic mobility of cranial bones in humans. Human Physiology. 1999; 25(1):51-58.

Nakagawa K, Antioxidant effect of astaxanthin on phospholipid peroxidation in human erythrocytes. Br J Nutr. 2011 Jun;105(11):1563-71. Epub 2011 Jan 31.

National Institute of Neurological Disorders and Stroke. (2022). Focus on Alzheimer’s Disease and Related Dementias. [online] Available at: http://www.ninds.nih.gov/current-research/focus-disorders/focus-alzheimers-disease-and-related-dementias?search-term=dementia

National Institute on Aging (2024) What causes Alzheimer’s disease?, National Institute on Aging. Available at: https://www.nia.nih.gov/health/alzheimers-causes-and-risk-factors/what-causes-alzheimers-disease.

Ng TP, Chiam PC, Lee T, Chua HC, Lim L, Kua EH. "Curry consumption and cognitive function in the elderly." Am J Epidemiol. 2006;164:898-906. [PubMed]

NHS (2024) Alzheimer’s Disease, NHS. NHS. Available at: https://www.nhs.uk/conditions/alzheimers-disease/.

Nicoletti VG, Marino VM, Cuppari C, et al. Effect of antioxidant diets on mitochondrial gene expression in rat brain during aging. Neurochem Res. 2005 Jun-Jul;30(6-7):737-52.
Nunzi MG, et al. Dendritic spine loss in the hippocampus of aged rats. Effect of brain phosphatidylserine administration. Neurobiol Aging. 1987 Nov; 8(6):501-10

OPEN full research report - General Osteopathic Council (no date) www.osteopathy.org.uk. Available at: https://www.osteopathy.org.uk/news-and-resources/document-library/research-and-surveys/open-full-research-report/.

Oxford University (2010) Dementia costs UK economy £23 billion a year, Medicalxpress.com. Medical Xpress. Available at: https://medicalxpress.com/news/2010-02-dementia-uk-economy-billion-year.html (Accessed: 17 November 2024).

Pandav R, Belle SH, DeKosky ST. "Apolipoprotein E polymorphism and Alzheimer's disease: The Indo-US cross-national dementia study." Arch Neurol. 2000;57:824-30. [PubMed]

Primary Care Dementia Data, September 2024 (2024) digital.nhs.uk. Available at: https://digital.nhs.uk/data-and-information/publications/statistical/primary-care-dementia-data/september-2024# (Accessed: 17 November 2024).

Ryan, N.S., Rossor, M.N. and Fox, N.C. (2015) ‘Alzheimer’s disease in the 100 years since Alzheimer’s death’, Brain, 138(12), pp. 3816–3821. Available at: https://doi.org/10.1093/brain/awv316.

Scarmeas N., et al, Mediterranean diet and…cerebrovascular disease, Annals of Neurology, Volume 69, Issue 2, pages 257–268, February 2011

Scarmeas N., MD Mediterranean diet, and Alzheimer disease mortality doi: 10.1212/01.wnl.0000277320.50685.7cNeurology September 11, 2007 vol. 69 no. 11 1084-1093

Smith et al, Oxford Project to Investigate Memory and Ageing (OPTIMA), University of Oxford, United Kingdom PLoS ONE | www.plosone.org 1 September 2010 | Volume 5 | Issue 9 | e12244

Soc. 2008

Solfrizzi, V, et al. Current Alzheimer Research, Volume 8, Number 5, August 2011,

Suh JH, Alpha-R-lipoic acid reverses the age-related loss in GSH redox status in post-mitotic tissues: evidence for increased cysteine requirement for GSH synthesis. Arch Biochem Biophys. 2004 Mar 1;423(1):126-35.

Swerdloff RS,. Androgens and aging in men. Exp Gerontol. 1993;28(4-5):435-446

Tadas (2022) The History of Alzheimer’s, Innovative care of dementia. Available at: https://innocareofdementia.com/news/who-was-dr-alois-alzheimer/.

The Alternative Medicine Review December 2011

The Beckley Foundation. (2017). Beckley / Sechenov Institute Research Programme. [online] Available at: https://www.beckleyfoundation.org/science/collaborations/prof-yuri-moskalenko-sechenov-institute-of-evolutionary-physiology-and-biochemistry-st-petersburg-russia/

Theresa E. Gildner, Melissa A. Liebert, Paul Kowal, Somnath Chatterji, J. Josh Snodgrass. "Associations between Sleep Duration, Sleep Quality, and Cognitive Test Performance among Older Adults from Six Middle-Income Countries: Results from the Study on Global Ageing and Adult Health (SAGE)." Journal of Clinical Sleep Medicine, 2014 DOI: 10.5664/jcsm.3782

Tobin, J. (2024) Dementia care, House of Lords Library. Available at: https://lordslibrary.parliament.uk/dementia-care/.

Turgeon JL, et al. Hormone therapy: physiological complexity belies therapeutic simplicity.Science. 2004;304 (5675):1269-1273.

UK Dementia Care Costs Reach £42billion, Alzheimer's Society (2024) www.dementiaresearcher.nihr.ac.uk. Available at: https://www.dementiaresearcher.nihr.ac.uk/uk-dementia-care-costs-reach-42billion-alzheimers-society/.

UK, A.R. (2020). Dementia information - Alzheimer's Research UK. [online] Alzheimer's Research K. Available at: http://www.alzheimersresearchuk.org/dementia-information

Van Gelder BM, et al. Fish consumption, n-3 fatty acids, and subsequent 5-y cognitive decline in elderly men: Am J Clin Nutr. 2007 :85(4):1142-1147.

Vingtdeux V., Therapeutic potential of resveratrol in Alzheimer's disease

Weil, R.S., Costantini, A.A. and Schrag, A.E. (2018) 'Mild Cognitive Impairment in Parkinson's Disease—What Is It?', Current Neurology and Neuroscience Reports, 18(4). Available at: https://doi.org/10.1007/s11910-018-0823-9.

Why women are bearing more of the impact of dementia (no date) Alzheimer's Research UK. Available at: https://www.alzheimersresearchuk.org/news/why-women-are-bearing-more-of-the-impact-of-dementia/.

Wilson, D. et al. (2011) ‘Latest Advances on Interventions that May Prevent, Delay or Ameliorate Dementia’, Therapeutic Advances in Chronic Disease, 2(3), pp. 161–173. Available at: https://doi.org/10.1177/2040622310397636.

Winzer, A. (2020). Could CranioSacral Therapy Help Treat Dementia & Alzheimer’s Disease? [online] Massage Magazine. Available at: https://www.massagemag.com/could-craniosacral-therapy-help-treat-dementia-alzheimers-disease-124040/.

Wnuk, A. (2019). How the brain changes with age. [online] Brainfacts.org. Available at: https://www.brainfacts.org/thinking-sensing-and-behaving/aging/2019/how-the-brain-changes-with-age-083019.

World Health Organization (2023) Dementia, World Health Organization. Available at: https://www.who.int/news-room/fact-sheets/detail/dementia.

www.nhpcanada.org. (n.d.). Craniosacral Therapy for Dementia and Alzheimer’s Disease | NHPC Blog. [online] Available at: https://www.nhpcanada.org/NHPC-Blog/Craniosacral-Therapy-for-Dementia-and-Alzheimers-Disease.

Yang F, et al. Curcumin inhibits the formation of amyloid beta oligomers and fibrils, binds plaques, and reduces amyloid invivo [published online ahead of print December 7, 2004]. J Biol Chem.2005 :280(7):5892-5901

Yian G. et al, Food Combination and Alzheimer Disease Risk: A Protective Diet, Arch Neurol. 2010; 67(6):699-706. doi:10.1001/archneurol.2010.84

Young onset dementia (no date) Alzheimer’s Research UK. Available at: https://www.alzheimersresearchuk.org/dementia-information/types-of-dementia/young-onset-dementia/.

Zandi et al, ArchNeurol. 2004; MaxwellC Dement Geriatr Cogn Disord. 2005; MorrisM et al, AlzheimerDisAssocDisord. 1998; GrayJ AmGeriatr