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Analysis of alleviating memory loss in Alzheimer's disease

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Abstract. There are two types of memory: prospective memory and retrospective memory. The capacity to recall future occurrences is known as prospective memory, whereas the recall of previous events is known as retrospective memory. Individuals with Alzheimer's Disease (AD) typically exhibit a general memory decline. These patients are unable to recall past events and struggle to form new memories. A comprehensive review of a vast body of literature indicates that the recovery of retrospective memory poses a significant challenge and can only be treated through a few simple external stimuli, such as utilizing auditory or olfactory cues, which are familiar to AD patients, to stimulate the recall of relevant memories. In the current research landscape, there are limited options for the recovery of retrospective memory, whereas there are numerous treatments available for the improvement of prospective memory, including the administration of medications and techniques that can specifically target the condition, significantly enhancing the likelihood of recovery in patients.

Keywords: Alzheimer's disease, memory loss, treatments, targeted drugs

1. Introduction

Alzheimer's disease is a neurological disorder that once it manifests, does not go away on its own and requires outside assistance for recovery. As a result, the patient's mental and memory are seriously compromised [1], and memory deficits are frequently among the first indications of cognitive decline in Alzheimer's patients [2]. Should the condition develop, these problems could become considerably more severe. Brain inflammation and oxidative stress are caused by the buildup of tau protein that is hyperphosphorylated in neurons and the deposition of amyloid-β in plaques, and these factors have a basic effect on the progression of the illness [3].

Currently, the limitations of human scientific development in brain diseases have left many unresolved challenges. Research includes the effects of external physical stimulation and sensory therapies on Alzheimer's disease treatment, such as music therapy and olfactory therapy. By utilizing the senses that patients have once been most familiar with, the memory of Alzheimer's disease patients is continuously stimulated. Additionally, research is being done to determine whether exercise can help with memory enhancement and possibly slow down the deterioration of memory in Alzheimer's sufferers. Regarding medicine, attention is mainly paid to αβ [4], soluble and insoluble aggregated amyloid β protein (Aβ) accumulation that may initiate or enhance the pathological process of Alzheimer's disease. Starting from this perspective, an analysis is conducted on multipotent stem cells induced by targeted differentiation schemes, CRISPR/Cas9 technology, and 3D brain organoid models. The aim is to explore whether this issue can be addressed at the genetic level through induced pluripotent

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stem cell (iPSC) technology and whether neural cell regeneration techniques can be employed. Investigating these issues can effectively alleviate the memory problems associated with Alzheimer's disease. A resolution of this problem would constitute a milestone on the path towards conquering Alzheimer's disease. There are many reasons why Alzheimer's disease can't be overcome up to now. The main reason is the lack of understanding of the brain region of the human body, and the inability to accurately locate the relationship between a specific location and symptoms. Although the model constructed by iPSC cannot completely solve this problem, it can greatly improve the efficiency of research.

2. Recovery of reverse memory

2.1. How music therapy helps individuals with AD regain their memory

Related experiments have shown that music therapy is helpful for memory recovery in Alzheimer's patients. By playing familiar or known musical melodies, it is often possible to stimulate the emotions of AD patients and stimulate related autobiographical memories [5]. Some AD patients' memories related to music are often retained [6], which is the key to restoring their relevant memories. Among these types of music, music related to emotions, especially sad music that can evoke AD patients' previous experiences, is the most effective [7].

2.2. Olfactory stimulation

The amygdala is known to have a function in the formation of emotional memory [8], as well as controlling autobiographical memory [9]. The amygdala and olfactory cortex are located close to one another in the brain's spatial hierarchy, which implies that scent is the best way to activate the amygdala [10], therefore causing AD patients to have autobiographical memory. When compared to a scent-free environment, the smell helped AD patients' autobiographical memory to recover [11]. Compared to vision and hearing, the smell is more stimulating. When AD patients smell relevant odors, the retrieval of their autobiographical memory is faster and more explicit [12].

2.3. Exercise

Situational memory creation is heavily influenced by the hippocampus, and situational memory storage is intimately associated with it [13], and the maintenance of hippocampal function is a prerequisite for memory recovery. Exercise can offset the effects of Alzheimer's disease on the hippocampus in patients [14]. By regulating the size of the hippocampus through exercise, which is related to memory, patients' memory will also be correspondingly improved, thereby improving brain plasticity [15], encouraging neural reorganization. Using mice models, researchers have found that exercise can significantly enhance amyloid-β breakdown and clearance, which can successfully treat and prevent Alzheimer's disease [16]. Measurements and surveys in individuals show a relationship between reduced brain amyloid load and physical activity levels [17], indicating a close link between exercise and the degradation of amyloid.

3. The recovery of timely memory

3.1. The use and method of cannabis in Alzheimer's patient care

It is believed that frequent cannabis usage can quickly impair a person's ability to learn and remember things. Nevertheless, cannabis has been shown to dramatically increase the hippocampus's capacity to create new neurons and reduce the buildup of amyloid protein in the most recent Alzheimer's disease rat model [18]. When using cannabinoids for treatment, studies have shown that the combination of multiple cannabinoids has greater potential than a single administration. The interaction between plant-derived cannabinoids and endocannabinoids can provide better anti-inflammatory, antioxidant, and neuroprotective properties [19].

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3.2. Hericium erinaceus

Experimental findings indicate that the ethanol extract from Hericium erinaceus, characterized for its antioxidant properties, exhibits both preventive and therapeutic potential against memory deficits in AD-afflicted zebrafish [20]. The aforementioned observation implies that Hiericium erinaceus has exhibited therapeutic efficacyin the treatment of AD, or Alzheimer's disease. Clinical studies conducted by researchers have demonstrated that Hericium erinaceus has therapeutic potential, maybe helping AD patients with their memory [21].

3.3. Medication

Alzheimer's disease-related memory loss is also caused by neuronal death in the cerebral cortex and hippocampus, in addition to alterations in particular neurotransmitters [22]. Therefore, drugs are needed to stimulate the brain to produce new neurons to restore connections between them. Currently, only sodium oligomannate capsules are known to have modest memory-enhancing effects in clinical trials. Furthermore, research has demonstrated that in a patient with severe memory deficit, the use of donepezil hydrochloride for three years resulted in minimal therapeutic benefit. Subsequently, the medication was changed to memantine hydrochloride tablets, which provided only superficial control of the condition for a short duration. It was only with the administration of sodium oligomannate capsules that the patient's condition was managed, and the rate of memory loss decelerated. Although no improvement was observed, this medication effectively stabilized the patient's condition [23].

3.4. Intranasal insulin

Intranasal insulin is a promising hormone for improving memory. Its administration characteristics allow it to rapidly cross the blood-brain barrier, reaching neural regions within one hour of administration. This results in minimal absorption of the hormone by the body, representing a significant advantage [24]. By inducing synaptic plasticity, it can help Alzheimer's disease (AD) sufferers regain their memory. Additionally, insulin signaling in the brain has a role in memory function [25]. Clinical trials have successfully demonstrated that long-term administration can improve memory function [26].

4. Study on the application of Alzheimer's disease technology

4.1. Stem cells with induced pluripotency (iPSC)

Although there has never been a pause in clinical research on Alzheimer's patients, there are very few positive outcomes. The biggest challenge is that the structure of the human brain is too complex, and researchers cannot accurately understand the function of the brain. Currently, the only FDA-approved AD treatment that targets cholinergic and/or glutamatergic neuronal function can only provide short-term cognitive benefits [27], but will not change the course of disease or potential neurodegeneration [28]. This indicates that current models are not sufficient and need further improvement. This requires the emergence of new technologies to simulate brain models, and pluripotent-induced stem cells are promising for establishing more accurate models [29].

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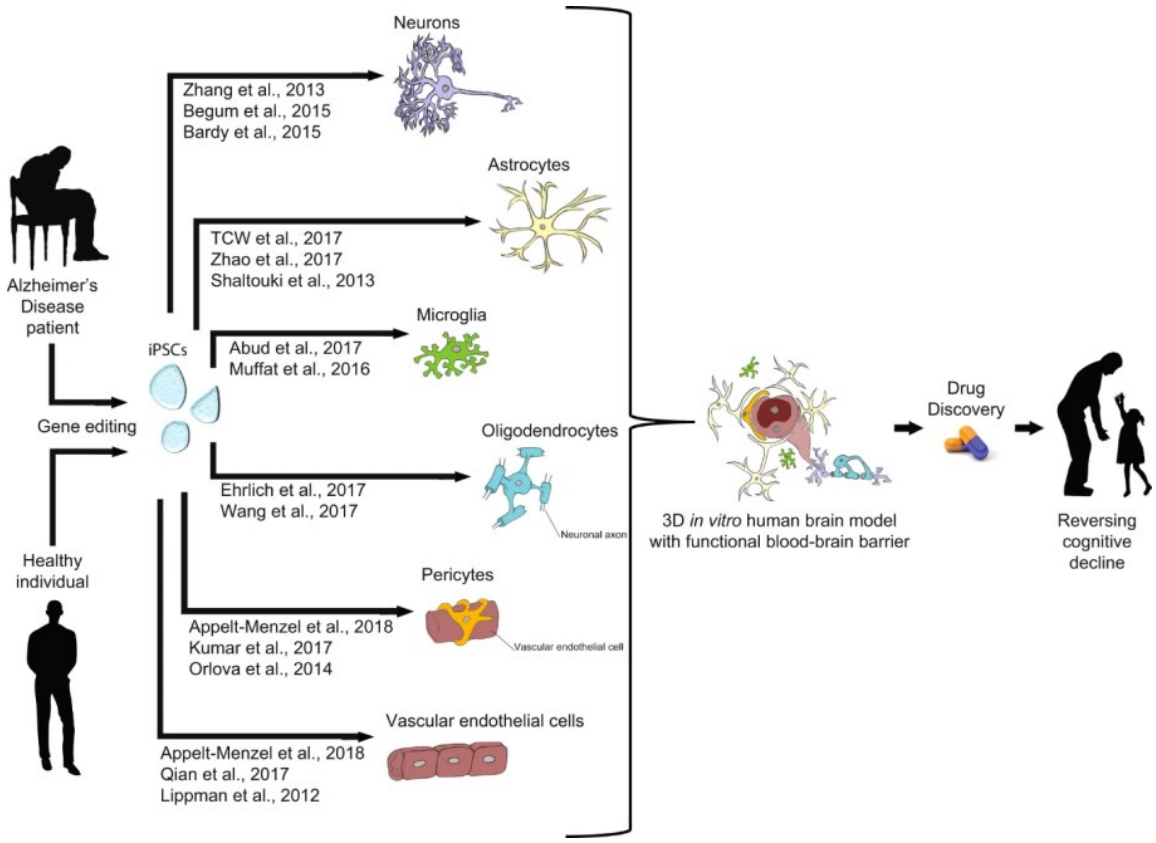

Figure 1. The Technical Process of iPSC [29]

Figure 1 is the operation process of iPSC. This technology can be used to effectively treat this disease. The establishment of an extracerebral model by induced pluripotent stem cell (iPSC), through the extraction of somatic cells from AD patients, reprogramming them into iPSC, and subsequently stimulating their maturation into primary brain cell types for scientific study, making it possible to more precisely examine how AD-related diseases or mutations impact them. Then, by modifying the mutated genes through gene editing technology, correcting AD-linked mutations, and observing whether it is effective.

Alzheimer's disease is known to have a genetic risk factor associated with the ApoE4 allele. Research has employed induced pluripotent stem cell (iPSC) technology to examine the effects of APOE4 on human brain cell types. This study elucidated the mechanism of action of APOE4 in the human body, a finding that is inseparable from the powerful and useful tool provided by human APOE isogenic iPSCs.

4.2. Neural regeneration therapies

Stem cell treatment applied to Alzheimer's disease. Sources of different kinds of stem cells that can be utilized for the creation of therapeutics include patients, healthy donors, and proliferators of embryonic stem cells. A wide range of procedures, including isolation, genetic modification, medication screening, and testing on mice and other species, may also involve stem cells. Eventually, BA patients receive stem cells, which are then employed for therapy.

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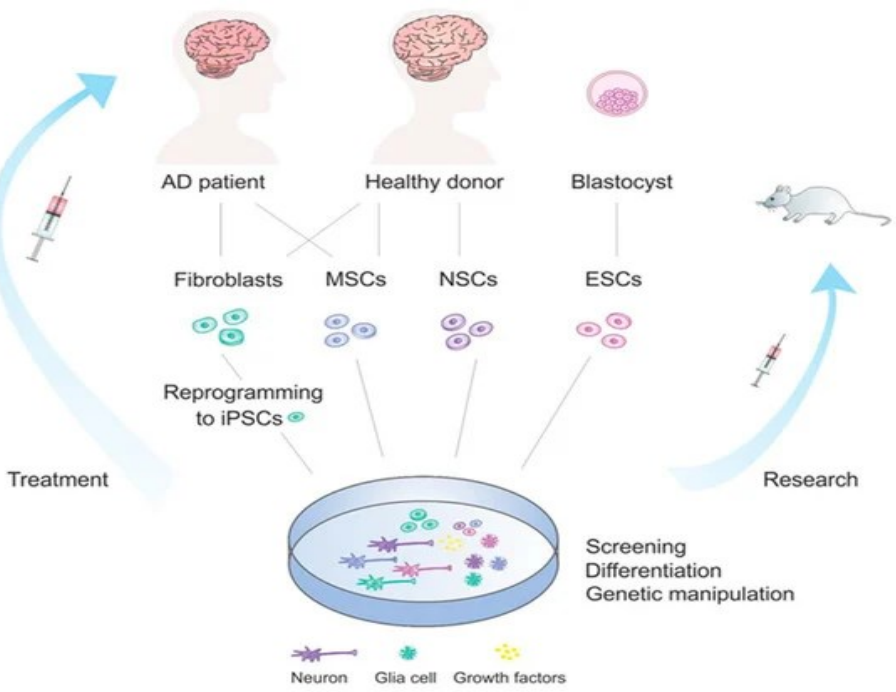

Figure 2. The Process of Neural Regeneration Therapy [30]

Therapy for neural stem cells, which have the capacity to produce new neurons and self-renew such neurons, oligodendrocytes, or astrocytes, is the mainstay of neural regeneration therapy [31]. Figure 2 is the process of nerve regeneration.Stem cells are used in the process of nerve cell regeneration. In related studies, the transplantation of human neural stem cells into mice's brains resulted in a decrease in tau phosphorylation and a drop in amyloid-β, levels, a protein strongly associated with Alzheimer's disease. As a result, there were more neurons and synapses. significantly enhancing the likelihood of memory recovery. This experimental finding also suggests that multiple mechanisms within the mouse model regulate various pathological features of Alzheimer's disease, thereby rescuing impaired memory [32].

5. Conclusion

A large number of literature show that it can completely restore the memory ability of AD patients and the episodic memory of former patients, which can not be achieved with the current level of technology and the degree of Alzheimer's disease research. We can only alleviate the memory loss of AD patients and restore the episodic memory of some patients in some ways, but the effect is very limited. There is almost no way to restore the reverse memory, which can only be stimulated by some external stimuli. According to research, patients' olfactory memory is often more effective than vision and hearing.

In terms of treatment, it is suggested that physical therapy and drug therapy should be used in parallel to achieve better results.

Using drugs to stimulate the hippocampus, inhibit the target, and then wake up the patients' involuntary memory with music therapy and olfactory therapy, which is more conducive to the recovery of patients' memory. The use of iPSC technology to establish a human Alzheimer's disease model is more conducive to the investigation into Alzheimer's disease. In order to help people regain their memories, it can also be used to better understand the disease's symptoms and develop targeted, screening, and even genetically-based treatments for the condition. Since neuronal degradation is the primary cause of memory loss in Alzheimer's patients, nerve cell regeneration technology holds great promise. The deposition of starch protein and other problems due to age. If these cells can be regenerated, this situation will be completely improved.

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