

Music as a Viable Therapeutic Treatment Option for Alzheimer's Disease

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Abstract

As the fifth leading cause of death in age group >65 years, Alzheimer's has taken the livelihood of millions of people, and this number keeps going up. Currently, the scientific community has turned to medication based treatment in order to decrease the presence of the negative symptoms that Alzheimer's entails. However, one might say these efforts are at no avail, as the number of cases is on a track of exponential growth. People with the disease face a plethora of mental health disorders, and the caregivers and the loved ones of these people are living in suffering. Instead of trying to tackle the disease head-on, health care professionals and caregivers are exploring the efficacy of non-pharmacologic treatments, such as music-based intervention programs. This article seeks to explore findings in the field, analyze them and propose methods of implementation.

Keywords: Alzheimer's disease, Music; Dementia; Non-pharmacologic intervention

Pathology of Alzheimer's Disease

Alzheimer's disease is an extremely debilitating neurodegenerative disease that results in gradual but severe loss, cognitive function decline, loss of personality and inability to perform basic tasks necessary for everyday life [1]. Currently, the precise cause of this disease is unknown, but researchers have found a strong correlation between the presence of amyloid plaques as well as hyperphosphorylated tau protein clusters (known as neurofibrillary tangles) with Alzheimer's disease. These amalgamations of proteins interact with physiological structure of the brain in an unknown manner and ultimately contribute to development of Alzheimer's [2] (Figure 1).

Considering that the specific cause of the disease is unknown, drug development companies and researchers have been focused on utilizing symptomatic therapies. These drugs and treatments objectively resolve some of the symptoms of a disease, rather than The direct cause. Most doctors and healthcare providers are prescribing drugs that act as cholinesterase inhibitors, such as donepezil and galantamine, for people with varying degrees of severity of Alzheimer's and other forms of dementia [3,4]. There is a plethora of other drugs being constantly tested, but the effectiveness and safety of them are still in question. Moreover, many antipsychotics prescribed to Alzheimer's patients have been linked to causing higher mortality [5]. Surprisingly, many people with Alzheimer's become more prone to mental health issue as a

side-effect of taking these medications, because of the constant physical side effects that occur such as diarrhoea, nausea and vomiting [6].

As a result of the many abnormalities present in the brain from the pathology of Alzheimer's, researchers are still in debate about how to approach future treatments, specifically pertaining to the timeline of cognitive decline. Medication with the goal of targeting different physiological abnormalities is currently underway in the development process. In the meantime, however, it is of utmost importance to preserve the emotional wellbeing of patients, as many people with Alzheimer's are greatly suffering from a mental health issues that researchers are touting the potential efficacy of integrating music as an alternative therapy to help treat Alzheimer's [7].

Current Research on Music and Alzheimer's

Many researchers who have opted to treat Alzheimer's with a more holistic approach in mind draw inspiration for potential therapies by focusing on the emotional, rather than the physiological state of Alzheimer's patients. This has led them to conduct a variety of quasi-experimental trials, randomized control trials, and other intervention studies on therapies like group reminiscence therapy, pet therapy, music therapy [8,9]. However, there has been some evidence that music might act as a significant non-pharmacologic intervention.

One of the most popular reasons why music has been selected as an effective therapy is due to its unique relationship with a person's memories. Researchers specifically believe that music engages memory centers that separate from the traditional memory centers of the brain [10,11]. This relationship between music and memories has been well documented and became an integral component of Oliver Sack's work. Sacks, a highly acclaimed neurologist, were one of the figures in the application of music to treat Alzheimer's. In the media, he has starred and created many documentaries and shows which showcase how

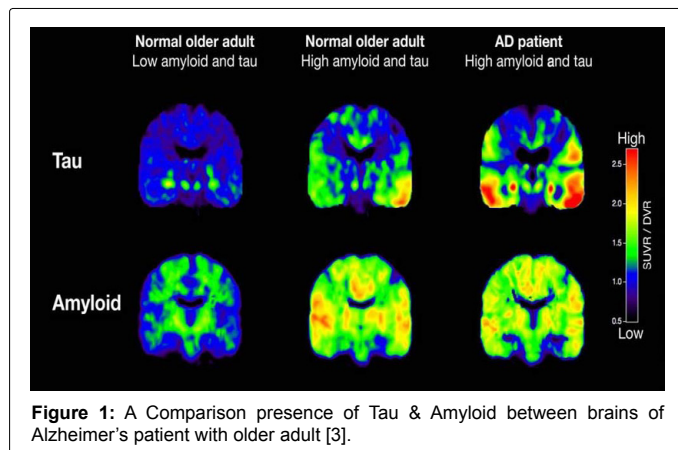


Figure 1: A Comparison presence of Tau & Amyloid between brains of Alzheimer's patient with older adult [3].

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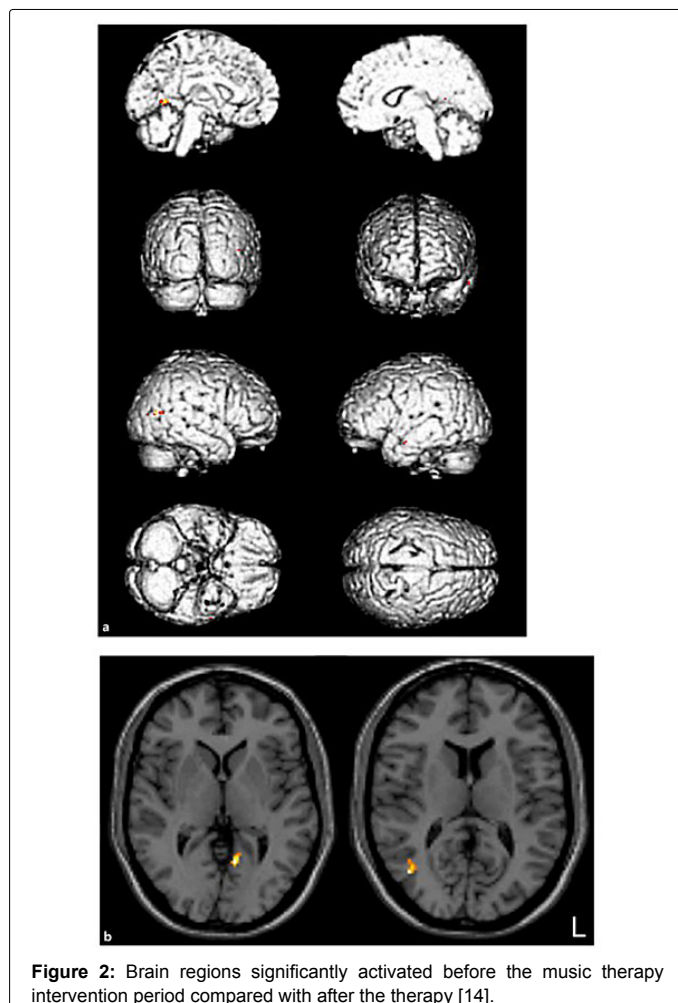
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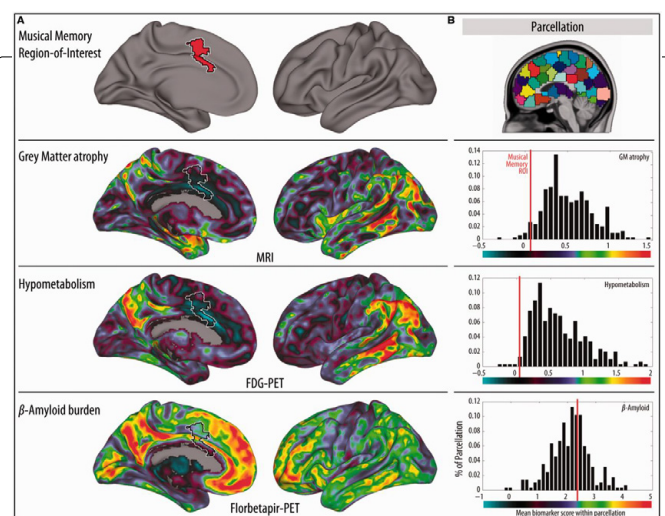
incredible the anecdote evidence for music therapy is. Notably, he has been featured in prominent documentaries such as *Alive Inside*. These forms of media have been critical in shedding light on the potential that music brings to the table in terms of treating Alzheimer's. In many cases, people with Alzheimer's who were otherwise sedentary or non-reactive to stimuli, were able to carry out full conversations with caregivers about their past, especially childhood experiences and memories with strong musical associations. Comprehensive review of research literature supports this. Researchers suggest that the "emotional resonance" of music essentially transports people to specific memories by utilizing the pre-existing structures in our brain that makes us feel good [11].

To explain the presence of these memory associations, researchers have been extensively digging to find out what is occurring on a physiological level. By utilizing imaging tools, such as functional MRIs and pet scans, scientists have been able to get a grasp of the degree to which music affects the neurophysiology of Alzheimer's patients. A study was conducted to investigate the effect of music on cognitive function in Alzheimer's disease using singing training. The result of this study shows that patients were able to talk properly and tell a joke. A patient who could not operate his cell phone for a year regained the ability to use it again changes within themselves. Another caregiver told of a patient who had forgotten his daughter's name for a long time, but was able to remember it and call her name again. The caregivers also reported that they felt changes within themselves [12,13] (Figure 2).



A study was conducted to learn about how muscle memory can be preserved in Alzheimer's disease. From the result it was concluded that as seen in the figure 3(A) the muscle memory region is almost spared in Grey Matter atrophy, Hypometabolism and beta-Amyloid burden. In the figure 3(B) the biomarker values have been shown. The musical memory region has low value of biomarkers compared to other regions of the brain [14]. This supports the suggestion of Baird and Samson that mostly implicit musical memory might be spared in Alzheimer's disease and thus our study gives a possible explanation for the preservation of long-term musical memory after severe bilateral temporal lobe damage (as in Alzheimer's disease), since we show that long-term musical memory representations heavily rely on ventral pre-SMA and the caudal anterior cingulate gyrus. Areas of musical memory shows least degeneration out of all areas of brain. This strongly suggests that using Music therapy can be useful in stopping further degeneration in brain, if not cure [15] (Figure 3).

According to research done regarding the neurophysiological effects of music, music activates a variety of different system in the brain corresponding to different functions at the same time. Parts of the brain controlling fine motor movements. Haptic feedback and emotional arousal all activate at once when listening to music [16]. Part of the reason why scientists believe that music allows for increased communication in patients with Alzheimer's is because it enhances speech, verbal interpretation and attention span. Due to so many cognitive functions being utilized and activated at the same time, when listening to music, patients experience a wide range of benefits for a



a: Surface maps; b: Axial images; L=Left

Figure 3: (A) Qualitative comparison between Alzheimer's disease biomarker maps and the musical memory region. The top row shows the musical memory region of interest (red) on a 3D brain render. The musical memory region of interest is shown as a white coloured contour in rows two to four, overlaid on the W-score biomarker maps. The second-row shows rendered surfaces and overlaid W-score maps of cortical atrophy. The third row displays the hypometabolism W-score map analogous to the second row. The bottom row shows amyloid-β deposition as W-score maps accordingly. Colour scales were adapted to each biomarker map and are presented under each corresponding histogram. (B) For a quantitative comparison, we computed the mean biomarker values inside of the musical memory region of interest and the mean biomarker value within other regions of interest of similar size accordingly. A view of the parcellation mask is shown in the top row on the right side. In the three histograms below, each black bar represents the frequency of parcels (y-axis) with a certain mean biomarker value (x-axis). The red line depicts the mean biomarker value within the musical memory region of interest. Each histogram shows the corresponding biomarker (e.g. the top one depicts the grey matter atrophy). GM = Grey Matter [15].

considerable amount of time even after listening music.

Implementation of Music into Alzheimer's Treatment

A variety of methods have been proposed pertaining to precisely how music should be implemented into Alzheimer's care. One method in particular covers the specific genres of music that yielded the best results among patients [17]. In a study published in 2020, this specific subject matter was extensively researched (Figure 4).

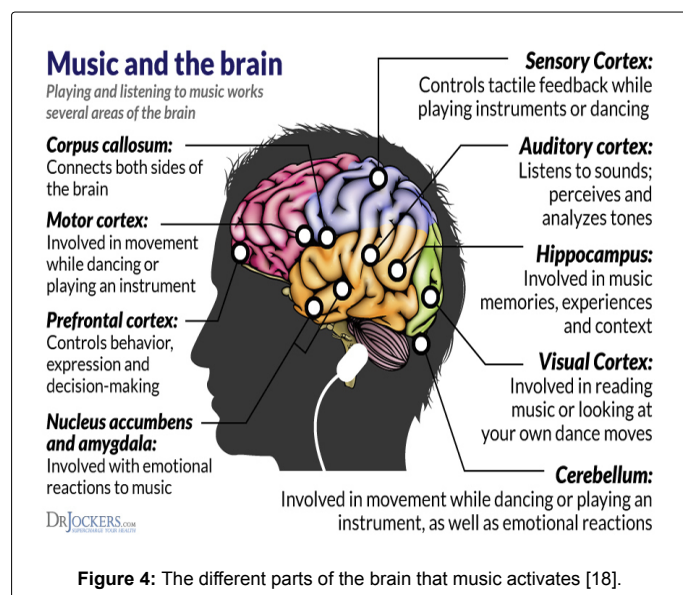


Figure 4: The different parts of the brain that music activates [18].

Researchers determined how multicultural music imparts six key aspects in a socioeconomically, culturally, and cognitively diverse community and older adults. After combing through hundreds of recorded interactions that people with Alzheimer's had with music as well as interviews with study participants, researchers were able to come to a key conclusion. Religious music, especially that of which was exposed to that person with dementia at a young age greatly improved cognitive function, communication skills and triggered better relationship building between them, loved ones and caregivers. In order to reap these benefits however, the environment of the patients should be carefully curated.

Whether the patient is living in an assisted living facility or memory care center, it is imperative that the music they are exposed to is personalized to yield the best results. Though either family or friends, caregivers need to discern the patient's favourite type of music from different period of their life. The reason musical memory seems to be extraordinarily unique is because of the strong emotional connections that are formed between events, the songs, and emotions experienced during that time. This consequently results in relatively vivid recollections and periods of reminiscence that these patients would regularly not be able to understand. Within these personalized playlists, music connecting to that person's faith and religion should be included. The study mentioned in the previous paragraph above supports this assertion, as it has been found that listening to this type of music reinforces self-identity and values, therefore allowing for better emotional stability and elevated mental wellbeing. Interesting studies have also been done to determine the effects that music and meditation have on certain biomarkers in people's blood that exhibited high practice adherence to intervention (Kirtan Kriya Meditation and Classical music listening) saw significant increase in telomerase

activity, telomere lengths and higher levels of A-beta peptides, all of which result in higher cognitive function, less stress and an overall higher quality of life [18].

To create similar results that participants in the program have experienced, it could be highly beneficial for memory care homes to implement these interventions as actual therapies, rather than for research purpose. Even if they follow the exact same intervention methodology that was performed in the aforementioned research, people suffering from Alzheimer's are highly guaranteed to experience positive benefits. These benefits can be expounded by using personalized music instead of standardized classical music. As shown by the research I have conducted, this will not only physiologically improve the patient but will greatly increase their emotional wellbeing.

Conclusion

With Alzheimer's becoming one of the greatest pathological threats that humanity faces, it is all more important to take a chance with other symptomatic therapies that are not all pharmacologic interventions. This has the potential to drastically increase the quality of life people suffering from Alzheimer's and is blocked by substantial empirical research and findings. Although some dismiss the benefits as pseudoscience, it is time to get serious about utilizing non-pharmacologic interventions like music that have been proven to be successful and to help in the treatment of Alzheimer's. It might not be the perfect cure, but at least we can allow people with the disease to lead more peaceful and happier lives.

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