

# The effects of art therapy on Parkinson`s and Alzheimer`s disease

## Učinci art terapije na Parkinsonovu i Alzheimerovu bolest

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**Abstract.** Art therapy is one of the non-pharmacological treatment modalities for many diseases, including neurological and psychiatric disorders. Adrian Hill started art therapy in the 1940s. Parkinson`s disease is one of the progressive neurodegenerative diseases characterized by various motor and non-motor symptoms. As patients with Parkinson`s disease often report low quality of life despite improving their motor symptoms, complementary therapy may reduce their difficulties. Music and dance therapy, clay manipulation therapy, and tai chi training have promising results. There is also art therapy for one of the most common causes of dementia worldwide, Alzheimer`s disease. In addition to standard pharmacological treatment for Alzheimer`s disease e.g. cholinesterase inhibitors, music and visual arts therapy are evolving. This article presented some of the art therapy methods used in the most common neurodegenerative disorders, Parkinson`s and Alzheimer`s. In addition, we also presented some of the limitations of those studies. Some of the limitations are as follows: small sample size, relatively short duration of therapy sessions, and the fact that it is doubtful that art therapy could improve symptoms and cognitive abilities of people with advanced forms of neurodegenerative disorders.

**Key words:** Alzheimer disease; art therapy; basal ganglia; dementia; Parkinson disease; quality of life

**Sažetak.** Art terapija jedna je od nefarmakoloških metoda liječenja mnogih bolesti, pa tako i neuroloških i psihijatrijskih. Adrian Hill započeo je provođenje art terapije u četrdeset godinama dvadesetog stoljeća. Parkinsonova bolest progresivna je neurodegenerativna bolest koju obilježavaju brojni i raznoliki motorički i nemotorički simptomi. Pacijenti koji boluju od Parkinsonove bolesti često imaju slabiju kvalitetu života unatoč poboljšanju motoričkih simptoma, a komplementarna terapija potencijalno može umanjiti njihove tegobe. Terapija glazbom i plesom, terapija glinom i *tai chi* trening daju obećavajuće rezultate. Također, postoji i art terapija za jednu od najpoznatijih i najčešćih vrsta demencija, Alzheimerovu bolest. Uz standardnu farmakološku terapiju za liječenje Alzheimerove bolesti poput inhibitora kolinesteraze, u posljednje vrijeme razvijaju se i različiti oblici art terapije poput terapije glazbom. U ovome radu predstavili smo neke od oblika art terapije koji se koriste u najčešćim neurodegenerativnim bolestima, Parkinsonovoj i Alzheimerovoj bolesti. Također smo prikazali i određena ograničenja studija o učinku same art terapije, kao što su mali uzorak ispitanika, relativno kratko trajanje terapijskih procesa te činjenica da nije izgledno da art terapija može pomoći ljudima koji već boluju od uznapredovalog oblika neurodegenerativne bolesti.

**Ključne riječi:** Alzheimerova bolest; art terapija; bazalni gangliji; demencija; kvaliteta života; Parkinsonova bolest

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## ART THERAPY AND PARKINSON'S DISEASE

### Parkinson's disease

Parkinson's disease (PD) is a progressive neurodegenerative disorder that manifests with various motor and non-motor symptoms<sup>1</sup>. The disease was first described by James Parkinson in 1817, and it was named "paralysis agitans." Later in the 19th century, Charcot named it "Maladie de Parkinson" in French, or PD in English<sup>1,2</sup>. The incidence of PD is rapidly increasing as the population is getting older, and PD is typically a neurological disease of seniors<sup>3</sup>. The prevalence of PD in people over 60 is 1 out of 100. The entire population's prevalence is 1-2 out of 1000<sup>4</sup>.

One of the cardinal neuropathological features of PD is the loss of dopaminergic neurons in the substantia nigra (pars compacta) and striatum. Neurotransmitter dopamine and basal ganglia are essential components of the brain for movement coordination and control. As dopaminergic neurons degenerate and dopamine levels decrease, it becomes tough to regulate movements, and typical motor symptoms of PD start to arise<sup>5</sup>. The most crucial motor signs of PD are bradykinesia, resting tremor, rigidity, and postural reflexes loss<sup>1</sup>. In addition to those motor symptoms, people who suffer from PD experience many non-motor symptoms, e.g. neuropsychiatric and neurovegetative symptoms. Even though non-motor symptoms are increasingly recognized<sup>6</sup>, dopaminergic drugs do not effectively control them. Some of the neuropsychiatric symptoms seen in PD patients are anxiety, depression, cognitive impairment, and those symptoms deteriorate their quality of life significantly<sup>7</sup>. Fatigue is a commonly reported symptom in PD patients with a prevalence of 40 to 80%. In addition to that, many PD patients (up to 85%) experience pain<sup>8</sup>. In some studies, pain has been described as a significant contributor to the lower quality of life<sup>8</sup>. Studies have shown that approximately 40% of PD patients suffer from anxiety and around 35% of patients suffer from depression, which is a significant concern<sup>9</sup>.

### Art therapy and Parkinson's disease

Art therapy is a form of complementary therapy based on the idea that every person can creative-

ly express themselves through art-making. The art product is not as important as the process of art therapy that is meant to improve a patient's quality of life. Art therapy is also a form of non-verbal communication between the feelings and thoughts of an individual. It can help people verbalize their problems and feelings<sup>10</sup>. This form of complementary therapy can potentially help individuals of all age groups. It is used to encourage personal growth, help the person understand his problems and aid their emotional restitution<sup>10</sup>.

Art therapy is one of the non-pharmacological treatment modalities for many diseases including neurological and psychiatric disorders. Different types of art therapy (music and dance therapy, tai chi training, clay manipulation therapy) can improve the quality of life of patients that suffer from Parkinson's disease and Alzheimer's disease.

Throughout history, art therapists have worked with people who suffer from neurological and psychiatric disorders and oncology patients, people with AIDS, tuberculosis, asthma, and different kinds of trauma<sup>10</sup>. Adrian Hill started art therapy in the 1940s, and it originated from both psychotherapy and art. He started art therapy sessions on patients with tuberculosis and continued to work with people suffering from post-traumatic stress disorder (PTSD)<sup>11</sup>.

Pharmacological treatment like levodopa/carbidopa therapy is usually not enough for patients with PD. Those medications effectively treat their motor symptoms such as resting tremor and rigidity, but they do not affect non-motor symptoms like depression and anxiety. That is why complementary therapy (exercise, physiotherapy, art therapy) is so essential<sup>12</sup>. Patients with PD often report a low quality of life even when pharmacological therapy reduces their motor symptoms<sup>7</sup>. Complementary art therapy has a lot of various modalities, such as music therapy, dance therapy (especially Argentine tango dance therapy), clay manipulation therapy, tai chi training, and some other art therapy modalities<sup>13</sup>.

Studies have shown that listening to music and playing instruments positively impacts a patient's

quality of life<sup>9</sup>. Music therapy can improve and recover gait, balance, and postural instability in PD patients<sup>9</sup>. The most frequent modality of music therapy interventions is sound/music improvisation, where a therapist and a patient interact while playing musical instruments. In that way the patient can more easily express his/her feelings. The neuroscientific background of music therapy efficacy is the activation of the limbic system, and especially the brain reward system<sup>9</sup>. Music therapy can be subdivided into relational and rehabilitative therapy. Relational music therapy promotes empathy, communication, and building a strong relationship between the patient and a therapist. In contrast, rehabilitative therapy aims to improve the cognition and predominantly motor symptoms of the disease<sup>9</sup>. There are many different forms of music therapy performance, and some of them are as following: music relaxation, different kinds of music therapy sessions such as voice exercises, singing in a choir, performing rhythmic and free body movements which can improve quality of life over time<sup>9</sup>.

Except for music therapy, dance therapy is also very popular in the field of art therapy. Although the long-term effects of therapeutic dancing have not yet been confirmed, studies have shown that people who participated in dance therapy enjoyed that activity, and beneficial effects on quality of life were evident<sup>13</sup>. It is also important to emphasize positive effects on mobility and balance in people who suffer from PD. Compared to conventional physiotherapy, dance therapy had higher adherence (78 to 91%), compliance, and satisfaction of participants<sup>13</sup>. An interesting example of dance therapy is PD patients' participation in tango classes for 13 weeks. Tango lessons were composed of many different exercises such as balance, stretching and footwork exercises, tango-style walking, and dancing. People were dancing both alone and with a partner. While dancing with a partner, they learned to dance both following and leading roles in tango, regardless of gender<sup>14</sup>. Those studies had limitations, such as relatively small sample size and the problem that patients involved in these studies suffered from a mild or moderate PD. There is no

evidence of dance therapy effectiveness in people with severe PD<sup>13</sup>. Recent studies have shown that Argentine tango lessons may improve self-esteem and quality of life in general<sup>14</sup>. Tango may help PD patients in a way that emphasizes turning movements, balance, and initiation of movements. Initiation of the movement and turning moves are especially difficult for PD patients. All of these exercises are extremely useful for PD patients and older adults in general. Group dancing and socialization may increase motivation and improve the patient's mood and symptoms<sup>12,14</sup>.

One famous study showed the effects of tai chi training, which is a successful method for reducing the number of falls and improving balance in PD patients<sup>15</sup>. Research has also shown that regular therapy sessions of clay manipulation may reduce stress in patients and improve their motor symptoms, such as tremor<sup>5</sup>. Somatic and psychological improvement is seen in patients and their caregivers, which is incredibly significant and important<sup>5</sup>. One of the critical aspects of art therapy and art-making is that the patient can be distracted from the disease and his problems. In that way distress levels may decrease<sup>3</sup>. Clay manipulation therapy may improve motor symptoms of PD like tremor, speech difficulties or dysarthria, stiffness, and fatigue, but it can also help people to feel better and happier, increase their self-esteem and improve their social interactions and social skills<sup>3,5</sup>. In clay manipulation therapy, participants were given four little clay balls, each a different color. After choosing the color, they were asked to squeeze the ball ten times in one hand, then do the same with the other hand. Afterward, they had to tear the clay ball into pieces and model some other shape (excluding the ball). Following the clay manipulation session, people were asked about their experience with the therapy. Before and after the clay manipulation session, participants had to complete a Brief Symptom Inventory (BSI). BSI is one of the psychological screening tools for symptoms overview in patients<sup>5</sup>.

Brain plasticity is one of the possible mechanisms underlying behavioral changes, so one of the potential mechanisms of art therapy efficacy is brain plasticity. It has been shown that brain cir-

uits are continuously changed and shaped by learning and even structural changes are found in the brain's gray matter. Animal studies have shown that even white matter microstructure can change due to training and exercise<sup>16</sup>. As brain plasticity and plastic changes in the brain are long-term processes, it is not likely that short-term art therapy interventions will help patients permanently<sup>17</sup>. In addition to that, one more potential physiological mechanism for explaining the art therapy efficacy except brain plasticity is the neurotransmitter dopamine's role. Dopamine is a neurotransmitter produced in the substantia nigra (pars compacta) and the ventral tegmental area of the brain, and it can modulate the activity of neurons in the prefrontal cortex, limbic system, and striatum<sup>18</sup>. One study showed the effect of the neurotransmitter dopamine on one person's ability to enjoy listening to music<sup>19</sup>. Participants of the study were given the dopamine precursor (levodopa), dopamine antagonist (risperidone), and placebo (lactose) while listening to music. By measuring pleasure responses, it was shown that levodopa which transformed to dopamine, increased the pleasure while listening to soothing music. Dopamine antagonist risperidone showed the opposite effect – it diminished the feeling of satisfaction while listening to music<sup>19</sup>. One study showed that listening to good music could promote dopamine release in the striatum and nucleus accumbens septi, a part of the brain reward system. Positron emission tomography (PET) scan of the brain was used in the study mentioned above<sup>20</sup>.

Furthermore, the Feldenkrais method and Alexander technique are complementary treatment modalities worth mentioning. Moshe Feldenkrais, the Russian electrical engineer, and physicist developed one of the complementary treatment modalities for PD patients, called the Feldenkrais method<sup>21</sup>. The center of interest of this method is the awareness of the patient's body through movement<sup>22</sup>. Feldenkrais method should be taught while the patient is in the horizontal position to lessen the gravity effect. People usually learn how to roll and crawl during the Feldenkrais method session<sup>21</sup>. It was shown that patients who were practicing Feldenkrais method-based

exercises had a better quality of life. Their score for quality of life was higher than in a control group. Their depression rate was much lower and the Mini-Mental State Examination (MMSE) score was higher after receiving the treatment. The rate of depression in PD patients was measured by the Beck Depression Inventory (BDI), which is a questionnaire that measures the severity of depression. Cognitive status was measured by MMSE with 11 different questions<sup>21,22</sup>. It is essential to emphasize some limitations of this study. The process of recruiting neurological patients in the study mentioned above was challenging because of the drop-out. Furthermore, the follow-up of those patients was not long enough to see their progress<sup>22</sup>.

An additional treatment modality similar to the Feldenkrais method is called the Alexander technique. An Australian teacher and actor F. M. Alexander, founded that method while dealing with his voice problems and trying to cure himself<sup>21</sup>. Alexander technique is usually taught while the patient is sitting in front of the mirror. The therapist guides the patient through standing, sitting, and lying down while watching themselves in the mirror. The idea is to help the patient maintain his position using vision instead of just proprioceptive information from muscles and joints<sup>21</sup>. Alexander technique emphasizes the importance of inhibition in changing daily movements. Sessions are held individually, in front of the mirror<sup>21</sup>. Alexander technique usually improves postural stability and movement, especially the movement's initiation in patients with PD<sup>23</sup>. Alexander technique's goal is to produce a controlled, functional movement. In the Feldenkrais method, the goal is a spontaneous movement. Both methods are movement reeducation techniques in which the patient and therapist act as students and teachers<sup>21</sup>.

One more severe problem for PD patients is dysarthria. It is estimated that around 70% to 90% of PD patients suffer from speech disorders, and just 37% of them receive a speech therapy to alleviate their symptoms<sup>24</sup>. Dysarthria associated with PD can be treated with speech therapy or surgically by deep brain stimulation (DBS) of the subthalamic nucleus. One of the complementary

speech therapies is called the Lee Silverman voice treatment (LSVT) and it is widely used in patients with idiopathic PD. The main characteristic of that therapeutic modality is great effort vocalization<sup>24,25</sup>. The LSVT aims to improve and increase the adduction of vocal folds and in that way improve vocalization and loudness of voice. LSVT therapy consists of speech and non-speech drills. Speech drills consist of diverse speech tasks starting from repeating single words to whole sentences and at the end to conversational speech. On the other hand, in non-speech drills, patients (participants) have to pronounce 'ah' phonation starting from low pitched voice and moving to a high pitch. After finishing the task, they have to pronounce it vice versa, from high pitched to low pitched voice<sup>26</sup>. LSVT improves the voice's loudness and reduces negative aspects of speech such as a monotone, hoarse voice. The primary intent of the LSVT is to enable patients to speak better and with fewer difficulties in their everyday life<sup>24</sup>. Voice Handicap Index (VHI) was used in the study to evaluate the effects of treatment on dysarthria. VHI is made of 30 different questions that evaluate speech problems' physical, emotional, and functional aspects. Studies have shown that LSVT improved the VHI score<sup>24</sup>. Limitations of this study were the small sample size and the fact that patients (participants) were usually referred for LSVT treatment in the advanced stage of the disease where that kind of treatment was not that effective anymore<sup>4</sup>.

In the days of new technology, virtual reality (VR) has been tried out as a new vehicle of neurorehabilitation therapy<sup>27</sup>. VR therapy's impact is still questionable but results have shown that VR neurorehabilitation therapy has a positive impact on neuropsychiatric symptoms in patients with PD<sup>27</sup>. Literature has shown that VR therapy in comparison with conventional rehabilitation therapy can have even better results in improving gait and balance<sup>27</sup>.

One of the exciting and intriguing complementary therapies is active theater<sup>7</sup>. In a study that compares the effects of conventional physiotherapy and active theater therapy, the benefits of physiotherapy are often temporary and transito-

ry<sup>7</sup>. Art and occupational therapy have positive outcomes in non-motor symptoms (depression and anxiety) and quality of life<sup>7</sup>. It has been shown that active theater is a valid complementary therapy modality in PD patients. One active theater therapy session consisted of a vocal warm-up that lasted for 20 minutes, preparation of the scene that lasted for about 40 minutes, and then staging where participants were acting the scene they were previously practicing<sup>7</sup>. People who participated in active theater treatments showed a significant improvement in their symptoms of depression, quality of sleep, and in general, their emotional well-being<sup>28</sup>.

### **Artistic evolution in people with Parkinson's disease**

Sometimes, non-motor symptoms of PD occur even before typical motor symptoms arise<sup>29</sup>. It is well known that artists can change their painting styles when they suffer from neurodegenerative disorders – some of them may become unskilled and incompetent while some of them may find new ways to express their art. People with PD sometimes experience difficulties with painting because of their motor impairment and hand tremor<sup>29</sup>. In one case report, the initial PD symptom was a dramatic change in artistic performance from abstract painting to extreme realism. Interestingly, that change occurred even before any of the motor symptoms arose<sup>29</sup>. Some changes in artistic performance and creativity are also associated with dopaminergic therapy and dopaminergic dysregulation syndrome (DDS)<sup>30</sup>. DDS is an iatrogenic condition of higher levels of dopamine due to dopaminergic therapy. It can lead to compulsive behaviors and impulse control disorders<sup>30</sup>.

Some reports have shown that people started experiencing compulsive behaviors (compulsive picking wild berries), changed their creativity (started writing poems), or started gambling while they were on dopaminergic therapy for PD<sup>31</sup>.

## **ART THERAPY AND DEMENTIA**

### **Alzheimer's disease**

Alzheimer's disease (AD) is one of the most common causes of dementia worldwide, and its inci-

dence rate is rising because our population is getting older<sup>2</sup>. It is estimated that the prevalence of dementia will double by 2030 worldwide and that it will more than triple by the end of 2050<sup>11</sup>. AD is one of the neurodegenerative causes of dementia, as well as frontotemporal dementia (FTD), Lewy body dementia, and Creutzfeldt-Jakob disease<sup>32</sup>. The most important AD symptoms are cognitive and language impairment, memory loss, problems with abstract thinking, spatial disorientation, disorientation in time, mood and personality changes<sup>32</sup>. Some of the common signs and symptoms are depression, hallucinations, apathy, delusions, psychomotor agitation, sleep disorders, and those difficulties increase over time and reduce the quality of life of people with dementia<sup>11</sup>.

AD was first described by a German psychiatrist and neuropathologist Alois Alzheimer in 1907<sup>33</sup>. It is defined as a progressive brain disorder that affects memory and cognition. The most prominent degenerative changes are found in the temporal and parietal brain lobe<sup>32</sup>. Pharmacological therapy for AD exists, but it can not alleviate all of the symptoms, and as we all know, AD is still an incurable disease. Cholinesterase inhibitors and memantine are used as a pharmacological treatment for dementia. Antidepressants and antipsychotics are used for treating neuropsychiatric symptoms, but their efficacy in improving behavioral symptoms is not satisfactory<sup>11</sup>. Antipsychotics have serious side effects such as parkinsonism, accelerated cognitive decline, and cerebrovascular incidents<sup>34</sup>. Because of all the side effects mentioned above and insufficient and incomplete pharmacological therapy, the need for complementary therapy arose<sup>11</sup>.

#### Art therapy in dementia care

Studies have shown that art therapy in AD patients provides satisfaction and pleasure, improves attention, neuropsychiatric symptoms, social behavior, self-esteem, and improves the quality of life<sup>11</sup>. Interesting fact is that artists that suffer from AD can change their artistic expression. Their artwork usually becomes more abstract, with fewer colors, less realistic, with more symbols in their artistic work<sup>11,29</sup>.

The most frequent modality of art therapy used in dementia care described in the literature is music therapy<sup>35</sup>. Music therapy has the most substantial evidence of efficacy in intensifying good behavior and lessening undesirable and socially unacceptable behavior. Another modality of art therapy worth mentioning is visual arts therapy (painting and drawing). It is believed that it can encourage nonverbal communication, help patients express their feelings through art-making, and help them build up their "self"<sup>35</sup>. Dance/movement therapy focuses on empowering people with dementia, emphasizing their quality of life<sup>35</sup>. The study which included the elderly at higher risk for dementia, showed that art therapy sessions could significantly improve their quality of life. It showed that the cognition of the elderly from the experimental group was improved compared to those from the control group, who did not get art therapy sessions. People from the experimental group showed fewer symptoms of depression. Music therapy was essential for improving cognition and reducing depression in people with mild dementia<sup>36</sup>. One randomized controlled trial showed that singing and painting interventions as a form of art therapy led to decreased anxiety levels and significantly eased the pain in patients who suffer from a mild form of AD<sup>37</sup>. Results also showed that those interventions might improve patients' quality of life and mood with a mild AD<sup>37</sup>. Despite the benefits of art therapy mentioned above, there is a lack of systematic data analysis. In addition to that, in many studies, measurement tools are not specified enough, and study design explanation is sometimes inadequate<sup>35</sup>.

#### CONCLUSION

Literature has shown that art therapy is useful as an additional treatment in many different diseases, including PD and AD, among the most common and well-known neurodegenerative disorders<sup>3,7,9,11</sup>. Many different art therapy modalities are already known, such as music therapy, clay manipulation therapy, visual arts therapy, dance therapy, and tai chi training. With standard pharmacological therapy, art therapy can improve the quality of life of patients who suffer

from PD and dementia and improve their caregivers' quality of life. Art therapy can diminish PD's non-motor symptoms, especially anxiety and depression, which is as necessary for those patients as reducing motor symptoms such as tremor, rigidity, and bradykinesia<sup>3,7</sup>. Those studies' limitations must also be considered when talking about art therapy's effectiveness in managing PD and AD symptoms. Many studies have relatively small sample sizes. Sometimes art therapy rehabilitation sessions do not last long enough to make a

It is important to emphasize some of the limitations of studies about art therapy effectiveness, such as small sample size and relatively short duration of art therapy sessions. It is very unlikely that art therapy could improve symptoms and cognition of people that already have advanced forms of neurodegenerative disorders.

difference for a patient with a brain disease. As brain plasticity is one of the potential mechanisms of art therapy's effectiveness, short-term interventions usually have temporary results. It is doubtful that art therapy could improve symptoms and cognition of people who already have advanced neurodegenerative disorders because they already have seriously impaired cognitive abilities<sup>17</sup>. Art therapy provides a holistic approach to patients that suffer from neurodegenerative disorders and other brain and mental disorders, but more scientific evidence and further research are needed in this area<sup>17</sup>.

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## REFERENCES

1. Jankovic J. Parkinson's disease: Clinical features and diagnosis. *J Neurol Neurosurg Psychiatry* [Internet]. 2008;79. [cited 2019 Feb 13]. Available from: <https://pubmed.ncbi.nlm.nih.gov/18344392/>.
2. Ropper AH, Samuels MA, Klein JP. *Adams & Victor's Principles of Neurology*. 10<sup>th</sup> Edition. McGraw-Hill Education, 2014;1060-1123.
3. Bae YS, Kim DH. The Applied Effectiveness of Clay Art Therapy for Patients With Parkinson's Disease. *J Evid Based Integr Med* [Internet]. 2018;23. [cited 2019 Feb 13]. Available from: <https://pubmed.ncbi.nlm.nih.gov/29607671/>.
4. Tysnes OB, Storstein A. Epidemiology of Parkinson's disease. *J Neural Transm* [Internet]. 2017;124. [cited 2019 Feb 22]. Available from: <https://pubmed.ncbi.nlm.nih.gov/28150045/>.
5. Elkis-Abuhoff DL, Goldblatt RB, Gaydos M, Corrado S. Effects of Clay Manipulation on Somatic Dysfunction and Emotional Distress in Patients With Parkinson's Disease. *Art Ther* [Internet]. 2008;25. [cited 2019 Feb 22]. Available from: <https://files.eric.ed.gov/fulltext/EJ811584.pdf>.
6. Chaudhuri KR, Schapira AH. Non-motor symptoms of Parkinson's disease: dopaminergic pathophysiology and treatment. *Lancet Neurol* [Internet]. 2009;8. [cited 2019 Mar 4]. Available from: [http://dx.doi.org/10.1016/S1474-4422\(09\)70068-7](http://dx.doi.org/10.1016/S1474-4422(09)70068-7).
7. Modugno N, Iaconelli S, Fiorilli M, Lena F, Kusch I, Mirabella G. Active Theater as a Complementary Therapy for Parkinson's Disease Rehabilitation: A Pilot Study. *ScientificWorldJournal* [Internet]. 2010;10. [cited 2019 Dec 2]. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5763766/>.
8. Barone P, Erro R, Picillo M. Quality of Life and Nonmotor Symptoms in Parkinson's Disease. *Int Rev Neurobiol* [Internet]. 2017;133. [cited 2019 Apr 3]. Available from: <https://doi.org/10.1016/bs.irm.2017.05.023>.
9. Raglio A. Music therapy interventions in Parkinson's disease: the state-of-the-art. *Front Neurol* [Internet]. 2015;6. [cited 2019 Mar 3]. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4553388/>.
10. Malchiodi CA. Art therapy and the Brain. In: Malchiodi CA (eds). *Handbook of Art Therapy*. 1<sup>st</sup> Edition. New York: The Guilford Press, 2003;16-25.
11. Chancellor B, Duncan A, Chatterjee A, Myers F. Art Therapy for Alzheimer's Disease and Other Dementias. *J Alzheimer Dis* [Internet]. 2014;39. [cited 2019 Apr 12]. Available from: <https://pubmed.ncbi.nlm.nih.gov/24121964/>.
12. Duncan RP, Earhart GM. Are the effects of community-based dance on Parkinson disease severity, balance, and functional mobility reduced with time? A 2-year prospective pilot study. *J Altern Complement Med* [Internet]. 2014;20. [cited 2019 Mar 3]. Available from: <https://pubmed.ncbi.nlm.nih.gov/25192393/>.
13. Aguiar LPC, da Rocha PA, Morris M. Therapeutic Dancing for Parkinson's Disease. *Int J Gerontol* [Internet]. 2016;10. [cited 2019 Apr 10]. Available from: <https://www.researchgate.net/publication/304370456>.
14. Hackney ME, Kantorovich S, Levin R, Earhart GM. Effects of Tango on Functional Mobility in Parkinson's Disease: A Preliminary Study. *J Neurol Phys Ther* [Internet]. 2007;31. [cited 2019 Mar 5]. Available from: <https://pubmed.ncbi.nlm.nih.gov/18172414/>.
15. Li F, Harmer P, Fitzgerald K, Eckstrom E, Stock R, Galver J et al. Tai chi and postural stability in patients with Parkinson's disease. *N Engl J Med* [Internet]. 2012;366. [cited 2020 Jan 7]. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3285459/>.
16. Scholz J, Klein MC, Behrens TEJ, Johansen-Berg H. Training induces changes in white-matter architecture. *Nat Neurosci* [Internet]. 2009;12. [cited 2020 Jan 8]. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2770457/>.
17. Mirabella G. Is Art Therapy a Reliable Tool for Rehabilitating People Suffering from Brain/Mental Diseases? *J Altern Complement Med* [Internet]. 2015;21. [cited 2020 Jan 7]. Available from: <https://pubmed.ncbi.nlm.nih.gov/25848886/>.

18. Kiernan JA, Rajakumar N. Barr's The Human Nervous System. 10<sup>th</sup> Edition. Philadelphia: Wolters Kluwer, 2014;26-7.
19. Ferreri L, Mas-Herrero E, Zatorre RJ, Ripollés P, Gomez-Andres A, Alicart H et al. Dopamine modulates the reward experiences elicited by music. *Proc Natl Acad Sci U S A* [Internet]. 2019;116. [cited 2020 Feb 1]. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6397525/>.
20. Salimpoor VN, Benovoy M, Larcher K, Dagher A, Zatorre RJ. Anatomically distinct dopamine release during anticipation and experience of peak emotion to music. *Nat Neurosci* [Internet]. 2011;14. [cited 2019 Apr 28]. Available from: <http://dx.doi.org/10.1038/nn.2726>.
21. Jain S, Janssen K, DeCelle S. Alexander technique and Feldenkrais method: A critical overview. *Phys Med Rehabil Clin N Am* [Internet]. 2004;15. [cited 2019, Mar 6]. Available from: <https://pubmed.ncbi.nlm.nih.gov/15458754/>.
22. Teixeira-Machado L, Araujo FM, Cunha FA, Menezes M, Menezes T, DeSantana JM. Feldenkrais method-based exercise improves quality of life in individuals with Parkinson's disease: a controlled, randomized clinical trial. *Altern Ther Health Med* [Internet]. 2015;21. [cited 2019 May 22]. Available from: <https://pubmed.ncbi.nlm.nih.gov/25599428/>.
23. Stallibrass C, Sissons P, Chalmers C. Randomized controlled trial of the Alexander Technique for idiopathic Parkinson's disease. *Clin Rehabil* [Internet]. 2002;16. [cited 2019 Mar 6]. Available from: <https://pubmed.ncbi.nlm.nih.gov/12428818/>.
24. Saffarian A, Shavaki YA, Shahidi GA, Hadavi S, Jafari Z. Lee Silverman voice treatment (LSVT) mitigates voice difficulties in mild Parkinson's disease. *Med J Islam Repub Iran* [Internet]. 2019;33. [cited 2019, Mar 6]. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6504915/>.
25. Fox CM, Morrison CE, Ramig LO, Sapir S. Current Perspectives on the Lee Silverman Voice Treatment for Individuals With Idiopathic Parkinson Disease. *Am J Speech Lang Pathol* [Internet]. 2002;11. [cited 2019 Mar 15]. Available from: <https://pubs.asha.org/doi/pdf/10.1044/1058-0360%282002/012%29>.
26. Sackley CM, Smith CH, Rick C, Brady MC, Ives N, Patel R et al. Lee Silverman voice treatment versus standard NHS speech and language therapy versus control in Parkinson's disease (PD COMM pilot): Study protocol for a randomized controlled trial. *Trials* [Internet]. 2014;15. [cited 2019 Apr 4]. Available from: <https://trialsjournal.biomed-central.com/track/pdf/10.1186/1745-6215-15-213.pdf>.
27. Lei C, Sunzi K, Dai F, Liu X, Wang Y, Zhang B et al. Effects of virtual reality rehabilitation training on gait and balance in patients with Parkinson's disease: A systematic review. *PLoS One* [Internet]. 2019;14. [cited 2019 Dec 13]. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6837756/>.
28. Mirabella G, De Vita P, Fragola M, Rampelli S, Lena F, Dilettuso F et al. Theatre is a valid add-on therapeutic intervention for emotional rehabilitation of Parkinson's disease patients. *Parkinsons Dis* [Internet]. 2017;2017. [cited 2020 Jan 4]. Available from: <https://pubmed.ncbi.nlm.nih.gov/29359066/>.
29. Shimura H, Tanaka R, Urabe T, Tanaka S, Hattori N. Art and Parkinson's disease: a dramatic change in an artist's style as an initial symptom. *J Neurol* [Internet]. 2012;259. [cited 2019 Feb 22]. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3359446/>.
30. Lopez-Pousa S, Lombardia-Fernandez C, Garre Olmo J, Monserrat-Vila J, Vilalta-Franch J, Calvo-Perxas L. Dopaminergic dysregulation, artistic expressiveness, and Parkinson's disease. *Case Rep Neurol* [Internet]. 2012;4. [cited 2019 Feb 24]. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3506064/>.
31. Joutsa J, Martikainen K, Kaasinen V. Parallel Appearance of Compulsive Behaviors and Artistic Creativity in Parkinson's Disease. *Case Rep Neurol* [Internet]. 2012;4. [cited 2019 Feb 24]. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3369413/>.
32. Louis ED, Mayer SA, Rowland LP. *Merritt's Neurology*. 13<sup>th</sup> Edition. Philadelphia: Wolters Kluwer, 2016;198-207.
33. Rubio-Perez JM, Morillas-Ruiz JM. A review: inflammatory process in Alzheimer's disease, role of cytokines. *ScientificWorldJournal* [Internet]. 2012;2012. [cited 2020 Jan 4]. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3330269/>.
34. Guseva E. Art Therapy in Dementia Care: Toward Neurologically Informed, Evidence-Based Practice. *Art Ther* [Internet]. 2019;0. [cited 2019 Nov 3]. Available from: <https://doi.org/10.1080/07421656.2019.1564613>.
35. Beard RL. Art therapies and dementia care: A systematic review. *Dementia* 2014;11:633-56.
36. Choi YH, Jeon EY. Effects of Art Therapy on Cognition, Depression, and Quality of Life in Elderly. *J Korean Acad Community Health Nurs* [Internet]. 2013;24. [cited 2019 Nov 18]. Available from: <https://synapse.koreamed.org/articles/1058316>.
37. Pongan E, Tillmann B, Leveque Y, Trombert B, Getenet JC, Auguste N et al. Can Musical or Painting Interventions Improve Chronic Pain, Mood, Quality of Life, and Cognition in Patients with Mild Alzheimer's Disease? Evidence from a Randomized Controlled Trial. *J Alzheimers Dis* [Internet]. 2017;60. [cited 2019 Nov 18]. Available from: <https://pubmed.ncbi.nlm.nih.gov/28922159/>.