Music Therapy in Dementia

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Abstract

Dementia is not a single condition; it describes a set of symptoms that may include impairment in memory, communication, and thinking. Alzheimer's disease is the most common form of dementia and may contribute to 60 to 80% of cases. Alzheimer's dementia results in permanent impairment of social or occupational functioning which includes difficulty in recognizing close ones or solving critical problems. Out of various researched remedies for treating patients suffering from dementia, music therapy is one such technique that is being practiced across the world. The impact of various types of sounds causes positive changes over neural synapses and plays a significant role in improving the severe symptoms in patients. Music therapy and the personal/private carers and nurses appointed to give such treatments to the patients have been shown to play an important role in curing dementia. The present chapter describes the basics of dementia and the mechanism of action of music therapy. Evidence from various case studies regarding the success of direct and indirect music therapy have been discussed in curing dementia.

Keywords

Dementia · Music therapy · Occupational functioning · Alzheimer's disease · Vascular dementia · Direct music therapy · Indirect music therapy

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18.1 Introduction

Dementia is described as a group of syndrome that occurs as a result of various other diseases and disorders of the brain, which is generally progressive and chronic. It mainly comprises impairment of the higher-order cortical functions, which includes comprehension, memory, the process of the discerning, learning process, calculative ability, language recognition, and social judgment (Grande et al. 2019). Usually, dementia can arise in two different age groups, before or after 65 years.

When the onset of dementia occurs before the age of 65 years, it is said to be early-onset dementia whereas, when people develop this disease after the age of 65, it is said to be late-onset dementia (Balin et al. 2018). As studied by several scientists, it is majorly caused by chemical and structural changes in the human brain which leads to loss of neurons and overall shrinking of the volume of the brain (Tan et al. 2017). Several medicines have been used for the treatment of dementia and now music therapy (MT) is also been given to such patients and it has been shown to have a positive impact in improving the conditions (Umbrello et al. 2019).

In the present chapter, the authors have discussed the basics about dementia, mechanism of action of MT, and the evidence of the success of this non-pharmacological treatment by describing a series of researches where listening to music resulted in enhanced memory, decreased feelings of anxiety and agitation, and improved social skills.

18.2 Risk Factors of Dementia

Risk factors are generally defined as visible or invisible causes responsible for either increasing or decreasing the chances of developing that particular condition. In case of dementia age, sex, genetics, and vascular risks are believed to be the major risk factors (Booker et al. 2016).

Age is one of the most consistent and prominent risk factors for dementia. The occurrence rate of this disease doubles after a gap of every 5 years as reported by several researchers. Nevertheless, the age of a person is said to be the biggest risk factor for dementia (Osler et al. 2019). In certain cases, vascular risk factors are also involved in causing dementia which includes blood pressure, diabetes mellitus, stroke, and heart disease (Takeda et al. 2020). These types of conditions usually cause dementia when they occur or affect the human body in different combinations with other causing factors (Kloppenborg et al. 2008; Savva and Stephan et al. 2010; Viswanathan et al. 2009). Vascular dementia is said to be more common in the case of males as compared to females whereas, the cases of Alzheimer's disease (AD) are more common in women (Savva et al. 2009; Sung et al. 2012).

Another risk factor involved in causing dementia is genetics. A minimum of around 20 different genes are observed to be linked with dementia or AD (Lourida et al. 2019). In case of AD, three genes, coding for different proteins (presenilin 1 and 2, amyloid precursor protein) were found to be linked with the early onset of dementia (Hunter and Brayne 2018). The amyloid precursor protein is a protein

integrated in the plasma membrane, usually found concentrated specifically in the synapses of neurons and even in other several tissues (Tang 2019). The presenilin class of proteins are special transmembrane proteins responsible for the cleavage of amyloid protein (Galla et al. 2020). Multiple mutations in this protein are said to be associated with occurrence of fronto-temporal dementia. These peculiar combinations of genes which generally cause this condition are rare in nature (Cacabelos 2008; Verghese et al. 2011). Down syndrome is another condition responsible for dementia (Bayen et al. 2018; Lott and Head 2019) which occurs due to the presence of three copies of chromosome number 21 and carries those genes which are majorly associated with amyloid production which in turn might be responsible in some cases of dementia especially in middle age dementia (Coppus et al. 2006; Coskun et al. 2010).

Besides the above-discussed factors, there are many other lifestyle factors responsible for causing dementia. These factors include smoking and drinking alcohol, etc. (Gupta and Warner 2008). Smoking, in general, affects the blood vessels which reach the different parts of the brain and can increase the risk of vascular dementia (which will be covered later in the chapter) (Meng et al. 2020). Also, the prolonged consumption of alcohol can lead to vascular changes in the brain and can lead to a high risk of developing the above-mentioned disease (Hulsegge et al. 2014; Shimada et al. 2018). Other than this, various scientists have observed many other plausible risk factors for the conditions such as consumption of non-steroidal anti-inflammatory agents, depression, hormone replacement therapy, and exposure to toxins such as aluminum (Bakulski et al. 2020; Cantón-Habas et al. 2020). Head trauma is also said to be a plausible risk in the early onset of dementia (Chen et al. 2009; Kristman et al. 2014).

18.3 Stages of Dementia

Dementia is classified into four progressive stages which have been formulated based on mini-mental state examination (MMSE) scores.

18.3.1 Mild Cognitive Impairment

In this stage, the signs and symptoms are not severe and do not affect the daily routine of patients. However, 70% of such patients go-ahead to develop clear symptoms of dementia in the later age range of life (Fymat 2019).

18.3.2 Early Stage Dementia

In this stage symptoms like difficulties with recalling certain moments, personality change, and social withdrawal start to get significantly visible (Fink et al. 2018; Steeman et al. 2006; Martyr and Clare 2018).

18.3.3 Middle Stage Dementia

In this stage, severe signs are: difficulties in problem solving and impairment in societal judgment. The patient might require assistance for personal hygiene and overall care as well (Kerpershoek et al. 2018; Lin et al. 2013).

18.3.4 Late Stage Dementia

Patients in this stage observe drastic changes in their overall personality and recognizing skills and assistance are needed for their personal safety, hygiene, and overall care (van den Dungen et al. 2012; Tekok-Kilic et al. 2007).

18.4 Types of Dementia

18.4.1 Alzheimer's Disease

Alzheimer's disease (AD) is known to be the most prominent type of dementia. It accounts for the major proportion of the cases related to dementia, i.e., up to 70% of the total cases (Klassen and Ahlskog 2011; Sacktor and Robertson 2014). The clinical features for AD include memory loss and word-finding difficulties (Yang et al. 2018; Zucchella et al. 2018). With the advancement of the disease, memory loss and language difficulties become common and severe. This causes difficulty in everyday activities such as shopping, handling money, and navigating routes. Other features include anxiety and lack of motivation and related emotions (Allen et al. 2013; Ewers et al. 2012; Rocca et al. 2011).

18.4.2 Vascular Dementia

Vascular dementia (VD) is the second most prominent type of dementia. This condition arises when the blood supply toward the brain is compromised by arterial diseases (Smith 2017). This results in the reduction of neuronal functions which usually occur due to axonal and cerebral abnormalities and leads to the gradual death of brain cells (Kalaria 2016). The clinical features of VD include a stroke which might usually occur progressively (Anor et al. 2017; Smith 2017). In addition to the features associated with AD, apathy and slowing down of cognitive processes is also common in this type of dementia (Jackson et al. 2013; Iadecola 2013).

18.4.3 Dementia with Lewy Bodies

This form of dementia generally accounts for approximately 10% cases of dementia worldwide (Jellinger and Korczyn 2018). It is said to be a combination of AD and

Parkinson's disease (PD) as it shares various characteristic features in common (McKeith et al. 2017; Mueller et al. 2017). Lewy bodies are said to be the combination of proteins called alpha-synuclein which commonly occurs in few parts of brain, including the cerebral cortex. The clinical features for this type include difficulty in maintaining alertness, difficulty in planning out things, and disorientation of the entire space (Tsunoda et al. 2018). Even hallucinations and recurring falls are said to be the most prominent features of dementia caused by Lewy bodies (Jellinger and Attems 2013; McKeith 2007).

18.4.4 Fronto-Temporal Dementia

Fronto-temporal dementia is one of the rarest forms of dementia and this type of condition mostly affects the front region of the brain which is responsible for emotions, language recognition, and planning out things (Bright et al. 2019; Olney et al. 2017). This condition is characterized by the diminished dynamic fluidity inside the brain and narrowing of the meta-state distance caused by the dynamic state of connectivity (Premi et al. 2019). The clinical features include two broadly classified categories having behavioral and language changes (Convery et al. 2019). These types of features might result in multiple problems associated with the normal functioning of the brain (Bang et al. 2015; Warren et al. 2013).

18.4.5 Huntington's and Parkinson's Diseases

Huntington's and Parkinson's diseases generally cause abnormal movements and difficulty in coordinating with the other parts of the body along with cognitive issues. These cognitive changes occur initially, resulting in becoming one of the common causes in advanced stage dementia (~50%) (Stopa et al. 2018; Zarowitz et al. 2014).

18.4.6 Corticobasal Degeneration

In corticobasal degeneration, there is damage caused and significant shrinkage of the brain due to the abnormal protein's (tau) deposition in the brain (Zhang et al. 2020). Additional symptoms include loss of balance and movement difficulties (Armstrong et al. 2013; Luzzi et al. 2007).

18.4.7 Creutzfeldt-Jacob Disease

Creutzfeldt-Jacob disease is caused due to the presence of infectious protein particles in the brain called prions (Groveman et al. 2019). It is a rare form of the disease which affects one individual in a million and also might take quite a lot of years for an already infected person to develop visible symptoms. This disease usually starts

with lethargy, severe changes in overall mood, and delays in recalling different events (Bougard et al. 2016). It may develop various psychiatric forms including dementia as well (Abudy et al. 2014; Riemenschneider et al. Riemenschneider et al. 2003; Tschampa et al. 2001; Zerr and Parchi 2018).

18.4.8 Mixed Dementia

Mixed dementia occurs as a result of more than one type of dementia-related symptoms usually in the late advanced stages of patients suffering from this disease (where age is more than 80 years) (Custodio et al. 2017; Davies et al. 2018). This condition is characterized by the presence of macroscopically visible lesions and increased frequency of a condition known as cerebral amyloid angiopathy (De Reuck et al. 2018). Generally, a mixture of AD and vascular changes are seen in such patients (Abudy et al. 2014; Jellinger and Attems 2007).

18.5 Music Therapy: A Healer in Disguise

Music makes a unique connection among the organisms conveying emotions (Reybrouck and Eerola 2017). It is a language which need not necessarily be expressed only through words, rather can be felt. Like any other form of art, music holds an aesthetic perspective and has tremendous healing powers which have been recognized as well as, documented worldwide. The shift in focus of the music from a simple societal model toward a more specific neuroscientific model has broadened the horizons for research in this field. The therapy involving music and its elements is being studied for its effects on language-related, cognitive, and sensorimotor functions (Matthews 2015; Zarowitz et al. 2014). It has been found that musical memories are usually often longer preserved than non-musical memories inside the brain (Armstrong et al. 2013).

Music is said to comprise of various small elements like singing, playing different types of instruments, moving or dancing to the beats of music, writing songs or sharing memories associated with any type of music which altogether helps meeting their long-lost requirements like a sense of achieving a particular goal, happiness including elements of success or attainment of the meaning of life (Héroux et al. 2020).

The active participation encouraged by music interventions can enhance a person's life through various types of biophysiological responses and also through self-awareness, self-discovery, and increased self-esteem, and complete satisfaction. Several findings of researchers working in this field revealed that feelings of anxiety, shyness, and stubbornness decreased and the positive social behavioral aspects such as eye contact, smiling, and handshaking increased following every successful MT. These findings reflect that this therapy can work wonders in providing a sense of familiarity, comfort like nothing else can which was observed even in the late stages

of dementia where the internal stimuli were almost non-existent (Abudy et al. 2014; Low et al. 2013).

18.6 Mechanisms of Action of Music Therapy

18.6.1 Regeneration Mechanism of the Neurons

There exists a prominent study which provided proof that MT causes positive effects on the cranial nerves from fetal to adult human being. Researchers have observed that musical elements cause a strong impact on neuronal responses also, the overall cell count changed (Fang et al. 2017). Besides, this specialized clinical research performed by another scientist depicted that listening to music can promote significant recovery of neurons and cognitive reservation during the early recovery stage of post-stroke trauma (Choi et al. 2010). Several research-related evidence showed that steroids regulated the processes like neurogenesis, cognition, and neuroprotection (Trimble 2007), and a strong connection between music-related activity and steroid hormones was also discovered (Fang et al. 2017; Kuhn et al. 2007). The effect of music on steroid hormones such as cortisol (Fig. 18.1) and estrogen and its production via the auditory pathway particularly through the neural pathway (circuits related to emotions inside the brain) is mediated by the cerebral limbic system. This system comprises the hypothalamic-pituitary-adrenal axis and amygdaloid complex (Fusani and Gahr 2006; Khalfa et al. 2003).

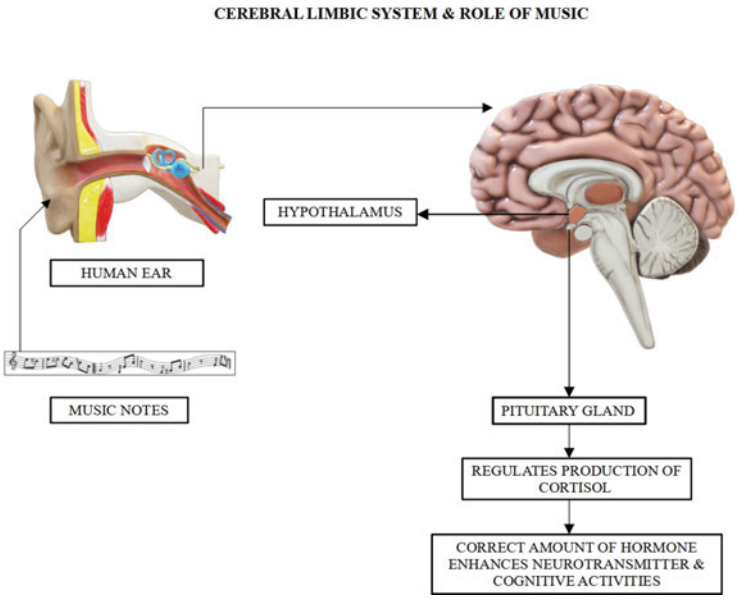

Fig. 18.1 Induction of different hormones during music therapy

In a study, a special therapy related to music was given to juvenile rats for 2 h daily. The controls were also considered and were exposed to the background noise which was considered as the main factor for them. This therapy lasted for 3 weeks with 60 days old rats who were exposed to the training in fear extinction, auditory fear conditioning. Anterior cingulate cortex (ACC) brain-derived neurotrophic factor (BDNF) assays were performed to analyze the impact of MT. BDNS protein helps in the survival of existing neurons, and it also promotes the growth as well as differentiation of newly formed neurons. During fear extinction, rats were showing less behavior of freezing as compared with control rats. Juvenile rats were showing results like a decreasing rate in anxiety behaviors, increases fear extinction, and the rapid increase of BDNF levels in ACC in adult rats (Chen et al. 2019).

18.6.2 Involvement of Neuroendocrine Pathway

MT has been shown to influence the level of hormones including cortisol (Fig. 18.1), testosterone, and estrogen (Trimble 2007). Fukui et al. enlisted patients suffering from AD to listen to his chosen playlist and songs with more frequent verbal contact with the music therapist. The treatment was continued for 1 month with which fugue decreased with a significant secretion of compounds like testosterone and 17-β-estradiol (Abbott 2002; Ménard et al. 2017), which meant that hormones had a preventive impact on patients battling AD through this therapy. This way MT has been found to be better than hormone replacement therapy as it is non-invasive, safe without having long-lasting side effects (Herman et al. 2019; Trimble 2007).

In the same line, to analyze the neurobiological effects of the Chinese traditional five elements music therapy, the experiment was carried with male Wistar rats (Särkämö et al. 2008). They were randomly assigned different experimental groups (powerful, sad, gentle, joyful, and music groups) and control groups. Experimental groups were exposed to mild sound pressure levels (between 50 and 60 db) for 2 hours/day which comprised an overall duration of 28 days. At the end of the session, the concentration levels of Glu (Glutamic acid) and GABA (gamma amino butyric acid) were noted down and matched with the different types of music which were taken into consideration. The levels of amino acids like aspartate, glycine, and glutamine were also measured afterward. As a result of MT, in the case of powerful music the levels of GABA dropped, whereas the levels of glutamic acid increased. In the case of a sad type of music, the levels of glutamic acid dropped and GABA levels increased. In the case of gentle music, the levels of both types of molecules remained constant and remained at the 0 levels. In the case of joyful music, the glutamic acid levels increased and GABA levels dropped significantly. It was concluded that different types of melodies were responsible for producing different effects over amino acids and the related neurotransmitter levels (Hao et al. 2020). Music seems to promote the secretion of several neurotransmitters, neuropeptides, and other biochemicals like endocannabinoids, endorphins, nitric oxide, and dopamine (Särkämö et al. 2008). It was suggested that music took part in the reward, stress

and arousal, immunity, and social affiliation-related emotions of human beings (Armstrong et al. 2013; Davidsson et al. 2002).

18.6.3 Neuropsychiatric Mechanism

One different opinion raised by several scientists and researchers is that it is the emotional competencies that significantly influenced the cognitive test scores of dementia patients rather than music therapy (Belchev et al. 2017). Captivatingly, almost all the researches in the years that passed by have suggested that MT had therapeutic effects on neuropsychiatric symptoms along with cognition effectiveness (Fukui and Toyoshima 2008; Nowrangi et al. 2015). Irish et al. (2006) used "spring" created by vivaldi from "the four seasons" as background music for verifying the recollecting power of the autobiographical memory of AD patients in musical conditions, which was found to be improved. As feelings of anxiety decreased gradually with time, it was concluded that anxiety reduction might become one of the promising mechanisms for enhancing autobiographical memory recall with music (Fukui et al. 2012; Vik-Mo 2019). As a development, another scientist found that sad music was the most effective in autobiographical memory. So, it was pointed out that music itself could not conjure memory, instead, the neuropsychiatric symptoms linked with music had a great result on semantic memory (Boso et al. 2006; Woodward 2005).

18.6.4 Neuroplasticity Mechanism

A functional magnetic resonance imaging (fMRI) was used by several scientists to detect the change in the overall functioning of the brain while the patients suffering from dementia were engaged in different types of singing activities generally considering the case of karaoke devices (Jung et al. 2019). A 6 months long music training increased the neural activities in the right portion of the affected brain, which indicated that MT improved the neural efficacy of the AD or dementia-affected patients. As a result, the activation of different regions of the brain during the karaoke task, i.e., left lingual and right angular gyrus, the site of multimodal sensory integration might have been caused by music and reading-related processing in the brain. According to one more study, the participation of the parietal lobe in pitch processing while listening to music and playing instruments is crucial (Satoh et al. 2003; Ashford 2015). This also echoed that music might play a pivotal role in neuroplasticity-related mechanisms in the brain which were depicted by the resonance imaging results of the scientist (Gallego and García 2017; Muresanu 2007).

As discussed above, it is clear that there is a scientific basis for the improvement of neurological conditions during MT. There have been many studies conducted by several scientists throughout the world over this, though the number of studies is not that high and we haven't reached up to the molecular level to derive the clear-cut results from these studies. There are several cases where medicines like

antidepressants, tranquilizers, and antipsychotics could not be tolerated (Kessing et al. 2009; Schneider et al. 2006), so in such cases, MT was chosen to treat dementia which consists of destructiveness and anxiety as a whole (O'Connor and Gray 2014; O'Connor 2016).

18.7 Case Studies Associated with Music Therapy and Its Effect on Brain Function and Dementia

18.7.1 Effect of Music Therapy on Brain Function

18.7.1.1 Effect of Music Therapy on Preterm Babies Mental and Overall Development

Preterm birth carries several risk factors for the baby including neurological impairment and gaps in motor function, differences in cognition, and problems related to behavioral development. Here in this study the author specially designed MT for preterm infants which are known as creative music therapy (CMT). The study included the selection of 60 medically stable premature infants less than 32 weeks of gestational age. The CMT sessions were conducted for 20 minutes thrice a week. The music included lullabies and soft rhythms which can calm down the babies and were also adjusted according to the individual requirement of the baby. The non-invasive type magnetic resonance imaging (MRI) was conducted at the corrected age for all the infants and the developmental changes in the brain were observed. The analysis of the result concluded that MT could positively affect the growth of premature infants (Haslbeck et al. 2017).

18.7.1.2 Effect of Music Therapy on Brain Function

Popescu et al. (2004) worked over the magnetoencephalographic signals, while the selected group of people listened to music. The study aimed to correlate various formulated studies, which explained the relation between the time course of a particular region of the brain's activation and the dynamic nature of music elements. It was depicted that the front region of the brain responded mainly toward the slow-paced music and the motor-related regions showed the smoother or transient types of responses which were later mapped with the temporal scales of music. The different types of rhythms and pieces of music were considered in this study. The final results confirmed that the overall activity in the motor regions and related structures especially, the lateral and supplementary motor areas were directly related to the extent of rhythmicity, which was derived from elements of music. This further concluded how music expression affected the overall performance of the human brain (Popescu et al. 2004).

In a study by Large and Snyder (2009) brain process during the musical performances was understood and, it was observed that high-frequency neural activity results from the high-frequency oscillatory activity which further leads to the communication between the neural areas while the rhythm of the music going on (Large and Snyder 2009).

A study conducted by Chen et al. (2008) was based on the listening of the predicted tapping and then again tapping with the musical rhythms. They conducted 2 fMRI studies involving rhythm perception and production. Mid-pre-motor cortex (PMC) and cerebellum were observed during predicted tapping. The second activity was conducted to check whether the previous activity was motor planning or rehearsal and, in this activity, there was no tapping along with the musical rhythm. It was proven that the motor regions were the same which were engaged in both activities. The ventral and dorsal parts of the PMC acted differently as ventral PMC occurred during the action-coupled process, whereas dorsal part was working only on actions, which were based on higher rules of temporal organization. These activities had shown that the action-perception process is responsible for the link between auditory and motor processes during musical rhythm (Chen et al. 2008).

18.7.2 Case Studies Based on the Detailed Response of Dementia Patients

18.7.2.1 Effects of Music on Agitated -Type Behavior

In this study, nurses opted MT for AD patients and it was used twice a week (Baker et al. 2008). It was given to the patients when their caregiver activities were going on to avoid unnecessary disruptive behavior of patients. CNAs (certified nursing assistants) conducted their activities based on certain formulated rules like the requirement of a basic overview of dementia and its relation with the irritable behavior of patients, ability to use I-pods while imparting this type of therapy and the last one included obeying the key elements of a successful music program always. Music therapists created different playlists according to the caregiver activities like for bathing there was a separate type of music, for dancing, there was a separate type of music and for a sing-along, there was a different music type. No headphones were allowed during music therapies. This method was found to improve certain behaviors like agitation, anger issues, etc., in patients suffering from dementia (Ridder et al. 2013).

Another study was conducted as a non-randomized quantitative study under the guidance of several authors in Australia. It was initially aimed to investigate the long-term effects of the grouped MT on the patients suffering from AD. The convenient type of sampling was conducted to select patients exhibiting the moderate symptoms of the above-mentioned disease. These patients were selected from a total of 13 different types of nursing homes. Weekly MT sessions were provided to them to see the significant changes in their anger-related emotions. In total, the agitation levels were completely assessed five times in an entire year. The detailed model-based study showed no significant difference between the two groups which were formed (one reference model and one group with high agitation levels). But the music therapist's observation stated that the patients felt relaxed or less agitated during or immediately after the therapy session. The limitations of the study conducted came out to be the very small sample size (19 participants) and the fact

that only five elaborative assessments were conducted in an entire year (Wall and Duffy 2010).

In another study, several criteria were adopted for the patients to be enrolled in MT like NPI-C (neuropsychiatric index) score, MMSE score, and CDI (children's depression inventory) score. Fifty-nine patients were then enrolled who matched certain criteria. There were 3 rounds of MT therapy which were 30 minutes each and the control group did several activities like playing with cards, and newspaper reading, etc., according to the patient preference. The first session was started with two factors which were empathetic behavior and non-empathetic behavior in which they assessed whether the patients made compatible relationships with them or not. The second session was based on the reactions of the patients to the MT therapy where they got to know about the patient's interest by their certain reactions like how they laugh, how they are enjoying music, and what are the body movements involved in that process. It was found that NPI scores were getting improved in some activities or behavior like irritation, anger, and how they behaved at night with other people. Reduction in non-EB (non-empathetic behavior) was also taking place (Gogoularadja and Bakshi 2020).

In another experiment (Prince et al. 2013) about 40 patients suffering from AD of mild to moderate form had undergone MT for 6 weeks and many factors were studied. Patients were selected from 2 geriatric residencies in the region of Murcia. Patients with dementia had shown to improve neuropsychiatric symptoms and cognitive functions to a much lesser extent (Gallego and García 2017). Patients were divided into two groups in which there were less than 12 patients in each group. Headphones were not allowed while listening to the song. Patients attended this therapy for 2 weeks lasting for 45 minutes each. Patients were examined for a series of parameters like neuropsychiatric, cognitive, and functional assessment after 3 weeks (6 sessions) and at the end of the study period (12 sessions). It was observed that depression did not improve after a total of 6 sessions of therapy ($p > 0.05$) and MT did not have any significant effect on BI scores but, it had an optimistic impact on feelings related to anxiety & depression according to the HADS (hospital anxiety and depression scale) scores. In totality, MT helped in stimulating cognitive function, improved mood, and reduced behavior problems which are triggered by stressful conditions (García et al. 2012; Satoh et al. 2015).

MT was getting famous in Japan also for the individual as well as group-oriented therapy (Eguchi 2018). Yukiko was a lady in Japan who was identified with AD-type dementia and after that, her family agreed to participate in home-based MT because Yukiko had a keen interest in music. There were several steps which were adopted to conduct MT for her such as Music therapists usually come and interact with the patient and used to take an interview of the patient and her family, as well. Sessions were being held at Yukiko's home with her Music therapist. After some sessions some positive responses could be seen in her behavior like, she used to recollect her memories for which she was nostalgic, she used to sing her favorite songs as a part of the therapy. This case study concluded that MT can help in social competencies as it helped her in building her social connections, communications skills, etc. This

therapy did not improve dementia symptoms much but really helped Yukiko on a personal level (Otera et al. 2020).

18.7.2.2 Indian Classical Music and Dementia

The roots of one of the oldest forms of music reside in India (dates back to 5000–2000 BC). The ancient manuscripts, called the "vedas", are said to be the source of inspiration for classical music. The samaveda, one of the 4 main vedas is said to be the main originating source of this form of music (Hegde et al. 2012). There exist different verses in classical music which are used for chanting. Ragas, meaning the "one which induces an emotion in mind" and taal (a rhythmic structure) form the main body of Indian classical music (Zarowitz et al. 2014). These terms form the basis of different compositions and melodic structure. The ragas are said to evoke a combination of various emotions like sadness, anger, devotion, passion, romance, etc. (Roy et al. 2017). The expression of these structures of Indian classical music is intended to vary during the main performance which is a result of the complex rhythmic cycle that evolved with the due course of time (Hegde 2017).

In a study conducted by several scientists, 20 musically untrained individuals were made to listen to the North Indian classical music (NICM) tunes and it showed high positive results which were comparable to the relaxed states found after a meditation session (Bardekar and Gurjar 2016). Moreover, the systolic and diastolic blood pressure showed a significant decrease, sensations related to stress, anxiety, and depression dropped and thereby increased the feelings related to ultimate satisfaction, hope, optimism, and harmony (Bardekar and Gurjar 2016).

Ragas are considered to possess healing powers and can enhance the overall well-being of an individual (Zarowitz et al. 2014. In the case of a patient named Harbhajan Singh who took the assistance of his daughter, Prabhjot Panwar for overcoming his illness temporarily (Parmar and Puwar 2019). Singh was fond of Hindustani classical ragas and it became the basis of his therapy later on. From the information collected based on his entire treatment during the sessions, it was concluded that he showed visible signs of improvement like moving his head and hands on the specific tunes of ragas, and in the next half of the session he even started recognizing the song and connected it with his memories related to his college days (Parmar and Puwar 2019).

18.7.3 Case Studies Including Carer/Nurse Training

18.7.3.1 Carer Training (Ridder, Denmark)

In this case authors focused mainly on the indirect and direct music therapy practices which are prevalent in various homecare centers in Denmark (Stige 2018). The concept of indirect music therapy included the sharing of knowledge related to music-related healing in patients suffering from dementia and AD. The training happened more in a teaching-specific manner. Direct music therapy included the art of process learning with real-life examples. An experienced music ambassador, Marie Munk Madsen taught the participants the basic model of therapy related to

music. The goals of the training which was provided included the ideas for implementing the music activities. The tools required to enforce the same in daily living were the theoretical knowledge related to the same and the courage which is required to use the body dynamically along with the voice to put the best effort in for treating the patients. Altogether, 20 caregivers from 11 different nursing homes or daycare centers were a part of this learning initiative. They weren't expected to have musical skills to participate. The training process required the participants to be active at all times and be able to cope with the pressure related to time and different situations. Adequate time was devoted to interacting with several patients from these 11 nursing homes from where the caregivers were selected. As a result, the carers learned the art of understanding and curing the patients at the same time. This training strategy stated that a music therapist isn't just required to act as a facilitator but also, as a supervisor and knowledge distributor for other carers (Schneider et al. 2006).

18.7.3.2 Training Social Workers and Caregivers in the Family (Wosch, Germany)

The University of Applied Sciences Wurzburg-Schweinfurt, Germany, formulated three main streams of music therapy skill sharing. First is the counseling which was required for the family caregivers of patients with dementia who are staying at home. Second is instructing the therapy techniques to the social workers and the third is forming projects in social work using several techniques in music therapy. After looking into the 3-year long calculated statistics, it was concluded by the authors that most family caregivers do not require special training for learning the art of empathizing and tackling patients with dementia. There were two main areas which emerged as a result of a one-day workshop for family caregivers and social workers. One area was about the importance of sharing the experiences of being a family caregiver and how that closeness affects the behavioral aspects of patients. Second area was to develop an individualistic approach toward music in a more informal way being the family caregivers (Wood and Ansdell 2018). It was also found that elements of group music therapy and therapeutic songwriting when integrated for the social work students increase their self-confidence with a significant rise in social competencies and behavior with social-communicative orientation (Baker and Yeates 2018). A group of carefully selected patients were treated with both direct and indirect therapeutic techniques and it was concluded that both direct and indirect forms of music therapy work as driving forces for teaching the paid/family caregivers the art of handling people with dementia and can together improve the behavioral changes in the patients (Raglio et al. 2008).

18.7.3.3 Polyphonic Partnerships (Stige, Norway)

This approach involves the connection between music and nature and also the surrounding environment while getting musical therapy into implementation (Stige 2018). This indirect type of MT is based on the ecological perspective of music which was initially developed in the presence of biological elements. Ecological perspectives mean that the goals and their practices of therapy focus mainly on

fostering the health-promoting relationships between several individuals including both carers and patients (Morell and Shoemark 2018). MT is generally viewed as a group initiative which can impact the larger audience and at a given time and can also run the economic activities related to the same domain (referring to nursing homes). In Norway, there are few guidelines formulated keeping in mind both the ecological and economical perspectives. They suggest the individualistic approach for handling the patients with dementia if needed in severe cases. The main objective for the carers was to improvise/teach other carers the ability to build emotional connections with their family patients or the patients in general. The implementation of the indirect mode of music therapy mainly requires the skill of staying occupied in polyphonic partnerships which permit semi-professional environments and promote organizational change. Both professionalism and collaboration can foster interactive sessions and make them easy between the carers and patients. It was concluded from the study that indirect music therapy requires cooperation from both sides and it mainly requires assistance from the side of professionals working in the same field. It also includes the mutual sharing of knowledge for the larger benefit of carers and patients (McDermott et al. 2018).

18.7.4 Case Studies Based on Song-Writing

18.7.4.1 Therapeutic Songwriting for the Family Caregivers (Baker, Australia)

Family carers play an important role in shaping the behavior of the people around with dementia as they impact them emotionally, physically, and enhance their overall well-being (Stige 2018). Therapeutic songwriting comes with several advantages which include the opportunity to tell the patients their own story, keeping a real-time track of their progress, allowing the people to process/re-process their own emotions and recollect the long-lost memories. The songwriting in this special way also encourages the pairing of the emotional content with the lyrics. The series of songs that were presented in front of the family carers instilled in them a sense of compassion, increased the level of understanding toward the patients, gave them time to introspect their role as a caregiver and reflect on their identity. This particular support program differed from the others in its way of preserving the emotions of both the carers and the people with dementia. This technique of therapeutic songwriting is kept under the category of direct music therapy and it also benefits the patients indirectly as the emotional competencies of carers are increased and this was tried over a small group of patients (small sample size) in a nursing home in Australia which gave positive results and enhanced the emotions competencies of the patients at large (Bunt and Stige 2014).

18.7.4.2 Songwriting by the Patient

In another study, one of the patients involved in this therapy was Margaret who was 94-year-old and her therapy of writing songs lasted for 18 months for the treatment of dementia. This songwriting technique has helped Margaret to indulge herself in

expressing her feelings fully. Her rhythmic attention was improving day by day although her cognition power was not so good but, as the days were passing, she was able to compose songs efficiently. Margaret was able to experience her life moments; she was able to recognize her past gradually. MT has developed her creativity too much (Ahessy 2017).

18.8 Recent Developments and Future Perspectives

Future research with MT should aim to indulge in high-quality research with large sample sizes. There should be proper planning of such experiments and there should be consistency in using the set protocols and assessing the parameters to evaluate the same. Studies at the molecular level should also be conducted along with measuring psychological behavior, physiological parameters to make out some conclusion at the molecular level so that we can further move into the deeper planning to treat such patients with this harmless therapy, which seems to be promising with these primitive studies conducted so far.

18.8.1 Implications of Music Therapy for Clinical Practice

Many health professionals and music therapists are taking part in musical intervention for the treatment of several diseases. Several authors have described and discussed various effects of MT on various diseases including dementia. Music therapists need to take any action and provide some basic knowledge and guidance, through education and specific medical personnel training to the medical staff or carers, to improve music-related medicinal practices. Now the therapeutic goals must be combined with the active singing experts to improve and accomplish the long-term setting of the people with dementia. Further, it will be best for the music therapists to train the family members/caregivers to incorporate the singing for daily caregiving with people having dementia (Cho 2018).

18.8.1.1 Musical Intervention in Improving the Quality of Life

The musical intervention helped to the loss of depressive symptoms, higher self-esteem, and a better quality of life (Cheung et al. 2019; Pongan et al. 2017). A case study was conducted where MT was given to about 60 patients of age 8–10 years old, suffering from a pediatric brain tumor (Payrau et al. 2017). Pre- and post-treatment results were observed for these subjects and were compared with the control group. The experimental group has received this therapy 45 minutes weekly for 52 weeks. Placebo intervention was given to the control group and three factors: depressive symptoms, self-esteem, and the quality of life were studied. Results were collected at baseline, 6 months, and 12 months after the intervention began. After the 12 months follow-up, changes like loss of depressive symptoms ($P < 0.001$), higher levels of self-esteem ($P < 0.001$), and improved quality of life ($P < 0.001$) were observed.

18.8.1.2 Musical Intervention in the Depressive State

Depression is one of the very common psychological disorders which leads a person into more anger issues, reduced social gatherings, and more toward isolation (Kok and Reynolds 2017). The musical intervention is useful to cure depressive states but very limited research has been performed in this field (Leubner and Hinterberger 2017). In their study, 28 different studies were analyzed and several factors like the length of the trial, patient's age, active or passive singing, and the type of sessions (individual or group) were considered. The main focus of the researchers was on only one type of music genre (classical, western, instrumental, or vocal). Patients had shown tremendous improvement in cognitive and emotional benefits when they sang or listened to any of these song types. MT also helped in several therapeutic approaches like it had shown positive effects on the patients before heart surgery and gives relaxation during angiography. Musical interventions have shown to help in improving the quality of sleep in old age people and it has also helped in improving memory in children. The immune system has also been reported to be strengthened with MT (Leubner and Hinterberger 2017).

The impact of music on the cognitive functioning of the brain is explained through this example where the authors analyzed that sudden behavioral or cognitive dysfunction leads to nerve damage especially in old age (Wang et al. 2018). They performed an elaborated literature search over platforms like PubMed and EMbase. A total of 34 studies were included out of which most of their quality checks were based on PEDro (physiotherapy evidence database) and CASP scale scores. These studies were divided into several subgroups based on the factors they took into consideration and later on the meta-analysis was performed. As the results of all of these studies being analyzed, it was found that in the majority of cases music therapy was successful in decreasing the behavioral symptoms related to depression, stress and at the same time lowered down the risks attached to cognitive dysfunction. The positive trends in these studies and their impact on the overall working of the brain reassure the researchers in this field to explore this non-pharmacological medium of treatment for reducing several risk factors attached to dementia, especially in elderly patients (Zhang et al. 2017).

18.8.1.3 Impact of Music on Memory

Memory loss which generally refers to an unusual type of forgetfulness is counted as one of the early symptoms of dementia and other neurodegenerative diseases (Gluck et al. 2016). In one study the strategy to treat this condition included the use of various types of MTs for encoding the verbal or written information about the patient (Abrahan et al. 2020). The biggest role in making the strategy successful was played by emotional competencies. In this study, 30 older adults (OA) and 24 young adults (YA) were made to upskill themselves in various sets and subsets of music which was either positively or negatively balanced. Both immediate and delayed memory flashbacks were recorded. The results depicted that the performance of OAs was less efficient than the YAs in the case of immediate recalling of memories which were directly associated with positive tracks of music. Lyrics that were sung were better retained when compared with spoken words in music in the case of OAs. The time

duration in recalling memories is independent of the type of music which was played in front of the participants. The analysis of these results shows that music intervention for recollecting the forgotten memories was beneficial for people of all age groups especially the aged adults. The research is yet to unfold the several hypothetical understandings of the mechanisms which are responsible for encoding music and its advantage (Ratovohery et al. 2018).

18.9 Conclusion

MT has been found to improve the severity of dementia and behavior issues of the patients and it can be the best method to cure dementia as it is a kind of home therapy with no harm. This therapy also helped in working as a facilitator and a supervisor. It helped in improving the harmony within patients as well. Songwriting techniques when integrated with some social work behaviors helped in increasing self-confidence with a gradual rise in social competencies. Direct or indirect type of therapy helped in improving the art of handling people with dementia and improved the emotional competencies. So, this therapy aids in improving the cognitive function, mood and also reduces the issues/behaviors which were activated by stressful conditions in the patients suffering from dementia. In most of the cases only behavioral changes have been studied for patients with dementia. In the future, the researchers can even study many other changes like physical, cognitive, and physiological at the molecular level for unfolding the mysteries of the human brain and its relation with music and its components.

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