

THERAPEUTIC MUSIC INTERVENTION TECHNIQUES FOR PATIENTS WITH PARKINSON'S DISEASE

Eva KRÁLOVÁ^{1*}, Nikoleta POLIAKOVÁ¹

¹ Faculty of Healthcare, Alexander Dubček University of Trenčín in Trenčín, Študentská 2, 911 01 Trenčín, Slovak Republic

* Corresponding author E-mail address: eva.kralova@tnuni.sk

Received 23.07. 2013; accepted 16. 08. 2013

Abstract

In the paper the employing of music in Parkinson's therapy is highlighted. There is a need for nursing professionals in this area to better understand the role a music therapist might play and to become acquainted with the therapeutically beneficial way of music.

The purpose of the article is to provide evidence for therapeutic use of music intervention with the patients suffering from Parkinson's disease. The goal of the theoretical overview is to offer other possibilities of non-invasive medical treatment with music therapy techniques which can improve deficiencies in motor, speech and cognitive skills. The section about non-invasive music treatment techniques describes some specific and commonly used applications of music therapy ideas. Each technique has a description of the therapy, followed by a brief analysis.

Keywords: depression, music, musical stimulation, motor impairment, Parkinson's disease

1 Introduction

Music art has been employed in the sphere of health and healing across cultures and times, with applications ranging from various healing rituals, through the social use of music within communities, to the more normative use of the arts in biomedical settings. Nowadays when music therapy and other healthcare and community-based practices meet the standards of evidence-based medicine and scientific critique, music art forms are becoming more expanded and practiced through physiotherapies, biomedicine and community practices alike.

Music as a therapy has also been used as an alternative method for patients with Parkinson's disease (PD). Research in both music therapy and neuroscience has shown that music therapy can slow the advancement of PD [1, 2].

Recent research has revealed that listening to and performing music may affect many different brain structures involving sensorimotor areas, cognitive and emotional processes [3, 4]. Music therapy can be active, where participants sing, make movements and play instruments, or passive, with participants listening to music [1]. Special emphasis of active music therapy is attached to functional skill redevelopment [5] and engages sensory and memory related processes, attention, perception and action related mediation, multisensory integration and social cognition [6]. It has also been suggested that active music therapy may stabilize the disturbed sense of rhythm in patients with PD [7].

2 General Background

Parkinson's disease is a degenerative neurological process attacking a small area of cells in the mid-brain. Decrease of these cells results in a diminution in levels of the neurotransmitter dopamine and upsets the balance between dopamine and another brain chemical, acetylcholine. It is characterized by progressive motor impairment, a variety of cognitive disorders, sleep disorders and depression [8].

PD constantly progresses with time and it has five stages. The Hoehn and Yahr scale, which defines five stages of progression, is commonly used to estimate the progress of the

disease [7]. If the motor symptoms are not treated in the early stages of the disease, they advance aggressively and later less quickly. Individuals who are not provided medical care are supposed to lose independent ambulation after approximately eight years and to be bedridden after ten years [7]. Fortunately, untreated individuals occur scarcely nowadays. Therapy and medicaments have improved the prospects of motor symptoms, while at the same time they represent a new source of disability because of the undesired effects of levodopa after years of use. In people taking levodopa, the symptoms progress to a stage of high dependency from life-in caregivers may be over 15 years [7]. On the other hand, it is hard to predict what direction the disease will take for an individual. Very good prognosticator of the disease advancement is patient's age [8]. The rate of motor decline is greater in the patients with less impairment at the time of diagnosis. Cognitive impairment is more frequent in the patients over 70 years of age at symptom onset [9].

As up to date therapies can improve motor symptoms, disability at present is primarily related to non-motor characteristics of the disease [9]. Regardless, the relationship between disease advancement and disability is not linear. Disability is at first associated with motor symptoms [7]. As the disease progresses, disability is more associated with motor symptoms that do not respond sufficiently to medication, such as speech and swallowing problems, gait and balance problems and also to motor difficulties, which are proved in up to fifty per cent of patients after 5 years of levodopa usage. After ten years majority of patients with PD have autonomic disorders, sleep problems, cognitive decline and mood swings [7]. These symptoms, particularly cognitive decline, increase disability considerably [7, 9].

The health care contains drug therapy with levodopa and in some cases neurosurgical treatment. On the other hand there is increasing support for the use of two rehabilitation therapies: physiotherapy and speech therapy [10]. Physiotherapy focuses on intensifying functional ability and decreasing second-rate difficulties by movement rehabilitation including transfers, upper limb function, balance, gait and cognitive movement strategies and in that way improving the quality of life [11]. Quite effective strategy to improve gait performance and mobility is to use external (auditory) cueing techniques [12]. Thaut and colleagues showed that rhythmic auditory stimulation during a gait-training programme for patients with PD significantly improved gait velocity, stride length and step cadence compared to a control group [13]. Rhythm is a powerful stimulus for activity and several studies have shown that therapies including rhythm are beneficial for patients with PD [13, 14]. Music therapy intended for patients with PD is based on various theoretical backgrounds such as psychodynamic, behavioral, and humanistic approaches.

3 Therapeutic Music Intervention Techniques for Patients with Parkinson's Disease

Music therapists utilize music as instrument to support patients learn, preserve or retrieve functional life skills: movement, attention and communication. Therapeutic Music Intervention (TMI) is formularized as "the use of music to influence the patients' physical, mental, or emotional states before, during, or after medical treatment" [19]. This is a kind of intervention which includes singing, playing both composed and improvised music, producing song lyrics, melodies, harmonies, and instrumentations and active listening to music to promote imagery and teach particular relaxation skills.

TMI techniques are adjustable to the patient's needs. They are based on the condition that the ability to perceive, create and enjoy music is regulated by the central nervous system, for example the brain and spinal cord. TMI techniques can be classified as active vs. receptive and improvisational vs. structured. The most frequent techniques used are musical improvisation (created and performed on the spot), the use of precomposed songs or music (precomposed means determined precisely in advance), receptive listening to music, verbal discussion about the music, and the use of creative media channels incorporated into the

music therapy [1, 3]. Music therapists should be careful about their choice of technique with each individual client, because it can affect the positive or negative outcomes of music therapy treatment. The patients with PD experience movement deficits such as akinesia and bradykinesia due to dysfunction of the basal ganglia and there are also structures within the brain which regulate the ability to control movement. Even when the basal ganglia are not serving optimally, patients with PD are able to enjoy rhythmic beat thanks to which they can undergo progress in walking and other bodily movements, as well as speech production.

Thaut M. H. [16] collected and developed music therapy (MT) techniques which are prevalent nowadays. The authors of the article selected those therapeutic techniques which can be utilized to help patients with PD and categorized them in three groups within the context of affective, conative and cognitive structuralization because these groups are determinants which contribute to successful communication and collaboration with PD patients:

- a) **Affective therapeutic music interventions (TMI):** Speech and language techniques: Rhythmic Speech Cueing (RSC), Melodic Intonation Therapy (MIT), Vocal Intonation Therapy (VIT), Therapeutic Singing (TS), Musical Speech Stimulation, Developmental Speech and Language Training Through Music (DSLTM),
- b) **Conative TMI:** Sensorimotor Techniques: Rhythmic Auditory Stimulation (RAS), Patterned Sensory Enhancement (PSE) and Therapeutic Instrumental Music Performance (TIMP)
- c) **Cognitive TMI:** Musical Mnemonics Training (MMT), Associative Mood and Memory Training (AMMT), Musical Executive Function Training (MEFT), Music Physiotherapy and Counselling (MPC).

3.1 Affective techniques - Speech and Language Therapeutic Music Interventions

Music and verbal language are equivalent in the structural-syntactic level, because separate elements can be put in sequence by respecting formal rules. That is why patients with aphasia who have problems with understanding the syntactic aspects of the language have also difficulty in grasping syntactical aspects of music related to harmonic relations. Verbal dimension of music appears at the phonetic-prosodic level when one tries to perform the modulations of the spoken language through musical sounds.

From a perspective of rehabilitation this parallel hints at the fact that exercises which are centered on the processing of sequential aspects of music can be beneficial for recovering syntactic abilities in the linguistic context. The sequential nature of music makes it adequate to be utilized in other field, for example Parkinson's disease.

- a) **Rhythmic Speech Cueing (RSC)** is a related technique to RAS. Principles of RAS encourage Rhythmic Speech Cueing (RSC), the music therapy technique which can be used to improve communication skills in patients with PD. There are several patients with PD who have difficulty controlling their rate of speech output which prevents them to communicate effectively with their care-givers or spouse. For this category RSC offers a way of rate control that uses auditory rhythm to cue speech. Working with a music therapist the patients learn how to follow simple metronome stimuli to produce clear, fluent and comprehensible speech. RSC can be utilized relying on patient's deficits in speech rate. Patients with severely impaired speech may supposedly benefit from metered cueing with rhythmic beats matched to each syllable of a sentence. Each syllable needs to have equal duration in the speech utterance. On the other hand, patients with mild speech impairments in speech rate may benefit from patterned cueing in which the music therapist uses beat patterns that correspond to normal speech articulation [16].
- b) **Melodic Intonation Therapy (MIT)** is a treatment that utilizes melody and rhythm (musical elements of speech) to improve expressive language by capitalizing on

preserved function (singing) and engaging language-capable regions in the undamaged right hemisphere [15]. Some PD patients are unable to speak, but they can still sing. MIT uses a therapeutic singing to offer the patients the possibility to communicate their feelings and thoughts. In several (not all) cases non-musical speech improves after repeated singing sessions.

- c) **Vocal Intonation Therapy (VIT)** utilizes intoned phrases echoing the poetics, intonation and tempo (musical time) of normal speech. It is carried out through vocal exercises which exercise all aspects of voice control involving poetics, pitch, breath control, timbre and dynamics. For example they sing a 4-5 note scale and progressively move the starting pitch up or down by half steps with a patient who has a limited pitch range in his/her normal speaking voice. The vocal exercise can be further extended by augmenting a functional sentence such as “I want to go out.”
- d) **Therapeutic Singing (TS)** is another technique which includes unspecified utilization of singing activities to promote initiation, development, articulation and language, and also to increase functions of the respiratory apparatus. TS can be successfully used with PD.
- e) **Musical Speech Stimulation (MUSTIM):** is the utilization of songs, chants, rhymes and musical phrases imitating prosodic speech gestures to imitate non-propositional speech. It uses activation of familiar song lyrics, linking together of words with familiar tunes, or musical phrases to evoke functional speech responses [16], such as finishing of familiar sentences which is stimulated through popular tunes or well known melodies (“How are you...”). This technique is often used with aphasic patients to help them produce and pronounce functional verbal groupings of speech such as “I need...”, “I don’t need...” e.t.c.
- f) **Developmental Speech, Language through Music (DSLTM)** is particular utilization of musical materials and other musical cognitive content (instrumental or vocal improvisations) to promote speech and language development through singing, playing musical instruments, use of music and kinetic activities, and combination of speech, music and movement.

3.2 Conative Techniques – Sensorimotor Techniques

Music can initialize neurovegetative reactions on the first level of the motor register naturally and it can affect the biological rhythm of the individual. Within a general tendency to adjust and harmonize the inner bio-physiological oscillations with the external rhythms which are heard, we can observe that the musical rhythm can elicit changes in the cardiovascular and respiratory rates that they successively affect other physiological changes. It has been proved for example that lullabies can diminish the heart beat and the respiratory rate, which synchronise with music [20].

It has been also evidenced that listening to music induces in a perceiver motor responses that allow the patient to mirror the gestures performed by the interpreter. This can be supported by the experiments which show that people are able to identify with music the corresponding gestures and actions. For example by watching the video of a musical performance with no sound tract, individuals can rate successfully the expressive meaning inherent in the piece [21].

The prospects of utilization the music and body reactions for rehabilitation purposes of PD patients are evident. Music has been for example used in gait instruction and results showed improvements in gait efficiency, supported by electromyographic measurements [22].

The motor register can be articulated at the level of neurovegetative responses activated by sounds, such as variations of the heart and breathing rates; at the level of gestural responses, such as tapping the feet or fingers while listening to music; and at a level

of more complex patterns of actions, such as the ones implied in the musically kinetic activities or dance.

- a) **Rhythmic Auditory Stimulation (RAS) rhythmic and patterned** is a prevailing technique for patients with PD. It is a specific technique to facilitate the rehabilitation of movements that intrinsically are biologically rhythmical. One of the most important of these rhythmical movements is gait. RAS uses a metronome or music with a very strong, regular rhythm to rehabilitate motor skills, such as walking, finger tapping. The therapist provides a rhythmic beat at a prescribed tempo within RAS to help the patient practise movements which are intrinsically or biologically rhythmic, such as gait. At first the rhythm tempo is matched to the patient's current walking cadence and successively the rhythm tempo is systematically increased, so as the patient could achieve a more functional gait.
- b) **Patterned Sensory Enhancement (PSE):** is a technique which utilizes rhythmic, harmonic, melodic and dynamic elements of music to give temporary, spatial and force patterns to structure and stimulate functional movements. These auditory patterns are adopted from translating or sonifying all components of the movement sequence which takes place in time, space and force. Pitch patterns simulate changing spatial positions; rhythmic patterns imitate the timing patterns of the movement; harmonic and dynamic patterns simulate applications of force and muscle tone. PSE can be utilized, despite they are intrinsically rhythmic or discrete, to constitute in time, space, and force any functional movement patterns and arrangements of the upper trunk, arms, hands, or whole body, such as stretching and gripping and lifting movements, etc. According to Levitin D. J. [17] music perception (listening to it) is processed in many areas of human brain. The amount of the brain's involvement was rarely imagined until early nineteen-nineties, when functional brain imaging became possible. The major centres for computational neuroscience include corpus callosum, motor cortex, prefrontal cortex, nucleus accumbens, amygdala, sensory cortex, auditory cortex, hippocampus, visual cortex and cerebellum (Fig. 1).

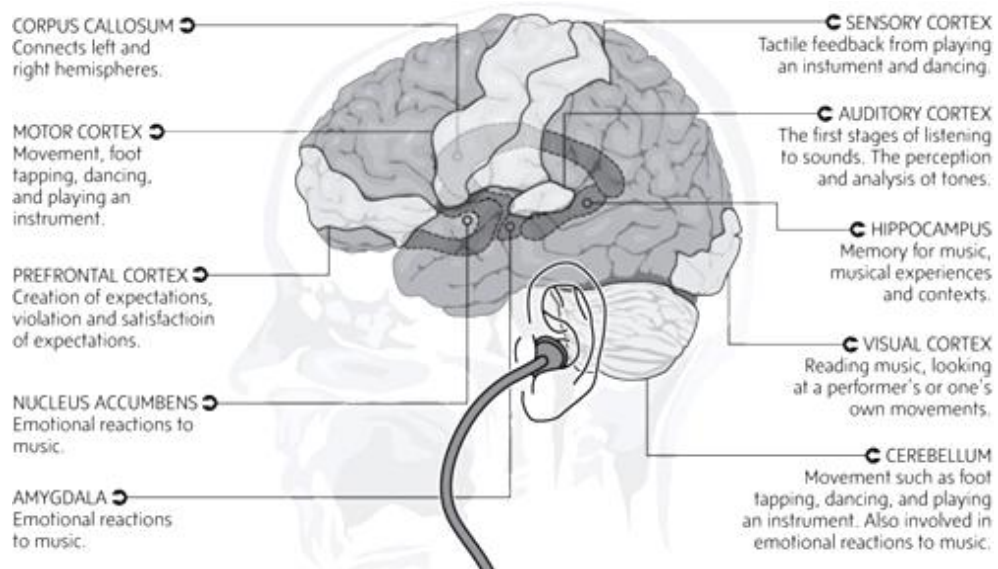


Fig. 1 Music processed in ten areas of human brain [17]

- c) **Therapeutic Instrumental Music Performance (TIMP):** applies playing the musical instrument to use and simulate functional movement patterns in motor rehabilitation. Musical instruments and their spatial arrangements are selected to accentuate, exercise and practise scope of motion, endurance, strength, flexion, limb coordination e.t.c. [16]

3.3 Cognitive Techniques

Within the middle and last phase of PD patients experience sudden confusion, loss of the ability to communicate, trouble walking and loss of coordination. During the therapeutic process some of the symptoms might remain, which may lead to patient's anxiety about what happened. It can also lead to medical care which is needed to be provided and to fear of what the future may bring for the individual patient.

The most frequently used medical treatment for anxiety is oral or intravenous sedative drugs. However, some of the physiologic responses uncovered with the sedative medicaments are a decrease in respiratory and heart rates. This type of response might also develop when the patient is listening to pleasant and relaxing music. Ellis and Thayer [23] researched the connection between music and the autonomic nervous system (ANS), which regulates the respiratory and circulatory systems, among others. The authors suggest that the ANS can be the way that music uses to establish a therapeutic health effect. Music is also non-invasive, economical nursing intervention, that does not lead to extreme muscle relaxation and central nervous system depression. They are both side effects of sedative medication which can lead to further delays in the treatment process [22].

- a) **Musical Mnemonics Training (MMT):** echoing mnemonics (immediate recall, sensory register), procedural mnemonics (rules, skills), declarative mnemonics (semantic, episodic memory). The technique uses musical exercises to address various memory encoding and decoding functions. Musical material – stimulant can be used as a mnemonic instrument in a song, chant, rhyme, or to promote learning of non-musical information by sequencing and organizing in temporally structured patterns.
- b) **Associative Mood and Memory Training (AMMT):** includes mood state-dependent learning and recall techniques to promote memory recall or to acquire associative mood and memory function through inducing a positive emotional state in the learning and recall process [14].
- c) **Musical Executive Function Training (MEFT)** is the use of improvisation and composition exercises individually or in a group to practise organization, problem solving, decision making, reasoning, comprehension, within a social context that affords important therapeutic elements, such as affective content, creative process, performance in real time and social interaction patterns [3, 13].
- d) **Music Psychotherapy and Counseling (MPC):** mood induction, cognitive reorientation, affective behaviour training, social competence training, musical incentive training for behaviour modification.

The work with PD patients can be carried out in the sessions in a group or individual format where a number of music therapy techniques are available to alleviate the symptoms of PD. Therapeutic music interventions can also concentrate on improving the quality of life, building self-esteem, sense of self-worth, and confidence of the patients. Progress in these areas can be measured by several tests, including qualitative questionnaires like Beck's Depression Inventory, State and Trait Anxiety Inventory, and Relationship Change Scale [18]. Effects of music therapy can also be observed in the patient's behaviour, body language, and changes in perception of mood and emotion.

4 Conclusion

The article focuses on the reviewed current Musical Intervention Techniques in Parkinson's Disease, and gives the initial analysis of their suitability for utilization. Nurses can promote the evidence basis of music in caring for the needs of PD patients. Music

listening, creating music and music therapy offer options that correspond with neurological models of mood, stimulation, and music processing. To use these techniques properly the nurses should co-operate with rehabilitation staff, for example physical therapists, speech-language pathologist and music-therapist. We need to promote the use of client-preferred, self-selected therapy process within medical facilities, communities, and within the family home environment.

Recently, the theoretical concepts justifying the therapeutic music intervention in patients with PD have been collected and clarified. However, there is a long way to understand better the potency of music in this field.

References

- [1] C. Pacchetti, R. Aglieri, F. Mancini, et al.: Active music therapy and Parkinson's disease: methods, *Functional Neurology* 1, 1998, Vol. 13, p. 57 – 67.
- [2] C. Pacchetti, F. Mancini, R. Aglieri, et al.: Active music therapy in Parkinson's disease: an integrative method for motor and emotional rehabilitation, *Psychosomatic Medicine*, 2000, Vol. 62, p. 386 – 393.
- [3] R. J. Zatorre, J. L. Chen, V. B. Penhune: When the brain plays music: auditory-motor interactions in music perception and production, *Nature Reviews Neuroscience*, 2007, Vol. 8, p. 547 - 558.
- [4] D. Aldridge, ed.: Gesture and dialogue: music therapy as praxis aesthetic and embodied hermeneutic, In *Music Therapy and Neurological Rehabilitation*, London: Jessica Kingsley Publishers, 2005, p. 27 - 39.
- [5] F. Baker, J. Tamplin: Music therapy methods in neurorehabilitation. A clinician's manual, London: Jessica Kingsley Publishers, 2006.
- [6] S. Koelsch: A neuroscientific perspective on music therapy, *Annals of the New York Academy of Sciences*, 2009, 1169, p. 374 - 84.
- [7] W. Poewe: The natural history of Parkinson's disease, *Journal of Neurology*, December 2006, 253 (Suppl. 7), VII 2 – 6.
- [8] A. Park, M. Stacy: Non-motor symptoms in Parkinson's disease, *Journal of Neurology*, 2009, Vol. 56, p. 293 – 8.
- [9] J. A. Obseo, M. C. Rodriguez-Oroz, C. G. Goetz, et al.: Missing pieces in the Parkinson's disease puzzle, *Natural Medicine*, Vol. 16, No 6., May 2010, p. 653 – 661.
- [10] C. P. Herd, C. L. Tomlinson, K. H. Deane, et al.: Comparison of speech and language therapy techniques for speech problems in Parkinson's disease, *The Cochrane Database of Systematic Reviews*, 2012, Issue 8. Art. No. CD002814.
- [11] K. H. Deane, D. Jones, E. D. Playford, et al.: Physiotherapy for patients with Parkinson's disease: A comparison of techniques, *The Cochrane Database Systematic Reviews*, 2001, Issue 3. Art. No. CD002817.
- [12] I. Lim, E. van Wegen, C. de Goede, et al.: Effects of external rhythmical cueing on gait in patients with Parkinson's disease: a systematic review, *The Clinical Science of Neurologic Rehabilitation*, 2005, Vol. 19, p. 95 – 713.
- [13] M. H. Thaut, G. C. McIntosh, R. R. Rice, R. R., et al.: Rhythmic auditory stimulation in gait training for Parkinson's disease patients, *Movement Disorders*, 1996, Vol. 11, p. 193 - 200.
- [14] L. A. Brown, N. de Bruin, J. B. Doan, et al.: Novel challenges to gait in Parkinson's disease: the effect of concurrent music in single and dual task contexts, *Archives of Physical Medicine and Rehabilitation*, 2009, Suppl. 90, p. 1578 – 1583.
- [15] N. Helm-Estabrooks, M. Nicholas & A. Morgan: *Melodic Intonation Therapy*. Pro-Ed., Inc. Austin, TX. 1989.

- [16] M. H. Thaut: *Rhythm, music and the brain: Scientific foundations and clinical applications*, Routledge: New York, 1st edition. 2005.
- [17] D. J. Levitin: *This is your brain on music: the science of a human obsession*, Penguin Book Inc., 2007.
- [18] A. Choi, M. S. Lee, H. Lim: *Effects of group music intervention on depression, anxiety, and relationships in psychiatric patients: a pilot study*, In *Journal of Alternative and Complimentary Medicine*, 2008, Vol. 14, No 5, p. 567 - 570.
- [19] K. E. Bruscia: *Defining music therapy*. Spring City, PA: Spring House Books. 1989.
- [20] K. R. Scherer, M. R. Zentner: *Emotional effects of music: production rules*, In *Music and emotion*, 2001, P. N. Juslin, J. A. Sloboda, New York: Oxford University Press, p. 361 – 392.
- [21] J. W. Davison: *Visual perception and performance manner in the movements of solo musicians*, *Psychology of Music*, 1993, Vol. 21, p. 103 – 113.
- [22] S. Paul, D. Ramsey: *Music therapy in physical medicine and rehabilitation*, *Australian Occupational Therapy Journal*, 2000, Vol. 47, p. 111 – 118.
- [23] R. J. Ellis, J. F. Thayer: *Music and autonomic nervous system (dys)function*, *Music Perception*, 2010, Vol. 27, Issue 4, p. 317 – 326.

*Review: Klaudia Košalová
Dušan Poliak*