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Assessment of Brain Function in Music Therapy

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Abstract **Background:** Music therapy, due to the characteristics and potential therapeutic applications, increase efficiency and provide treatment for the mental and physical relaxation. In effective therapy are used from well trained music therapists for providing the voice, body language and facial expressions. **Methods:** this procedure is performed after examination and imaging tests and in addition to the requirements of a therapeutic relationship. By the music therapist is discussed a clear sense for shared purpose. **Results:** A recent comprehensive meta-analysis of research on music has been performed, the results of which were presented to support this argument. **Conclusion:** The empirical studies show that there are positive steps in the effort to build a solid and dependable structure of empirical research in the field of the method.

Keywords: *assessment, brain function, music therapy*

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1. Introduction

Research on Music Therapy has grown significantly in the past half century. Today, modern cognitive rehabilitation methods like music therapy can help to improve patients, quality of life. Lack of attention to this procedure causes patients to face serious problems such as medical costs and reduced quality of life. Music therapy program is a general approach which allows the patients to enhance their self-knowledge, social skills, verbal and non-verbal communications, emotional and body awareness, self-confidence and integration [1,2,3]. Music plays a very important role in cognitive rehabilitation (CR), especially, in neurological disorders. Cognitive rehabilitation should be done step by step. It starts with basic skills and leads to more complex skills. Cognitive therapy is another complementary form of treatment that is used for many diseases including psychosomatic disorders, peptic ulcers, chronic Pancreatitis, Asthma, Diabetes, obesity, cancer, dementia, chronic dialysis, rehabilitation activities due to the cerebral vascular accident (CVA), blood pressure stability, sleep facilitation and pain reduction. Acquired brain injury (ABI) may cause impaired motor functions, language, cognition, sensory processing and emotional disorders. This may seriously affect a person's quality of life. As a result, one of the primary concerns in rehabilitation of acquired brain injury is restoration of motor function. Other communication deficiencies such as lack of understanding, speaking, spoken and written language creates serious problems. Furthermore, brain injury often results in memory, learning and consciousness impairments. Finally, sensory disorders, neuropathic pain, disinhibition, apathy and unresponsiveness may also occur [4]. Rehabilitation of these disorders seems attractive with music therapy. Despite the empirical evidences on the benefits of music therapy, the scientific proof is not easy. Before the development of non-invasive research tools on the human brain, there were many restrictions for researches on cognitive studies from cognitive neuroscience standpoint. Advanced brain imaging techniques which upgraded in the mid-to-late 1980s were not fast enough to be used for music research on brain [5]. Brain imaging studies have shown that neural activities associated with listening to music go beyond the auditory cortex and involve a wide range of bilateral frontal, temporal, parietal and subarachnoid networks. These include attention, semantic processing, memory functions as well as limbic and paralimbic brain regions related to emotional processing. The mechanisms such as attention and memory which lead to musical cognitive processing exist in similar non-musical cognitive processing. Music therapy is used to stimulate brain functions including movement, cognition, language, emotion and sensory perception. Music interventions are different that consists of using auditory stimulation to assist movements and normalization of parameters, listening to music and singing in order to reduce pain and song composition for solving emotional needs and promoting a sense of well-being. Therapists have used music listening in other rehabilitation environments to enhance relaxation, mind diversion and pain reduction.

2. Methods

Music therapy interventions should be based on the following principles:

1) Targeted use of music interventions by a trained therapist.

Some of the major interventions include but not limited to these items: improvising music (using musical instruments), recreating (singing a song that already exists), solmization (creating and recording a new song by patient with the help of therapist) and receptor (listening to recorded songs).

2) Using music experiences based on the patients' needs in rehabilitation settings:

These interventions include listening to live or pre-recorded music, stimulating auditory rhythm, playing musical instruments, performing improvising music using voice or instruments or both, singing or vocal music activities and music composition [6]. Music therapy interventions are determined on the basis of patients' needs and are used in the following cases: a way for communication, interaction and self-expression, exploring connections, promoting creativity and immediacy, sensationalism, improving cognitive-perceptual and sensory-motor skills, growth of sequential skills, promoting short term and long term memory, expression and development of emotional integration, improving organizational and behavioral skills, promotion of coping and self-reliance skills, enhancing problem solving skills, promotion, integration and transmission of inner experiences, transforming part to the whole, body awareness and promoting listening skills [1-5].

3. Discussion

Music therapy is used in many hospitals and clinics for rehabilitation activities of patients with CVA. In patients with hypertension, the blood pressure comes down and became constant. Orthostatic hypotension is also stabilized with the use of music therapy. Music therapy has been used in long-term treatments and rehabilitation activities after acute myocardial infarction and was followed by patient satisfaction [4]. Such stories of musical interventions are available about patients who are in coma [7]. We live in an era, the era of advanced technology, in which medical science cannot cure the diseases alone. Recently, music therapy has been used in medicine, health care, education and social welfare [8,9,10]. Music therapy is widely used in many areas of health care. Today, many music therapists are engaged to work in different settings from hospitals to educational and also private psychotherapy environments [10]. Of course, music therapy is mostly used in internal medicine for the treatment of peptic ulcers, non-ulcer dyspepsia (NUD), chronic pancreatitis, bronchial asthma [10], diabetes, obesity, cancer [9],dementia associated with aging [11]. Chronic dialysis, blood donation, cerebral vascular accident (CVA), endoscopy [12]. Patients in ICU, blood pressure stability, sleep facilitation [13] and pain reduction. This type of rehabilitation has complementary effects besides to its beneficial impacts on the treatment of diseases [13]. Music therapy covers all aspects of patients care. Previous studies have shown that music therapy can help to reduce pain and increase comfort as a supportive treatment in patients with paraplegia and tetraplegia [14]. Long-term effects of daily music and speech on sensory-auditory memory after cerebral infarction have been approved. The results indicate that only listening to music and daily speech after neural damage can lead to long-term changes in sensory processing [15]. Traditional speech therapy also was used to facilitate speech, voice and breathing functions and was effective in swallowing practice [16]. Music therapy also affects on motor functions including walking. Temporal motor and auditory processing are parallel with neural processes. As a result, motor system is responsible for auditory system [17]. The Shared Affective Motion Experience (SAME) which has been formed on the basis of brain imaging research suggests that music not only is understood through auditory signals, but also intentional and classified motor functions make it perceptible. In a neural network including the temporal cortex, fronto-parietal Mirror Neuron System (MNS) and the limbic system, auditory characteristics of music signals are primarily processed in superior temporal gyrus and are combined with structural characteristics of motor data in MNS [18]. It assumes that motor control is caused following the rhythm. Auditory rhythms which occur semi-consciously can be synchronized with the movements and facilitate them regardless of cognitive processes. The patient's breathing pattern can be matched with the melody which makes keyboard keys moves up and down [19]. A key aspect of SAME model is the proposed role of anterior insula as a conduit between limbic system and the MNS [18]. Musical experiences are multimodal which include at least hearing, vision, cognition, memory and motor systems. A number of studies have shown that music processing involves independent practical models. Music activates the right side of the brain which is parallel with the left side of the brain that becomes activated during speech reading. Modern imaging suggests that centers of language and music expression in the brain are not isolated and have some important and common neural processing aspects. Language and music analyses have shown that magnetoencephalography in Broca's area of the brain associated with language production is not enabled just in time for syntactic analysis of auditory language but also is involved in analysis of received harmonic arrangements. Based on animal studies, cortical plasticity is increased by related behavioral motivation [19]. Diagnostic evaluation, music therapy rehabilitation techniques and applied research models are accounted as new low-cost priorities in treatment of diseases. Researchers have found that several musical elements including rhythm, harmony and disharmony, voice tone and loudness can affect pulse, respiration and blood pressure which are measurable. Although current medical claims are too little compared to past centuries, music therapy has gained an accepted place in the treatment of mental disorders and music programs have been established in many hospitals. Even many of those patients whom seem to have no awareness of their surroundings react to rhythmic elements of music. Also, patients who cannot communicate with each other may get out of isolation through group musical activities. Music has been used to relief and stimulates the patients in electro-shock therapy. In psychotherapy, the music occasionally is applied for feeling excitation and helping the patients to recall contents of the subconscious mind. In general, psychiatric hospitals and specialized institutions for mental retardation use music as a form of therapy by creating interest and providing an output for energy and feeling progression in patients. Music therapy also has

been effective in communicating with autistic children [20]. Music therapy reduces anxiety of children with cancer [21]. Physiotherapists have diagnosed muscle strength and performance improvement as the effects of playing a musical instrument. Music helps reduce anxiety and distress caused by pain and relieves restlessness. The music is fun and has an immense therapeutic value. Listening to music makes patients calmer when undergo surgery, so that they experience less pain and unfamiliar surrounding sounds may not bother those [22]. Researches on art and music therapy have increased in the past half century [23]. The increasing use of music therapy in rehabilitation is the direct result of advances made in brain imaging technology which leads to improved understanding of brain functions. Since great steps have been taken in this field, huge leaps in technology are expected to be created. Researchers from different disciplines have sought to the human brain. Empirical successes of music therapy in rehabilitation open the way for new research. Following the repeated results, understanding of neuroscience and creation of standardized protocols will occur. Also, the music is an ideal scope for exploring the brain's ability to perform complex cognitive tasks [24,25,26]. A new study has shown the relationship between mental imagery through music, emotional draining and the disease [27]. The role of music in cognitive rehabilitation is the last domain in neurologic music therapy that goes under full consideration. Neurological impairments are cognitive by nature. Cognitive therapy should be carried out step by step starting with the basic skills and ending with more complex skills. The briefing processing occurs in classified order. Ultimately, music is effective in improving cognition.

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