

*A Review:*

## **Music Therapy: A battery charger for human brain**

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Music Therapy is growing as a profession globally, both in quantity and stature as a recognized treatment. In Italy, many physicians incorporate music into their medical practices. The United States of America, Russia, South Africa, Argentina, Norway, United Kingdom and Spain have well developed Music Therapy centres and active associations of music therapists. In India, classical music comprising of ragas has been employed for healing the Body- Mind -Soul complex. The purpose of any therapy is to improve the physical and mental well being of a person. Music Therapy is an innovative, artistic, scientific and evidence based method of restoring, maintaining and improving the emotional, physiological and psychological well-being of human beings of all ages and abilities through the power of music. Music knows no boundaries. It pervades everywhere irrespective of caste, creed, culture, national barriers or blood-brain barrier. Music can be found in every nook and corner of the world. It forms an integral part of our lives. Music represents an intriguing stimulus widely used in films to increase the emotional experience. The emotion processing brain structures are amygdala, hippocampus, parahippocampus, insula, striatum, medial ventral frontal cortex, cerebellum and fusiform gyrus. Music constitutes an ideal means to create a sense of suspense in movies. The efficacy of Music Therapy has been proven in patients suffering from a wide range of disabilities such as dementia, acute brain injury, Parkinson's disease, cerebral palsy, autism, Alzheimer's disease, depression, anxiety, schizophrenia, migraine, insomnia, chronic pain, and multiple sclerosis. Since Music Therapy is a non-invasive, enjoyable and cost-effective therapy, unique outcomes are possible.

Key words : Music Therapy, Brain, Memory, Depression, Insomnia

### INTRODUCTION

Music Therapy comprises of use of music interventions to accomplish individualized goals within a therapeutic relationship by a credentialed professional. Music Therapy interventions can be designed to promote wellness, manage stress, alleviate pain, enhance memory, improve communication and provide unique opportunities for interaction. Music therapists use their training to bring about positive alterations in cognitive, physical, communication, social and emotional skills. Music therapists work in a variety of settings such as educational, medical, psychiatric and gerontology institutions. Music Therapy has proven itself to be a very effective modality for connecting with persons suffering from dementia and enabling them to reach optimal levels of functioning. Musical interventions not only motivate the patients to engage in treatment but also provides an outlet for expression of feelings to clients and their familiar. Music Therapy possesses the mystical curing powers, which can tremendously improve the quality of life of human race. The purpose of any therapy is to improve the physical and mental well being of a person. Music is an age-old part of Ayurveda, the holistic Indian System of Medicine,

which promises a healthy life style. Music is the harmonious confluence of notes, rhythm, pitch, melody and composition. As a matter of fact, seven notes (Sa, Re, Ga, Ma, Pa, Dha, Ni) of music were developed in Vedic period, which serve as the foundation of Indian Classical music. On parallel lines, Western music is founded on seven notes *viz.* Do, Re, Mi, Fa, So, La, Ti. The modern history of music therapy dates back to World war-II, when the professional musicians alleviated physical and emotional injuries of the patients, hit by war through Music Therapy (White, 2001).

#### *What is Music Therapy ?*

Music Therapy is an innovative, artistic, scientific and evidence based method of restoring, maintaining and improving the emotional, physiological and psychological well-being of human beings of all ages and abilities through the power of music. Music knows no boundaries. It pervades everywhere irrespective of caste, creed, culture, national barriers or blood-brain barrier. Music can be found in every nook and corner of the world. It forms an integral part of our lives. We are exposed to music consciously or unconsciously throughout our life. It is very difficult to think of any important event of life (*viz.*

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celebrations of births, marriages, victories and festivals), where music has not played a major role. People have not only enjoyed music, but also created and performed music in different parts of the world on happy as well as sad occasions. While Music Therapy is beneficial in psychiatric and health care settings, there are also ways, we can use music intentionally in our day to day life for producing the same benefits. Here are some steps to get "hit with music and beat the stress arising from unpredicted situations:

- Listen to sober music while driving. This will diffuse stress and help reduce negative thoughts cropping up on the road.
- While at work, play music in the background. This has been found to increase the physical as well as mental stamina. However, avoid all kinds of music, when you wish to concentrate/study technical information.
- Combine music and exercise so as to make the exercising task a pleasant event.
- Listening to relaxing music at bed time improves the quality of sleep, duration of sleep and makes it easier to fall asleep.

People from different walks of life sing together, dance together, clap together and exchange happy ideas together in a musical environment. It is observed that we listen to music with our limbs and muscles for example, we tap our feet, we sing along with the singer, we clap using hands, we hum/dance. Our facial expression, emotions and feelings change for the better with rhythm and melody of the music, which we are listening to. Several reports in literature suggest that therapeutic effects of music are enhanced, when patients actually choose their own musical selection (Lesiuk, 2008).

There are several Universities having dedicated and independent Departments of Music all over the world. They offer academic programs in music ranging from Diploma to Doctorate level. International professional organizations such as American Music Therapy Association (AMTA), Japanese Music Therapy Association, Uruguayan Association of Music Therapy, Canadian Association for Music Therapy, Norwegian Music Therapy Association, World Federation of Music Therapy (WFMT) and Nada Center of Music Therapy, Chennai (India), are working with the mission of popularizing therapeutic efficacy of music in various countries. These professional associations not only organize conferences / workshops, but also publish prestigious journals to cover recent research findings related to Music Therapy. Fortunately, Music Therapy is growing as a profession, both in quantity and stature as a

recognized treatment. In Italy, many physicians incorporate music into their medical practices. In Japan, approximately 6500 practitioners identify themselves as music therapists. In China, there are both ancient and modern approaches to Music Therapy. The United States of America, Russia, South Africa, Austria, Argentina, Canada, Norway, Denmark, United Kingdom and Spain have well developed Music Therapy centres and active associations of music therapists. In India, classical music comprising of ragas has been employed for healing the Body- Mind -Soul complex.

*How does music therapists deal with the patients?:*

After assessing the strength and needs of each client, qualified music therapists develop a treatment plan with well defined goals and objectives. Music therapists structure use both instrumental and vocal music to improve functioning or facilitate changes that contribute to life quality. Different types of music viz. Classical, New age, Mozart or Rock trigger different types of physiological events in the body. Using this information, the therapists design music sessions for various patients. Music therapists use methods such as song writing, guided imagery, singing, instrument playing, and Music Therapy relaxation techniques to treat various needs of the patients. The images, behavior and feelings evoked by the Music Therapy are taken as responses of the patients. There is no need for the patients to be trained in the field of music to undergo the treatment. Music therapists may choose vocal music or instrumental music depending upon caliber and the type of ailment to be cured. The Music Therapy professionals can employ voice for chanting, singing and toning. Musical CDs comprising of classical music, instrumental music, artificially programmed music and nature's sounds (like bird's chirping, insect humming, water falls, sea waves, sound of rain/ wind) yield wonderful results, when handled by experts. Music therapists are usually members of a health care team, who implement programs for groups or individuals from leisure time classes to bedside care. Music serves as a battery charger for the human brain and patients frequently begin to reminisce and verbalize thoughts and feelings, which had been long dormant.

*How do music therapy help in elderly persons?:*

Music Therapy is remarkably efficacious in elderly individuals, who exhibit functional deficits in physical, psychological and cognitive areas. Clinical experience attests to the viability of Music Therapy even in those, who are resistive to other treatment approaches. Music is a form of sensory stimulation, which provokes responses

**Table 1 : How music therapy affects physiological and psychological parameters?**

Sr. No.	Behavior	Effect of Music	References
1.	Memory	Enhanced and maintained	(Brotons and Marti, 2003; Zarte and Diaz, 2001)
2.	Attention	Improved	(Gregory, 2002)
3.	Dementia	Reduced	(Brotons and Marti, 2003; Sherrat <i>et al.</i> , 2004)
4.	Awareness	Increased	(Gottel <i>et al.</i> , 2003)
5.	Fear	Diminished	(Vollert <i>et al.</i> , 2003)
6.	Worries	Reduced	(Vollert <i>et al.</i> , 2003)
7.	Anxiety	Reduced	(White, 2001)
8.	Agitation	Reduced	(Myskja, 2005)
9.	Depression	Alleviated	(Myskja, 2005; Gagner-Tjellesen <i>et al.</i> , 2001)
10.	Aphasia	Diminished	(Belin <i>et al.</i> , 1996)
11.	Social interaction	Increased	(Zarte and Diaz, 2001; Gottel <i>et al.</i> , 2003)
12.	Well-being	Improved	(Evans, 2002; Myskja, 2005; Burns <i>et al.</i> , 2001)
13.	Sleep	Improved	(Gagner -Tjellesen <i>et al.</i> , 2001)
14.	Inertia	Reduced	(Formisono <i>et al.</i> , 2001)
15.	Confusion	Reduced	(Gerdner and Swanson, 1993)
16.	Distraction	Decreased	(Gagner -Tjellesen <i>et al.</i> , 2001)
17.	Orientation	Enhanced	(Sherrat <i>et al.</i> , 2004)
18.	Energy levels	Increased	(Burns <i>et al.</i> , 2001)
19.	Fatigue	Decreased	(Kinney <i>et al.</i> , 2004)
20.	Irritability	Reduced	(Suzuki <i>et al.</i> , 2004)
21.	Delusion & paranoia	Decreased	(Suzuki <i>et al.</i> , 2005)
22.	Posture	Straightened	(Gottel <i>et al.</i> , 2003; Zarte and Diaz, 2001)
23.	Movements	Symmetric and enhanced	(Gottel <i>et al.</i> , 2003 )
24.	Nutritional intake	Increased	(Ragneskag <i>et al.</i> , 1996)
25.	Bathing co-operation	Increased	(Kydd, 2001)
26.	Pain	Diminished	(White, 2001)
27.	Motor skills	Regained	(Gottel <i>et al.</i> , 2003)
28.	Self Esteem	Enhanced	(Zarte and Diaz, 2001)
29.	Quality of life	Tremendously improved	Hillard, 2003
30.	Heart rate	Lowered	(Knight and Richard, 2001)
31.	Respiratory rate	Decreased	(Evans, 2002)
32.	Blood pressure	Lowered	(Knight and Richard, 2001; Stefano <i>et al.</i> , 2004)
33.	$\mu$ Opiate receptor expression	Significantly increased	(Stefano <i>et al.</i> , 2004)
34.	Myocardial oxygen consumption	Reduced	(White, 2001)
35.	Finger temperature	Enhanced	(Brownley <i>et al.</i> , 1995)
36.	Nausea & Vomiting	Reduced	(White, 2001)
37.	Sedative requirement	Diminished	(Evans, 2002)
38.	Analgesic requirement	Decreased	(Evans, 2002)

due to familiarity, predictability and the feeling of security associated with it. The efficacy of Music Therapy has been proven in patients suffering from a wide range of disabilities such as dementia, acute brain injury, Parkinson's disease, cerebral palsy, autism, Alzheimer's disease, depression, anxiety, schizophrenia, migraine, insomnia, chronic pain and multiple sclerosis. (Krakouer *et al.*, 2006; White, 2001; Myskja, 2005; Oelkers *et al.*, 2008; Brotons and Marti, 2003).

#### *Therapeutic benefits of music therapy:*

- Music stimulates and utilizes many parts of the

brain.

- Music provides a social meaningful and enjoyable context for interaction.
- Music supports and encourages movement
- Music taps into memories and emotions.

#### *Physiological basis of music therapy :*

Regular sessions of Music Therapy provide environment for natural bio-adjustments and time for removal of toxins from the body leading to a harmonious body- mind -soul complex. Music creates sound vibrations, which reach every cell of the body after penetrating the

layers of skin, mind and soul. Music also produces electromagnetic waves in the brain. The activity of  $\alpha$ -brain waves is increased and that of  $\alpha$  - waves is decreased during stress. But a soothing piece of music charges the cortex of the brain and increases activity of  $\alpha$  - brain waves. A similar effect on brain waves is noted with meditation too. Sober music helps in enhancing blood levels of immunoglobulin- A as well as interleukin I, thereby increasing resistance of the body to fight diseases. Whenever, we experience stress, it is the sympathetic nervous system, which gets activated, triggering flight or fight response. Music Therapy is based on the associative and cognitive powers of the mind. Sounds create certain vibrations, which are picked up and amplified by the human ear. These waves are then picked up by the sensory nerve connected with the mid brain. These waves are then redistributed throughout the neuronal network to reach other parts of the brain, which subsequently distinguish the pitch, tone and frequency of that sound. It is the right side of the brain which responds to the creative arts, including music. It has been demonstrated that different types genres of music bring about different effects in the body/mind *e.g.*, Rock music increases the secretion of adrenaline (from adrenal medulla) and adrenocorticotrophic hormone (ACTH) from the anterior pituitary. Whereas, soothing music elicits opposite effects on these endocrine glands. Rock music, has a series of repetitive high and low pitches and tones, which demand constant adjustment of the neuronal network to appreciate the different musical notes. Orchestral music, on the other hand, has opposite effects. The orchestral music takes the listener to a different plane of thought or emotion, whether it is love, anger, fear or happiness. A good piece of music is so impressive that you will not even realize that it has aroused profound emotion in your personality and yet its hallmark is that you may not remember the exact tones/end-notes that have been struck. This is because every sound that goes into the brain will be carried through a series of electrochemical impulses through different pathways of the brain. Each sound not only registers itself in the primary and secondary auditory sections, but is also stored up as a part of memory. An experiment conducted on Schizophrenic patients showed that the hallucinations are the results of some impulses which activate the memory of sounds in the brain.

While selecting music to invoke physiological and psychological changes, attributes of music, namely, rhythm, melody and harmony should be taken into consideration (White, 2001). Rhythm is one of the most essential structural and organizational elements of music. Rhythm can alter inherent body rhythms, such as heart rate. Slow,

repetitive, but steady rhythms provide a soothing effect on listeners. Melody of music is the result of the sequence of musical pitch and interval between musical tones. Pitch refers to the number of cycles that the sound vibrates each second. Faster vibrations create higher pitched tones, whereas slower vibrations produce lower tones. High-pitched music can result in feelings of tension, whereas lower pitched music can promote a relaxation response (Chlan and Tracy, 1999). In music, harmony refers to the way the pitches are blended together. The permutations and combinations of sounds can be characterized as consonant or dissonant. Consonance refers to an orderly blending of pitches that provides the richness of relations. In contrast dissonance has been equated with noise or lack of order.

Essential features of music to be an effective healer are

- *Rhythm*- The rhythm should be smooth and flowing for restoring internal biorhythms and energy flows.
- *Pulse* – The pulse should be in any case below the heart rate (72 beats / minute) in order to produce a calming effect.
- *Melody* – Should be slow, sober and sustained for triggering positive biochemical events in the body.
- *Tone*- Instruments like Violin, Sitar and Flute produce soft and pleasing tones.
- *Duration*- Usually 15-45 minutes is optimum.

Yoga believes that the heart and other organs of the body vibrate at particular sound frequencies. Thus, certain vibrations and frequencies can soothe or disturb the mind and the body. As per Ayurveda, body is made up of five basic elements *viz.* Fire, Water, Wind, Earth and Sky. Any disturbance in the proportion of these five elements present in the body causes imbalance of mind-body-soul complex. Concomitantly, disturbances in the doshas *i.e.* vata, pitta and kafa also take place. This imbalance leads to the development of diseases. Music Therapy effectively regulates the equilibrium of these three doshas and restores the basic proportion of five universal elements, thereby antagonising the disease process.

Music Therapy, like some other alternative therapies, works through the mind. The chanting of certain mantras create vibrations within the vocal cords, which move deeper through the whole body. These vibrations must be felt in totality for them to have any effect. Hence meditation techniques, whether eastern or western, always make use of chants for creating a brotherly feeling. Ragas and raginis represent different permutations and combinations of seven basic musical notes. The raga Miya

Ki Malhar is for the monsoon season, when the grey clouds are just about to burst. It begins on a tense note and ends in a crescendo of sounds. Thus, if played near a person, who is emotionally charged up, it will help that person release pent-up energies and negative feelings. The right type of music helps a person relax by soothing the nerves. Perhaps that is really the most effective way in which music helps us by generating protective endorphins and prevents depletion of energy within a person. It probably cleanses the emotional and spiritual system. Saints from ancient to modern times have demonstrated the mystical powers of music, which can kindle the higher centers of the brain and help to attain the peaceful state of mind.

*Brain structures affected by music:*

Brain structures connected with the development of various kinds of emotions, pleasant/unpleasant experiences, expression and different types of memory are highlighted in foregoing paragraphs. Music represents an intriguing stimulus widely used in films to increase the emotional experience (Baumgartner *et al.*, 2006). Music has a unique power to evoke strong emotional feelings, when combined with visual pictures. The emotion processing brain structures are amygdala, hippocampus, parahippocampus, insula, striatum, medial ventral frontal cortex, cerebellum and fusiform gyrus. These brain structures are substantially activated, when we experience the feelings of fear, sadness, happiness etc. On the other hand, exposures to pictures alone show activation of cognitive part of prefrontal cortex (Baumgartner *et al.*, 2006). Music constitutes an ideal means to create a sense of suspense in movies. Koelsch *et al.* (2006) investigated the impact of pleasant and unpleasant music on emotion processing. Unpleasant music (dissonant) showed activations of amygdala, hippocampus, parahippocampal gyrus and temporal poles. These structures are implicated in the emotional processing of stimuli with negative emotional component. In contrast pleasant music (consonant) showed activations of the inferior frontal gyrus (IFG), inferior Brodmann's area (BA), the anterior superior insula, the ventral striatum, Heschl's gyrus and the Rolandic operculum. IFG activation appears to reflect processes of music syntactic analysis and working memory operations (Koelsch *et al.*, 2006).

During the prenatal period, the development of an individual is influenced by the environmental factors. Kim *et al.* (2005) studied the differential effects of prenatal noise and sober music on the spatial memory and neurogenesis in hippocampus of developing rats. The exposure to the noise during pregnancy caused decreased

neurogenesis in the hippocampus, impaired spatial learning in pups and significant growth retardation. On the other hand, exposure to sober music during pregnancy caused increased neurogenesis in hippocampus and better spatial learning ability in pups. Traverthen (2000) emphasized the potential importance of empathetic support and music therapy in helping autistic children. There is increasing evidence that enriching the environment with pleasant music can improve cognitive and motor deficits following a variety of brain injuries in weanling rats (Favorjan *et al.*, 2002). Furthermore environmental enrichment improved cognitive impairments induced by status epilepticus in rats (Favorjon *et al.*, 2002). Auditory capability of fetus particularly primary both in infants can be greatly developed and improved by music therapy (Jayne and Standely, 2001). Semantic and episodic types of memory are often impaired in Alzheimer patients and there is no satisfactory laboratory model to study various aspects of these memory types. Music can be used to determine the neural substrates underlying the semantic and episodic memory types using familiar and non-familiar melodic tunes.

In chronic aphasic patients language tasks induce abnormal activation of right hemispheric structures (Silverstrini *et al.*, 1995), although these abnormal activation patterns are clear consequences of lesions. Knopman *et al.* (1984) reported that the right inferior frontal region was activated, when aphasic patients listened to music, but whose recovery was incomplete, where as activation of the left posterior temporoparietal region took place in patients with good recovery. Simple passive (word hearing) and active (word repetition) verbal tasks performed without melodic intonation therapy (MIT) resulted in abnormal activation of right hemispheric structures (Belin *et al.*, 1996). On the other hand, word repetition performed with MIT reactivated Broca's area and the adjacent left prefrontal cortex (left hemispheric structure). In other words, when the patients performed simple verbal tasks without MIT, there was abnormal activation of right hemispheric structures along with deactivation of left hemispheric structures. MIT could correct the abnormally right shifted pattern of activations and was able to successfully reactivate the impaired essential motor language zones (Belin *et al.*, 1996).

Singing ability in severe aphasic patients was preserved, because of at least partial mediation by right hemispheric structures. Apart from spoken language, singing represents another mode of acoustic (vocal-auditory) communication in humans. Reproduction of the non-lyrical tune elicited activation of the the right motor cortex, the right anterior insula and the left cerebellum

(Jeffries *et al.*, 2003). The left insula supported the coordination of speech articulation, while the right insula mediated temporo-spatial control of vocal tract musculature during singing. During rudimentary singing of a single pitch and vowel cerebral blood flow increased in cortical areas related to motor control, anterior cingulate cortex, precentral gyri, anterior insula, cerebellum and right Heschl's gyrus (Perry *et al.*, 1999). Mothers spontaneously exaggerate the prosodic contents of their language, when speaking to young children. Similarly children exaggerate speech prosody, when they learn new verbal material such as multiplication tables or poetry. MIT facilitates the complex process of controlling the pitch and duration of each syllable and phrase.

Listening to Mozart Sonata Music enhanced spatial temporal reasoning ability in Alzheimer patients. Spatial temporal reasoning involves maintaining, transforming and comparing mental images in space and time using symmetry operations as in the game of chess (Mark Bondar *et al.*, 2001). Specific cortical regions crucial for spatial temporal reasoning are dorsolateral prefrontal cortex (DPC), occipital cortex and the cerebellum. A wide range of behavioral experiments have shown that listening to the Mozart Sonata resulted in subsequent enhancements in spatial temporal reasoning denoted by the Mozart effect (Mark Bondar *et al.*, 2001). Neurophysiological basis of the Mozart effect appears to be related to i.) Increased cortical blood flow, ii.) Temporal cortex activation and iii.) Activation of dorsolateral prefrontal cortex (DPC), occipital cortex and the cerebellum (Mark Bondar *et al.*, 2000). Activation of auditory association areas such as Brodmann's area in temporal cortex, areas of frontal cortex and parietal cortex was observed regardless of the type of music indicating that these areas are part of networks that participate in auditory processing than emotional responses to music. Parsons (2001) showed that neural systems underlying music perception, performance and comprehension are distributed throughout the left and right cerebral and cerebellar hemispheres with different aspects of music processed by distinct neural circuits. Furthermore, music has been employed as a tool for studying of human auditory brain structures and function. Increased volume of gray matter in Heschl's gyrus has been associated with musical aptitude. Activation of Broca's area, a region traditionally considered to sub serve language is important in interpreting a musical note. Passive music listening spontaneously activates limbic and paralimbic systems resulting in pleasant feelings (Brown *et al.*, 2004). Music elicited a unique capacity of producing highly pleasurable experience of shivers-down-the-spine or 'chills' (Blood and

Zatorre, 2001). As intensity of these chills increase, cerebral blood flow increases or decreases in brain regions thought to be involved in motivation, reward, arousal and euphoria. These areas are midbrain, ventral striatum, orbitofrontal cortex, amygdala and ventral medial prefrontal cortex. These brain structures are well documented to be responsible for eliciting euphoria (pleasant feeling) in response to stimuli such as drugs of abuse (morphine, alcohol), favorite food (ice cream etc.) and sex. Thus, music has the unique capacity to evoke and enhance feel-good experiences similar to euphoric stimuli through common brain circuitry mechanisms responsible for experiencing pleasure (Blood and Zatorre, 2001).

*How music therapy is superior to other therapies?:*

- Music captivates and improves attention.
- People of all abilities, ages and communities can participate in this therapy.
- It provides a safe social setting for verbal and non-verbal communication.
- It initiates and encourages physical movements of the body.
- It helps in recalling past memories and excites emotions.
- It is the best way of utilizing the time, particularly at advanced age.
- It provides a pleasant and meaningful context for sensory, short term and long-term memory.
- It provides dramatic relief without any side-effects
- It employs non-invasive, natural and pleasure some experience.

*Conclusion:*

It is evident that Music Therapy has potential to create wonders, if used judiciously in the management of various diseases. This therapy is now being recognized globally. An extensive research is in progress to reveal its new dimensions. Only music has the unique capability of bringing back the charm and improve the quality of life of neuropsychiatric patients. Every country is striving for greater recognition to music therapists by devolving training programs, clinical applications and through the conduct of conferences/ symposia. The days are not far off, when Music Therapy would be preferred to other medical therapies for managing cognitive, psychological, stress related and ageing induced neuro-degenerative disorders. Since Music Therapy is not only a non-invasive, enjoyable, but also a cost-effective therapy, unique outcomes are possible.

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