Music: A promising therapy

Rachel Ao*

"Our bodies like rhythm and our brains like melody and harmony."

-Daniel Levitin

Music has been used as a healing implement for centuries and a healing influence which could affect health and behavior. Three phases have been identified by K D Goodman that describe the healing ability of music: magical, religious and scientific healing.

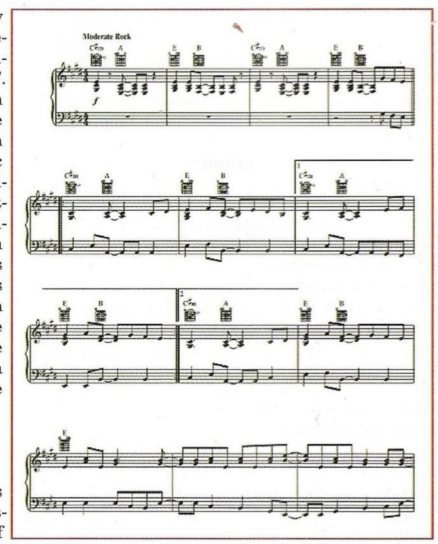
Magical healing phase is the one where the primitive man believed that certain sounds in the nature were the media with which man can communicate with the invisible, supernatural spirit.

Religious healing phase is the one where man believed that music and musical instruments are gifts from god and he used them in ritual purification treatments.

Scientific phase started with Greek philosophers like Socrates, Aristotle and Plato.

The origin of modern music therapy dates to post-world war II period, where several musicians visited various hospitals around United States of America to play music for people suffering from post-war physical and emotional traumas. Since then there have been many significant milestones in the field of music therapy across the globe.

Indian system of music treatment is defined as an "individualistic, subjective and spiritual art, aiming at personal harmony with one's own being and not at symphonic elaboration". India has a very rich musical heritage and literature on the science of music described in 'gandharva tattva' dating back to 4th century B.C. Music as a therapy in India has a rich history of its own and is just an emerging discipline that warrants more research in this area to make it evidence based.



Definition

Music therapy is defined as "a systematic process of intervention wherein the therapist helps the client to promote health, using music experiences and the relationships developing through them as dynamic forces of change."

According to the World Federation of Music Therapy and the American Music Therapy Association, music therapy is defined as the clinical and evidence based use of music and/or its elements (sound, rhythm, melody, harmony, dynamic and tempo) by a qualified music therapist to accomplish individualized goals within a therapeutic relationship with one client or group.

Selection of music as therapy

Music is a universal language. It influences all levels of human existence- a medium for communication, which can be both a pleasant and healing experience. Comparing classical and heavy metal music, researcher has pointed out that clas-

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sical music makes one feel relaxed and comfortable while hard rock music usually quickens the heart beat.

Indian classical music has soothing qualities that change the mood of being dejected, depressed and distressed individuals facing stressful situations and can benefit a whole host of conditions ranging from insomnia, high and low blood pressure to schizophrenia and epilepsy.

Mozart, a western classical music icon, popularly suggested by the researcher; as the listening stimulus cure a variety of disorders. The basic difference between Indian and Western music is that Indian classical music is based on melody, while western music is based on harmonic system.

Brain connects to music

Brain activity is present predominantly in the frontal lobes for pleasant music and in the temporal lobes for unpleasant music. When engaged in listening to music, it indicates there is both a psychological and neurochemical process involved. Studies have measured changes in serotonin, dopamine, endorphins, melatonin, as well as norepinephrine, epinephrine, and prolactin following music therapy.

An important neurotransmitter in the brain is serotonin which elevates moods and a sense of well-being, positive effects on memory, learning, sleep functions, body temperature regulation mechanisms, sexual desires, and other processes. Another is dopamine, which is known as the pleasure drug of the brain, associated with the reward system of the brain, providing feelings of enjoyment and reinforcement to motivate a person to repeat certain activities.

Endorphins are neurotransmitters which help in speeding the process of healing. Melatonin is a neurohormone that the brain produces in darkness, and affects the body's sleep cycle and sense of relaxation. The importance of understanding the influence of music on messenger production is a means of explaining behavioral reactions through physiological mechanisms. Research on the effects of music exposure on the release of biochemical messengers is an expanding field.

Psychoanalysis and music

Apart from a dominant biological perspective, music can also be considered from a psychological view point. Music expresses the forms of feelings which the individual is not able to express. Music helps to bring memories spontaneously. Psychoanalysis has a distinct contribution in describing the relationship of the human psyche and music. Most psychoanalytic theorists subscribe to view that there are three possible functions of music, emotional catharsis for repressed wishes (Id), mastering the threats of trauma (ego) and enjoyable submission to rules (super-ego).

Evidence based: Music as medicine

Music improves the state of mind by reducing anger, stress, anxiety and depression. Classical music is the highest form of art that arouses emotions. Thus there is a strong association between music and emotions. It helps in expressing and experiencing emotions. Rauscher et al. report that brief exposure to Mozart's Sonata for Two Pianos in D major, K.448 (Mozart K.448), produces a temporal increase in spatial reasoning scores, the so-called "Mozart Effect."

In addition to improvement of cognitive function, subsequent studies reveal positive effects from listening to music for many medical diseases, including hypertension, anxiety, and dementia. The use of guided imagery with autistic children has been found to decrease stereotypical behaviours and hyperactivity, increase attention and the ability to follow instructions, as well as increase self-initiated communication, both verbal and non-verbal.

Music therapy can play an important role during pregnancy. At just 16 weeks, a fetus is able to hear their mother's speech as well as singing. Through technologies, such as ultrasound, health care professionals are able to observe the movements of the unborn child responding to musical stimuli. At the beginning of the second trimester, the ear structure is fully matured. By this time, the fetus will begin to hear not only maternal sounds, but also vibrations of instruments. Prenatal music therapy has three main benefits: Prenatal stress relief, Maternal-fetal bonding and Prenatal language development.

Music has the ability to associate physiological changes in the body and elicit physiological responses such as pulse rate, respiration rate, blood pressure, and muscle tension. Music may also stimulate a calming effect of the cardiovascular system.

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Interaction of neurotransmitter in alcoholism

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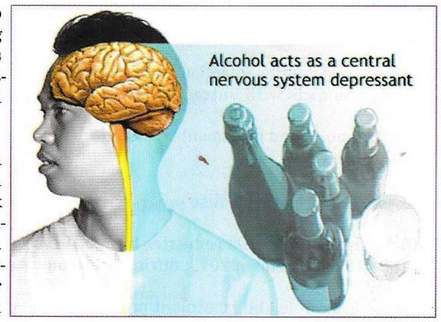
Alcoholism, also called dependence on alcohol, is a chronic relapsing disorder that is progressive and has serious detrimental health outcomes.

The development of alcoholism is characterized by frequent episodes of intoxication, preoccupation with alcohol, use of alcohol despite adverse consequences, compulsion to seek and consume alcohol, loss of control in limiting alcohol intake, and emergence of a negative emotional state in the absence of the drug.

Tolerance and withdrawal are tangible evidence of alcohol's influence on the brain. When the brain is exposed to alcohol, it may become tolerant—or insensitive— to alcohol's effects. Thus, as a person continues to drink heavily, may need more alcohol than before to become intoxicated. As tolerance increases, drinking may escalate, putting a heavy drinker at risk for a number of health problems—including alcohol dependence.

Some of the mechanisms lead to these changes—changes that begin with the brain's unique communication system. The brain communicates through a complex system of electrical and chemical signals. These signals are vital to brain function, sending messages throughout the brain, which, in turn, regulate every aspect of the body's function. Neurotransmitter chemicals play a key role in this signal transmission. Other changes in the brain may increase some people's sensitivity to alcohol. Desire for alcohol may transition into a pathological craving for these effects. This craving is strongly associated with alcohol dependence.



Other changes in the brain increase a heavy drinker's risk for experiencing alcohol withdrawal—a collection of symptoms that can appear when a person with alcohol dependence suddenly stops drinking. Withdrawal symptoms can be severe, especially during the 48 hours immediately following a bout of drinking. Typical symptoms include profuse sweating, racing heart rate, and feelings of restlessness and anxiety.

Neurons and synaptic transmission

The brain transmits information through a system of interconnected nerve cells known as neurons. Signals travel rapidly along chains of neurons using a combination of electrical and chemical processes. Nerve signals are transmitted from one region of the brain to another region of the brain or to the rest of the body through communication between two or more neurons located next to each other.

When a neuron is activated, an electrical signal is generated which travels along the membrane surrounding the neuron body and the axon – the long extension protruding from the neuron body. When the signal reaches the end of the axon, it triggers the release of neurotransmitters from the cell. These neurotransmitters travel across the narrow space separating one neuron from another (i.e., the synaptic cleft). On the signal-receiving neuron, the neurotransmitter molecules then interact with receptors, and this interaction either promotes or prevents the generation of new electrical signals in that neuron, depending on the neurotransmitters involved.

These signals cause many of alcohol's effects on behaviors, such as tolerance, craving, and addiction. Neurotransmitters that often have excitatory effects include dopamine, glutamate, and serotonin; the neurotransmitter that primarily has inhibitory effects is gamma-aminobutyric acid (GABA).

Alcohol and dopamine

Dopamine is a chemical naturally produced in the body. Activation of the mesolimbic pathway increases the firing of dopamine neurons in the ventral tegmental area (VTA)

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of the midbrain and subsequently increases dopamine release into the nucleus accumbens and other areas of the limbic forebrain, such as the prefrontal cortex. Alcohol activates the mesolimbic pathway indirectly, by activating beta-endorphins (naturally occurring opioids) that innervate the ventral tegmental area and the nucleus accumbens, producing a net effect of excitation as information is transmitted to the dopamine receptors in these brain areas.

Alcohol consumption produces very large and rapid dopamine releases enhancing the excitatory effect of dopamine in the nucleus accumbens (NAc) from ventral tegmental neurons. Nerve signals are sent to the cortex, where they are registered as "experience" and memories of the rewarding effects of alcohol, such as its taste or the feelings of relaxation after drinking

Serotonin and alcohol

The excitatory neurotransmitter serotonin helps regulate such functions as bodily rhythms, appetite, sexual behavior, and emotional states. Serotonin subtly modifies the function of neurons by interacting with receptors on the neuron's surface.

Alcohol exposure affects the function of serotonin receptors, and medications that act on these receptors alter alcohol consumption in humans and animals. Serotonin has also been implicated in the rewarding effects of alcohol and alcohol dependence through an indirect effect on dopamine release as well.

Alcohol and GABA

Y-Aminobutyric acid (GABA) is the major inhibitory neurotransmitter in the brain. It acts via two receptor subtypes called GABAA and GABAB. Neurons that bear GABA receptors are especially abundant in the brain's frontal cortex where a widespread loss of GABA-induced inhibition can cause seizures, and seizure disorders. A more isolated loss of GABA-induced inhibition, however, is thought to be involved in behavioral impulsivity, which is a trait of a number of psychiatric disorders including substance abuse and chronic conduct problems.

Alcohol consumption causes motor incoordination and sedation as does high activity of inhibitory neurotransmitters. Chronic alcohol consumption leads to a decline in the number of GABA receptors in the brain and thus reduces GABA's ability to bind to its receptors. Thus the body is forced to compensate for the reduction of GABA's inhibitory properties. These effects are a part of the changes in brain function that lead to tolerance and dependence on alcohol.

Alcohol can increase GABA activity in the brain through two general mechanisms: It can act on the GABA-releasing (i.e., presynaptic) neuron, resulting in increased GABA release; or It can act on the signal-receiving (i.e., postsynaptic) neuron, facilitating the activity of the GABAA receptor. Alcohol drinking is suppressed by compounds that interfere with the actions of the GABAA receptor (i.e., GABAA receptor antagonists) as well as compounds that stimulate the GABAB receptor (i.e., GABAB agonists) in the nucleus accumbens, ventral pallidum, bed nucleus of the stria terminalis, and amygdale.

Glutamate and alcohol

Glutamate is the major excitatory neurotransmitter in the brain; it exerts its effects via several receptor subtypes, including one called the N-methyl-D-aspartate (NMDA) receptor. Glutamate systems have long been implicated in the acute reinforcing actions of alcohol, and alcohol effects perceived by an organism can be mimicked with NMDA receptor antagonists. Acute alcohol administration also suppresses glutamate-mediated signal transmission in the central nucleus of the amygdala, an effect that is enhanced following chronic alcohol exposure. The involvement of NMDA receptors in alcoholism is especially interesting because they also play a role in neuroplasticity, a process characterized by neural reorganization that likely contributes to hyperexcitability and craving during alcohol withdrawal.

Neuroscience is showing that the pathways of addiction are based in the brain. Using advanced techniques such as imaging methods and studies with animal models, researchers are learning more about how alcohol interacts with the brain's communication system in different people. Innovative technology also is helping identify the changes that occur in the brain's structure and function as a result of drinking, and how alcohol disrupts the brain's delicate chemical balance.

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