The Healing Power of Music

Scientific American Mind

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Music as Medicine

- Across cultures and throughout history, music listening and music making have played a role in treating disorders of mind and body.

- Music is a uniquely effective tool for treating neurological impairment because it recruits nearly every region of brain.

- Music- based therapies can trigger neuroplasticity (restoration of damaged nerves) -fostering local connections and long range pathways that compensates for impairment in damaged regions of the brain.

Universal Language

- ☐ Music simultaneous activation of diverse brain circuits seems to produce some remarkable effects. Instead of facilitating a largely semantic dialogue, as language does, melody seems to mediate an emotional one.
- ☐ Music reliably conveys the intended emotion in all people who hear it.
- ☐ The ability of a song to elicit a particular emotion does not necessarily depend on cultural background.
- ☐ Music contains information that elicits a specific emotional response in the brain regardless of personality, taste and training.
- ☐ Appreciation of music appears to be hardwired at birth. Infants pay rapt attention to song and even seem to prefer song to speech. Functional MRI studies showed the brains of one- to three day newborns responded to classical music similar to adults. The brain seems to be born ready to process music.

Seven Ways that Music Might Work to Benefit the Brain

- ☐ 1. Music is Physical: It encourages to move with the beat. The more salient the beat, the more sweeping and emphatic the body movement. Physical exercise can help improve circulation, brain health, and fine and gross motor function.

- ☐ 2. Music is Emotional: It induces emotional states by initiating changes in the distribution of chemicals in the brain that can induce positive moods and heightened arousals. This, in turn, increases the rate of changes in the brain, speeding recovery and rehabilitation.

- ☐ 3. Music is Engaging: Musical treatments are engrossing and rewarding, so patients are highly motivated to participate with enthusiasm, focus and dedication.

- [ ] 4. Music Permits Synchronization: Music helps listeners synchronize rhythm (by tapping along) and melody (by singing along), addressing problems of timing, initiation and coordination in people with stroke, Parkinson's disease, and other brain disorders involving sensory and motor systems.

- [ ] 5. Music is Social: Musical activities can be collective experiences. Social isolation is a common consequence of many neurological disorders, and social support through music making helps in recovery, rehabilitation and coping.

- [ ] 6. Music is Persuasive: Music can make associated media such a lyrics and films seem more compelling. When patients believe in their treatment, their attitude tends to remain positive.

- [ ] 7. Music is Personal: Neurological impairment can make people feel that they have lost touch with themselves. The personal nature of music can evoke memories and help individuals maintain a sense of identity.

First Clinical Studies

- In 2008, Teppo Sarkamo did a study on patients who had suffered from a stroke in the middle cerebral artery (the most important artery inside the brain) of one hemisphere. They listened to music during 2 month therapy. These patients exhibited the greatest recovery in verbal memory and attentions as compared to the patients who were not exposed to music.

The Singing Cure (Melodic Intonation Therapy)

- In 1970s neurologist Martin Albert with two speech pathologists in Boston developed a treatment called melodic intonation therapy (MIT) in which singing is a central element.

- MIT technique: patients will sing words and short phrases set to a simple melody while tapping out each syllable with their left hand. The melody usually involves two notes, perhaps separated by a minor third note. As the treatment progresses, the phrases get longer and the frequency of the vocalization increases, perhaps from one syllable per second to two.

- ☐ Each element of the MIT contributes to fluency by recruiting undamaged areas of the brain.

- ☐ The slow changes in the pitch of the voice engage areas associated with perception in the right hemisphere, which integrates sensory information over a longer interval than the left hemisphere does; as a consequence, it is particularly sensitive to slowly modulated sounds.

- ☐ The rhythm tapping with the left hand invokes a network in the right hemisphere that controls movement associated with the vocal apparatus.

- ☐ Benefits evident after even a single treatment session but when performed intensively over months, MIT also produces long term gains that appear to arise form changes in neural circuitry -the creation of alternative pathway or the strengthening rudimentary ones in the brain.

- In patients with severe aphasia (unable to talk), singing trains structures and connections in the brain's right hemisphere to assume permanent responsibility for a task usually handled mostly by the left.

- In recent studies, researchers stimulated an area in the right hemispheres (inferior part of frontal lobe, which helps to connect sounds with the oral, facial and vocal movements that produce them) with non- invasive magnetic stimulation (Trans-cranial Magnetic Stimulation or TMS). Stroke patients who received combined MIT with non-invasive stimulation (TMS) showed improvements in speech fluency after only a few sessions.

- Functional MRI studies in these patients also showed increased activity in the right hemisphere network associated with vocalization.

Music and Motion (Music-Supported Treatment)

- ☐ Music making can also help stroke survivors living with impaired motor skills.

- ☐ In a study published in 2007, stroke patients were asked to use their movement- impaired hands to play melodies on the piano or tap out a rhythm on pitch producing drum pads. This treatment is called music-supported treatment. These patients showed greater improvements in the timing, precision and smoothness of fine motor skills than did patients who only receive conventional therapy. The gain resulted from an increase in connections between neurons of sensory motor and auditory regions.

Music Rhythm Therapy in Parkinson's Disease and Stroke.

- Parkinson's disease arises from degeneration of cells in the upper part of brainstem that produce dopamine (a chemical mediator or neurotransmitter) and send it to the basal ganglia. This area in the middle part of the brain is involved in the initiation of smoothness of movements. The dopamine shortage in this region result in motor problems ranging from tremors and stiffness to difficulties in timing the movements associated with walking, facial expression and speech.

- Music with strong beat can alleviate some of these symptoms by providing an audible rhythmic sequence that people can use to initiate and time their movements (rhythmic entrainment therapy).

- Rhythmic stimulation therapy (RAS) is another therapy for people who had trouble walking because of Parkinson's disease and stroke. The patients are asked to walk at a comfortable speed and to audible rhythm. Tempos that pushed patients slightly passed their comfort zone yield the greatest improvement in velocity, cadence and stride length.

Music and Alzheimer's Disease

- Fewer neurological disorders inspire greater fear than dementia, one of the most common diseases of the elderly. the most common form of dementia is Alzheimer's disease (AD).

- Music has several benefits in AD. It stimulates memory and helps patients to maintain a sense of self. It also stimulates normal emotional response and reduces agitations.

- Music also reduces the risk of dementia. Studies suggest that older adult musicians tend to have stronger memory, more focused attention and faster brain processing.

Music and Autism

- Autism is a neurodevelopment disorder that occurs in 1-2% of children. The symptoms are: impaired social interaction, repetitive behaviors and difficulties in communication. Up to 30% of autistic patients can not make the sound of speech at all.

- Neurobiology of autism: these patients have the overdevelopment of short- range brain connections and therefore, they tend to focus intensely on the fine details of sensory experience, such a the precise sound qualities emitted by appliances such as a refrigerator or air conditioner.

- Because of this fascination with sound, a disproportionate number of these children are musical savants, with extra ordinary abilities in specialized areas such as absolute pitch.

Music Therapy in Autism

- Music activates areas of the brain that relate to social ways of thinking. When we listen to music, we often get a sense of the emotional states of the people who created it or are playing it. By encouraging autistic children to imagine these emotions, therapists can help them learn to think about other people and their feelings.

- Auditory-motor mapping training (AMMT) is a new technique for autistic patients who can not speak. It has 2 components: intonation of words and phrases (changing melodic pitch of one's voice) and tapping alternatively with each hand on pitch-producing drums while singing or speaking words or phrases. In one study, after 8 weeks of therapy all of the children were able to produce some speech sounds and some were even able to voice meaningful and appropriate words.

Music For Treatment of Tinnitus

- Tinnitus is an experience of noise or ringing in the ear in the absence of sound that affects roughly 20% of adults and can cause serious distress.

- Neurobiology of tinnitus: cochlear damage (caused by prolonged exposure to loud sounds) reduce the transmission of particular sound frequencies to the brain. To compensate for the loss,neuronal activation the central auditory changes, creating neural “noise”, perhaps by interfering the balance between inhibition and excitation in the auditory cortex, leading to the perception of sounds that are not there.

- Music treatments can counteract this dysfunction by inducing changes in the neural circuitry.

Methods of Tinnitus Treatment

- ☐ Notched Music: it is for patients with tonal tinnitus. This music is generated by digitally removing the frequency band that matches the tinnitus frequency. It helps to reverse the imbalance in the auditory cortex, strengthening the inhibition of the frequency band that might be the source of tinnitus.

- ☐ Another technique involves playing a series of pitches to patients and then asking them to imitate the sequence vocally. As the patients refine their accuracy, they learn to disregard irrelevant auditory signals and focus on what they want to hear. In time, the stimulus of effortful attention might help the auditory cortex return to its normal physiological state.