

Effect of Music Therapy on Stroke Patients

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Neurological impairment produces cognitive, communicational, physical, and social deficits. Music has the power to help stroke patients to regain speech and overcome other deficits. Rhythm and melody help to rehabilitate memory, muscles, breathing, etc. This article introduces how music therapy approaches stroke patients and helps them. It focuses particularly on speech; however, music affects not only one part of the body but the whole body. In cases in which music therapy is used, we can see how music helps with stroke patients and how to achieve these goals.

Key words : Stroke, rehabilitation, music, music therapy

Introduction

Stroke is one of the most common and disabling neurological diseases in adult life. In western society, it is estimated that 450,000 to 500,000 people are affected by some form of stroke¹⁾. Stroke is also to become common diseases in Korean society too. Stroke is brain injury so after an attack, cognitive, physical, communicational, and social interaction problems follow. Moreover, rehabilitation is slow. Therefore, people think and look for many kinds of treatment programs and therapies other than medical ones.

A stroke is attributable to brain damage and the symptoms vary depending on which part of the brain is involved. The production of speech is usually attributed to the left hemisphere. However, it is hypothesized that an interhemispheric relationship exists for the coding and production of purposive (conversational) language, with the right hemisphere mediating prosody, or the musical characteristics of speech²⁾. The right hemisphere is also believed to regulate the production of nonpurposive speech, such as automatized material or previously-learned song lyrics³⁾.

Musical perception and production are thought to be regulated by both cerebral hemispheres. Certain theorists attest to the role of the right hemisphere in melodic aspects such as the perception of individual pitches, intervals, and directionality of pitches. Rhythmic aspects, conversely, are

thought to be processed either in the left hemisphere⁴⁾, or are bihemispherically located. So, generally, a patient who has a left brain damage has a language problem but can sing with melody. However, a patient who has right brain damage can sing with words but not with melody. This person's melody is flat and monotone.

In the case of music, there is really a big difference whether there is right brain damage or left brain damage. It is curious how music affects the brain. However, the brain is a very complex organ and still holds many mysteries, even for neurologists. Therefore, despite a lot of research, it is still not clear how music helps the brain to work on the human body. However, music has the power to rehabilitate stroke patients although researchers don't exactly understand how this works.

Discussion

1. Music

1) Rhythmic Auditory-Motor Integration

Sound primes the motor system by arousing the motor neurons in the spinal cord and thus sets the motor system in a state of heightened readiness and excitability. When sound is organized in repetitive rhythmic patterns, the priming effect beings to arouse the motor neurons and activate muscle patterns in a predicable time structure, thus creating a physiological auditory-motor entrainment effect: that is, the motor system tends to remains very stable, even when the rhythm changes⁵⁾. Rhythmic stimuli serve to enhance timing and readiness can be helpful for treatment programs such as gait rehabilitation or physical fitness programs.

Rhythm can play an essential role in treatment by

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providing the necessary cues to reintegrate the sense of movement. The loss of neurologic function can trigger the activation of compensatory mechanisms, which have been lying dormant within the brain, to partially or completely 'take over' the absent function. This phenomenon is known as 'neural plasticity'⁶⁾. There are many alternate nerve pathways and connections that can be used to re-establish behaviors. For even severe stroke patients, music, with a strong rhythmic base, can allow for spontaneous movement. For example, when we hear the music, our hand or foot moves to beat to the music without consciousness. It is moving automatically.

The rhythmic character of music serves as an auditory cue to influence timing and readiness (potentiation) of the nervous system, and consequently supports more precise and sustained physical movements. Nonrhythmic, slow tempos, and/or low frequencies can entrain brain frequencies to levels that reduce relaxation and facilitate the alleviation of pain⁶⁾.

2) Communication

Working on regaining speech, communication, we have to work on memory first. People's experience with music throughout their lives can influence how they will respond to rhythm and sounds presented during therapy sessions. Research in neuroscience indicates there is a strong connection between the auditory system and the limbic system. This biological link makes it possible for sound to be processed almost immediately by the areas of the brain that are associated with long-term memory and the emotions⁷⁾. This link is also mediated at a subcortical level, making it possible for the processing of information despite higher cortical damage. This is evidenced clinically by the strong emotional responses to familiar music we observe in persons with memory deficits. Familiar songs become a tool for connecting to seemingly lost parts of the personality by providing a necessary link to the 'self'. We have memories for not only the particulars of a song, such as the melody or lyrics, but also the rich associations that keep the melodies alive, for us throughout our life. Memories are not actually lost with brain injuries; rather, the ability to retrieve and gain access to these is damaged⁶⁾.

The anatomical structure of procedural memory is presumed to involve striato-prefrontal circuits, whereas the substrate of declarative memory, memory for specific facts and information, is presumed to involve circuits connecting the hippocampus, subiculum, and association cortex. Because neurologic damage resulting from head trauma, some strokes occurs in higher cortical areas, finding responses that are mediated at a sub-cortical level can greatly enhance the recovery of function.

Those with expressive aphasia (difficulty in word retrieval but with good comprehension) can often sing familiar musical phrases without a problem. Using singing to stimulate language centers of the brain can aid in nonmusical word retrieval, eventually making purposeful speech possible⁸⁾.

2. Methods and cases

1) Singing

MIT and MMIT mainly use the voice as singing. Many therapists use songs, precomposed songs because it really helps. Nordoff and Robbins said "It is possible in many therapy situations to make considerable use of already composed songs for both rhythmic and vocal work: songs played to suit the child's mode of beating, songs with rhythmic structures that develop his beating skills, songs in different moods to widen and enrich his experience, songs played with expressive variations and dynamics to deepen his involvement, songs to establish interrelationship and to develop a child's vocal-verbal expressiveness and confidence"⁹⁾.

Klinger and Peter talked about a singing group as a therapeutic adjunct in the treatment of aphasia at a New York veterans' Hospital. Some of the patients who had failed at past speech were able to produce words while participating in the singing group. The singing treatment, which was jointly planned by the music and speech departments, consisted of the following strategy¹⁰⁾:

- (1) The tempi of the songs were slower than normal. All patients were observed carefully while singing to determine if they were able to form the words adequately at the given tempo.
- (2) The therapists acted as models by singing along with the patients.
- (3) The ranges of the songs were selected to match the patients' vocal ranges.
- (4) The song texts contained few words, and the music was syllabically set.
- (5) Each song was repeated twice.
- (6) The song texts were printed on cards. These cards were posted in front of the group, and the song leaders pointed out the words during the singing.

Many therapists who use singing songs know this is a very good therapeutic method and this strategy can be changed or modified to adjust to particular patients. One of examples used the following characteristics:

- (1) The tempi of the songs were slower than normal. But the tempo was changed depending on the situation and patients' ability. Sometimes it became faster than normal or started slow then gradually faster or the opposite direction.

(2) I sang with them as a model but not all the time. I also give them a chance to sing by themselves without me.

(3) Usually patients' vocal range was lower than other people's were.

(4) I chose familiar songs for patients or I chose songs that I had a therapeutic reason for. I also usually chose songs with few words, or otherwise simple songs.

(5) Each song repeated many times. It also depended on the situation but I usually repeated each song more than two times.

(6) Reading the text, depending on patients' level. The severe aphasia patients could not read and write. But, the patient who was in a moderate level was able to read. One of my patients who was in a moderate level could read so he had the music in front of him while he was singing.

For stroke patients, the music therapist had a song list and kept going over and over it for each session. The main songs used in one case were: "Amazing Grace", "Amen", "Day O", "Daisy", "Goodnight Irene", "Bye Bye Blackbird", "He's Got the Whole World In His Hands", "I've Been Working On The Railroad", "Love Me Tender", "She'll Be Coming Round the Mountain", "Side By Side", "Singing In the Rain", "The Lion Sleeps Tonight", "You Are My Sunshine", "Let Me Call You Sweetheart", "Take Me Out to the Ballgame", "Home On the Range", "When Irish Eyes Are Smiling", "Oh When the Saints", "Swing Low", "This Little Light O Mine", "Red River Valley". And also other songs used that fit at the moment. Singing the song usually kept the same order of songs in each session. For example, "You Are My Sunshine", "Amazing Grace", "Side By Side", "Let Me Call You Sweetheart", "Home On the Range", etc. Also one song sang over and over. These songs were very familiar to all group members and group members could sing them even though they could not speak. Each member had strength for different songs. For example, G's favorite song was "Amazing Grace". She could sing this song with very clear articulation. However, the other members could sing this song but not like G. In the case of E, she was just humming. When I repeated that song over and over, other members could sing that song with words. That's why the therapist made a song list and sang those songs over and over. There were two reasons for keeping the songs' order. Routine helped them to remember the songs and it also helped to promote their memory because group members could memorize the ordering.

Another method was the therapist just played the melody. This method expected them to recognize the song by melody. When the therapist played the melody on the guitar or the piano, at that time the therapist didn't tell them the name of the song. If group members didn't recognize the song, than the therapist started to sing the song. It often followed

the order unless the therapist had a reason not to. At first, they could not recognize the song by melody. In the second stage, group members could hum. Then, group members could recognize several songs that they could sing just by hearing the melody. Many stroke patients have a memory problem. The therapist was helping them with memory to help their speech because when patients memorized words, they could use them. Many stroke patients can sing and sometimes sing with clear articulation even though they cannot speak at all because the melody helps them to access the words of the song. From practicing, patients' repertoire built more and more and they had a greater possibility for speaking. In spite of their very slow progress, group members got motivation from having the therapy because they realized that they could sing with verbalization even though they could not talk at all.

The music therapist picked one syllable each day, or week, or sometimes it took several weeks to work on one syllable. For example, when patients needed to work on the "Oh" sound, the therapist chose the songs, "The Lion Sleeps Tonight", "Day O", "Oh When the saints", and "Home On the Range". The therapist focused on making the "Oh" sound in music and songs. Many stroke patients have verbal apraxia. The apraxic speech doesn't sound normal because of the disturbed rhythm and intonation. Broken, dysfluent, and repetitive speech attempts sound different from the normal rhythm and intonation that are associated with speech that flows smoothly. So, the therapist made group members practice in the music because music has rhythm and intonation. Also, melody and well-known songs made them comfortable. S had difficulty opening her mouth in the beginning because she had apraxia. In the later stage, she was able to make the mouth shape, "oh" and other sounds. She was able to sing even though her articulation was still not clear.

The music therapist made a particular signal for some songs as a next step in helping them with memory. In the case of the "Good Morning" song, it was a signal before starting the song. The signal was ascending G, A, B, and the starting note of the good morning song was C. So, when the group members heard the notes "G-A-B", they could know it was the good morning song and they could sing it. Before the therapist made the signal, the therapist noticed that G remembered the melody of the good morning song even though she could not remember the words "Good morning". When therapists saw her in the morning in the hall or lounge, they were waiting to hear the words, "Good morning" from her but when she didn't say them, just hummed the melody of the good morning song. Then, she sang the good morning song right away.

The therapist used the rhythm to speak. When the

patients needed to practice the phrase, the music therapist only used the rhythm. This method used when the group members' vocalization was good but utterance was not good. After they were using rhythm, they could sing better than before. Group members' articulation was much clearer than before doing this (melody and rhythm are both important for regaining speech). When the therapist was using this method, the therapist played the drum, tambourine, or clapped my hands to help them to keep the rhythm.

2) Stimulation approach

Improvising and playing instruments are other stimulating things to help patients to have verbal output. These things give motivation and a safe situation to try to work on their disability.

S is 50 years old and had an individual music therapy in rehabilitation unit. She had left brain damage and paralysis of the body. She doesn't show any reactions. People also could not assess her mental state because she could not talk at all and didn't show any response to them. For her in music therapy was to use voice only and improvise very simple melodies. The melody had only three or four notes. The techniques was sustaining simple because if someone has very limited abilities and low energy, remaining simple is a good way to match energies and to connect.

In the first session, the therapist improvised with two notes and sang up and down between two notes, E to G trying to match the patient's breathing. Then she showed her response right away. She opened her mouth and made a sound, "uh". She made that sound a few times but there were long intervals between each time. The therapist used more notes and made simple melodic melodies (D-G-G-A-G, D-A-A-B-A) and sang softly. Then she made the sound again, and now the intervals between each time shortened. The sound of "uh" is the only sound she could make at this time. When she said, "uh", the therapist responded "la". So, it was like, "uh, la, uh, la." and sustained in one note for a while then moved to another note. But melody still had basically three notes and made phrases. Sometimes the therapist just held the note and hummed for the duration of the time between her saying, "uh".

The next step was to sing, improvising using two notes in minor 3rd intervals. The therapist made phrases and half step raise up and down. She started to make the sound, "uh". When she made the sound, the therapist responded by singing "la" back to her. The therapist waited until she made the sound and when she did, the therapist responded right away with the pitches. At first the therapist sustained one note for a while then moved to another note but it had not many notes

and not more than 3rd intervals. When the therapist was waiting until she made the sound and responded right away after her responding, she smiled. She kept making the sound steadily. The therapist used her prompt to make the notes of a scale. The melody was D-G-G-A-F, F-A-A-B-G. The rhythm was quarter, quarter, eighth, eighth, and quarter. Then the therapist changed to sing with her exactly at the same time. S kept singing even though the therapist alternated those techniques. She was singing even though she could only make one sound and it was flat because her beat was steady and she was responding to person, music therapist. This may not be enough to claim she was speaking. But that it is the first step to speech. She probably will not ever be able to speak as she did before she was sick. However, she made a sound and started to communicate with people. Improvising singing made her produce sounds to connect to people.

Conclusions

Music and music therapy can help stroke patients with the following: memory deficits, depression, balance/gait problems, fine motor problems, poor attention, and decreased vocal projection. Working on memory is important for stroke patients. The perception of the rhythmic, melodic, harmonic, and dynamic pattern of music is very helpful at organizing the flow of attention and also helps the memory function. Rhythm and melody provide an excellent structure to organize, sequence, and remember verbal information. Rhythm and melody are strongly associated with a verbal text. Rhythm, melody, and harmony are used in music to create larger patterns that are easily recognizable. Rhythmic and melodic patterns help patients to remember muscular movements because they trigger the ability to remember movement sequences.

Music therapists are very aware that stroke patients get many benefits from music therapy. But it is sometimes difficult to know what causes a certain effect on the brain. So, it is better to work with a variety of therapies together to develop good treatment programs.

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