

# *Function Centered Analysis of Music Therapy in Rehabilitation Practice*

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**Abstract:** At this stage, a large number of clinical studies have shown that music has great impact for the body and mind. Music, as a therapeutic intervention, can better achieve personalized goals and apply it to rehabilitation treatment, and can play an important therapeutic role. This paper briefly expounds the classification of music therapy, analyzes the application of functional-centered music therapy in rehabilitation treatment, and puts forward possible mechanisms.

## **1. Introduction**

Based on different therapeutic perspectives, music therapy is not only used in the traditional process oriented physical and mental intervention therapy, but also widely used in the “function” oriented rehabilitation therapy. Therefore, this article mainly from the functional point of view, based on dysfunction, analyzes the application of music therapy in different indications and its existing mechanism.

## **2. Classification of Music Therapy**

### **2.1 Give Priority to Intervention**

As early as the 1980s, Dr. Wheeler proposed different levels of music therapy. At present, music therapy is mainly divided into reception, improvisation, recreation and synthesis[1]. Receptive music therapy refers to the treatment of patients by passively listening to music to induce their physiological and psychological experience. Common treatment techniques include song discussion, music recall, music synchronization, music imagination, etc; Improvisation generally refers to allowing visitors to choose their favorite musical instruments to perform impromptu. This method does not require training. The performance can be thematic or non thematic; Recreational music therapy emphasizes the process of personal participation in various music activities, which usually includes singing, playing, music learning, music creation, lyrics adaptation, music games, etc; The comprehensive formula is the combination of the above methods. This kind of music therapy based on physical and mental intervention focuses on the treatment process and the internal response of the clients to music. For more targeted treatment of symptoms, the neurological music therapy established by using the actual physiological relationship between brain and music is also widely

used in clinical rehabilitation.

## 2.2 Function Oriented

From the work of professional music therapists, the frequency of contact with patients with dysfunction is very high. This kind of research has great research value in clinical practice. At the end of 1990s, with the research and induction of many scholars and clinical workers, the neurological music therapy system was gradually established. Neurological music therapy mainly refers to the needs of the client, the use of standardized technology system composition, therapeutic application of music to intervene speech and language deficits, cognitive deficits, and sensory motor deficits caused by neural function damage. For example, the use of rhythm auditory stimulation technology can effectively regulate the abnormal gait of patients; For patients with non fluent aphasia, melodic intonation therapy can be used to adjust. In this way, music can play a better functional role, which is helpful to promote the application of music in rehabilitation therapy.

## 3. To Analyze the Application of Music Therapy in Rehabilitation Based on Function

### 3.1 Speech and Language Deficits

The main way of using music therapy to intervene the speech function of patients is to connect speech and music. Based on the current research in this field, neurologic music therapy is mainly applied to the patients with aphasia, apraxia and dysarthria; The goals are mainly for functional and spontaneous speech, language understanding, oral muscle control and coordination for clear pronunciation, language fluency, language order and pronunciation, language speed and language comprehensibility. Some common methods and techniques are: Melodic Intonation Therapy (MIT), Music Speech Stimulation, Rhythmic Speech Cueing, Voice Intonation Therapy, Therapeutic Singing, Oral Muscle Training and Respiratory Exercise, etc. Its specific application is shown in Table 1.

*Table 1 Speech/Language Musictherapy Techniques Commonly Used in Clinical*

Music therapy intervention technology	Ways and means	Therapeutic purpose
Melodic Tone Therapy Musical Speech Stimulation Rhythmic Speech Cueing Voice Intonation Therapy Therapeutic Singing Oral Exercise Training	Remaining singing ability Familiar tunes and phrases External rhythm and speed control The tone and rhythm of a sentence The overall trend of music Pronunciation training and playing practice	Promoting autonomous speech To stimulate spontaneous speech Coordinate muscles and regulate speech speed Training voice control Stimulate the development of language, enhance respiratory function Improve articulation and vital capacity

A large number of studies have shown that music therapy is an effective way to treat speech/language disorders. Ozdemir et al. found that a large number of brain areas activated during speech and singing coincide, suggesting that music and speech share some common neural pathways, and music may promote speech recovery. Li Shun [2] and other researchers found that early Melodic Intonation Therapy (MIT) can activate the frontotemporal lobe of the right hemisphere through rhythmic activities such as melody, rhythm, tone and left hand slap, which is especially suitable for the language rehabilitation of patients with left large area brain injury and non fluent aphasia, and improve their speech expression ability; Wu Xiaoli [3] and other researchers found that Melodic Intonation Therapy (MIT) combined with speech training can not only improve

listening comprehension and retelling, but also improve reading comprehension and naming; The improvement of reading comprehension and naming ability may further improve the patients' activities of daily living.

## **3.2 Cognitive Deficits**

### **3.2.1 Cognitive Ability**

Music therapy is very effective in improving the patients' emotion regulation ability, memory, attention, decision-making ability, executive ability and other cognitive functions. The focus of neurological music therapy for cognitive impairments is how the patients' response to music can be transformed into cognitive therapeutic response. Some common techniques include: Music Sensory Orientation Training, Musical Neglect Training, Musical Attention Control Training, Musical Memory Training, Auditory Perception Training, etc.

The application of music therapy in cognitive impairment has been verified in many studies. Bernardi et al. asked patients with left sensory deficiency to play the keyboard from right to left. With this predictable pitch feedback, they stimulated the left neglect patients to pay attention to the left area. In addition, Dr. Thaut, in order to enhance the patients' attention, adopted the interactive group music creation method, under the guidance of the therapist, let the patients play percussion music, and adjust it according to the speed and rhythm of other peers. In this way, it can effectively improve the patient's concentration. Strictly speaking, the concept of cognitive function itself is relatively broad. According to the existing music therapy research, it is not difficult to find that when using this technology, it is mainly limited to a certain kind of cognitive impairment. Therefore, in the future clinical practice, more randomized controlled trials should be conducted to fully verify this effect, and then more precise use of music therapy to strengthen cognition [4].

### **3.2.2 Wake Up Promotion**

For patients with low consciousness or unconsciousness, the main way to promote awakening is to stimulate and wake up related neural pathways, including naming stimulation, sensory stimulation, electrical stimulation, music stimulation and so on. Among them, music therapy is mainly to contact and interact with patients with low consciousness with the help of music itself. According to relevant practical research, music stimulation and name calling stimulation were applied to patients with minimal consciousness state (MCS) [5] and patients with vegetative state respectively. It was found that the effect of music stimulation was significantly better than that of name calling stimulation. In addition, the use of music stimulation, will also promote the patient's cardiovascular activity, respiratory rate, autonomic nervous system, will also change the facial expression. Music therapy cannot be regarded just as a kind of sound stimulation without purpose in promoting wakefulness. In fact, promoting wakefulness through music mainly relies on the cognition and connection between patients and music, and makes correct response by observing the changes of physiological indexes of patients.

## **3.3 Sensorimotor Deficits**

Music therapy is mainly used to improve patients' gait, enhance muscle strength and endurance, promote limb coordination and balance, and expand the range of motion. The common techniques include: Rhythmic Auditory Stimulation (RAS), Patterned Sensory Enhancement (PSE), Therapeutic Instrumental Music Playing (TIMP), Music Entrainment, Auditory Feedback and Purposeful Movement and so on.

### 3.3.1 Gait Training

Rhythmic Auditory Stimulation (RAS) has been widely used in gait training of patients with Parkinson's disease and stroke. It uses the physiological effect of auditory rhythm on human motor system to help those people with nerve damage and serious gait disorder to improve the movement control, stability and adaptive gait in rehabilitation training. This technology mainly through to prompt the rhythm to the patient, carries on the gait correction, carries on the intervention according to the patient's stride, the stride speed, the stride frequency and so on. Practical experience has proved that this kind of music intervention can well correct the problems of Parkinson's disease patients, such as starting, walking difficulties. On this basis, some researchers have made further improvements, integrating music into the original metronome, and found that the effect is better than using metronome alone [6]. In a word, through music therapy intervention gait training, give full play to the music of auditory cues, let patients produce a sense of time axis, on this basis, combined with other cues, so as to achieve the effect of improving abnormal gait.

### 3.3.2 Improve the Motor Function of Limbs

Patterned Sensory Enhancement (PSE) provides time, space and strength for functional training and daily physical movement by using various elements of music, such as rhythm, melody, harmony and strength. Therapeutic Instrumental MusicPlaying (TIMP) is a way to practice and stimulate functional movement by playing instruments individually for different patients. Music therapists choose musical instruments according to patients' treatment needs and goals, expand the range of motion, improve endurance and strength, improve functional hand movement and finger flexibility, and promote limb coordination through high individualized therapeutic playing. In this training, the traditional way of playing musical instruments is usually not used, but the therapist places the musical instruments in different positions according to the needs of patients' functional movement, so as to promote the generation of motor function.

Amengua et al. conducted relevant research by using music therapy, let patients with chronic stroke play special musical instruments [7], trying to improve the upper limb movement ability of patients with disease side. The main practice mechanism is to use MIDI drum to train gross movement and MIDI keyboard to train fine movement. After four weeks of training, the fingers and palms of stroke patients in chronic stage have been significantly improved in both frequency and overall flapping fluency. Since then, Massi et al. have also carried out relevant research, with the help of rhythm training to improve the upper limb motor coordination of patients.

## 4. Possible Mechanisms of Music Therapy Based on Functional Therapy

### 4.1 Common Neural Pathways

According to the neuroimaging research, music and speech not only share Broca's area, Wernick's area, but also have common neural pathway. Using functional MRI, researchers found that, whether speaking or singing, there were a large number of overlaps in the activated brain areas. When the patient performs with the music ability, it can stimulate the autonomous language ability. Therefore, it is not difficult to find that the application of music therapy technology is conducive to improve the speech and language function of patients [8].

### 4.2 Music Stimulation Cognition

A large number of studies have shown that music is closely related to perception, attention, memory, reality orientation and imagination. Music is a powerful form of sensory stimulation and

multiple sensory experience. Music has a great influence on people's perception. All elements of music, such as melody, rhythm, beat, strength and lyrics, will affect people's feelings to a great extent. The various skills contained in music activities can stimulate the development of perceptual ability to a certain extent. Music experience can attract and maintain people's attention for a long time and promote the concentration of attention. At the same time, music can also carry memory, convey information, and provide "here and now" experience stimulation. In addition, music can be used as a stimulus to wake up the nervous system, promote the release of subconscious activities, and produce imagination and association.

### 4.3 Combination with Body Rhythm

Different music can cause different physiological reactions, respiratory rate, heart rate, blood pressure, skin temperature, muscle potential, blood vessel volume and so on. Patients in coma, even if unconscious, can also perceive music rhythm through their inner rhythm, such as breathing, heart rate and so on. Therefore, with the help of music rhythm changes, can effectively stimulate patients with demand to adjust the internal body rhythm, so as to achieve the purpose of promoting physical and mental health.

### 4.4 Synchronization Effect Affects Motion Control

Based on the synchronization effect between the auditory center and the motor center, as well as the natural stimulation of rhythm to human hearing and the irresistible response to rhythm, the external rhythm prompt signal prompt can regularize the motor response and significantly improve the motor function of patients. Fujioka and others found that the beta wave in neural oscillation is related to the rhythmic stimulation in specific areas of the human body through practical research [9]. Following the external rhythm cues not only helps to synchronize the time value of movement and rhythm, but also helps to promote good movement organization and integrate complex movement patterns. This also shows that the intervention with the help of music rhythm can not only improve the patient's movement speed, but also adjust the patient's movement strength and improve the patient's range of activities.

## 5. Conclusion

Through the research on the application of function centered music therapy in rehabilitation therapy, this paper finds that music therapy plays an important role in promoting rehabilitation therapy, and has formed a relatively mature and perfect treatment system. Therefore, we hope that in the future research, on the basis of the existing treatment methods, we can actively promote the application of music therapy in various fields of clinical rehabilitation treatment, so as to obtain more practical data and effectively improve the wide application of music therapy in this field.

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