

Effects of music therapy on emotion and behavior regulation in children with sensory integrative dysfunction

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ABSTRACT

Children with sensory integrative dysfunction have difficulty processing sensory information, so emotional fluctuations often occur. Music therapy is popular in treatment because of its low stress and high participation; in recent years, it has attracted increasing attention in special education. Therefore, this article discusses the mechanism and specific application strategies of music therapy in regulating emotion and behavior in children with sensory integrative dysfunction, aiming to provide a reference for therapists to make more precise interventions to promote the standardized application of music therapy in special education.

KEYWORDS

music therapy; sensory integrative dysfunction; regulation of emotion and behavior; gamification intervention

Sensory integration dysfunction refers to the discoordination that occurs in integrating sensations, perceptions, thoughts, emotions, and behaviors in individuals. This discoordination can lead to an inability to effectively process various stimuli in the surrounding environment, affecting learning, daily life, and interpersonal communication abilities. Traditional intervention methods, such as sensory integration training, can improve basic sensory function. However, they are not targeted enough to regulate emotion and behavior, and repetitive training makes it easy for children to resist. As a cross-cultural and cross-age universal language, music has the natural function of empathy and connection, which makes music therapy maturely applied in the intervention of neurodevelopmental disorders such as autism and ADHD. The advantage of music therapy is that it can provide stable sensory input through controllable sound vibrations and help children learn emotional regulation methods through impromptu interactions. Based on this, this article will systematically explore the role of music therapy in regulating the emotional behavior of children with sensory integrative dysfunction and propose intervention strategies. This exploration not only helps to optimize the existing intervention programs but also has practical significance for improving the quality of life and social adaptation of children with sensory integrative dysfunction.

1 Characteristics of children with sensory integrative dysfunction

1.1 Abnormal physical responses

The manifestations of abnormal physical reactions of sensory integrative dysfunction mainly include tactile sensitivity or retardation, visual dyslexia, auditory memory problems, poor balance ability, poor motor coordination, etc.; these symptoms affect children's daily life, learning, and social ability. Touch-sensitive children may feel intensely uncomfortable when touched or when clothing rubs. They may refuse to shake hands or hug others. They may be nervous in group activities and afraid of touching others. Children who are hard of touch do not respond to pain, temperature changes, and physical contact. They are socially awkward and withdrawn and can be misunderstood and isolated^[1]. Some children struggle to identify light intensity, color contrast, and spatial relationships. They are easy to skip lines and miss words when reading, and their learning efficiency is low. The abnormality of hearing function is manifested by inaccurate positioning of sound sources. When the teacher's voice in class is mixed with the sound of other students turning books and the footsteps, it makes them feel noisy and difficult to concentrate. The vestibular sense, which is responsible for sensing head position and movement speed, is abnormal, making children afraid of activities such as swinging and climbing stairs; children with proprioceptive disorders often have poor body control, this can be seen in over-exertion when writing, and in bumping into chairs and tables when walking.

1.2 Difficulty controlling emotions

The limbic system and the prefrontal cortex work in concert to regulate normal emotions, but sensory integrative dysfunction can disrupt this process. Oversensitive or blunted sensory processing can result in a mismatch between the intensity of a child's emotional response and the situation, and a slight noise can startle him or her. Because children can

not accurately judge the safety of an environment, they often experience frequent mood swings, from calm to anger, and find it difficult to recover from conventional comfort. Emotional dysregulation significantly negatively impacts children's social interactions and self-awareness. Children with sensory integration dysfunction struggle to adapt to loud noises and frequent physical contact, which can lead to emotional breakdowns and confusion among their peers. Over time, there are fewer and fewer friends willing to communicate with children with sensory integration disorder, leading to a state of loneliness^[2]. At the same time, children with sensory integrative dysfunction, unable to understand their emotional states, resort to slapping their heads and biting their fingers to relieve their inner turmoil and stress. Long-term emotions out of control will form a vicious circle: the outside world will impose more restrictions on them, and the restrictions will aggravate children's anxiety and resistance, frequent frustration into self-denial. This has a negative impact on the subsequent treatment and development of children with sensory integrative dysfunction.

2 The path of music therapy on children's emotion and behavior regulation

2.1 Using rhythm to stabilize brain activity

The human brain is naturally sensitive to rhythm, and a steady beat activates the cerebral cortex and basal ganglia to work together. When children listen to the regular rhythm of music, their brain waves gradually synchronize with the beat frequency; this synchronization is known as the "Entrainment effect," in which the heartbeat and respiratory rate are directed towards a steady rhythm, reducing sympathetic hyperactivity and making it easier for children to relax and concentrate. Children with sensory integrative dysfunction will be stimulated by the chaos of the external environment, resulting in anxiety. The repetition and regularity of music rhythm can reconstruct their cognition of order. As children beat instruments or move their bodies to rhythm, their brains reinforce the anticipation-feedback loop by matching actions to sounds, thus enhancing their control over time and space and reducing impulsivity. Music rhythm stabilizes the brain's physiological activity and indirectly enhances the confidence of children with sensory integrative dysfunction in regulating their behavior. In the long run, they will be better able to cope with the stimuli brought by the external environment, and they may also experience less aggression and emotional outbursts. When they can control their emotions and behaviors, they will have more opportunities to socialize and better integrate into society for healthy growth.

2.2 Using melodies to guide emotional expression

Musical melodies are composed of pitch, interval, and tone. The human brain is susceptible to melodies: high tones and fast melodies can cause excitement and tension, and low tones and slow melodies induce calm and sadness. Based on this, therapists can design specific melodies to guide children to identify their emotions and release them. The creation of melody and improvisation can further strengthen children's emotional table, and the choice of pitch and the change of rhythm often reflect the emotional state in their subconscious. Short, rapid tones indicate anxiety, while long, continuous tones are associated with loneliness or a calm emotional state. Therapists can design small games with musical melodies and work with children to complete the tasks in the interaction to guide children to their emotions into musical symbols to enhance the perception of their feelings^[3]. This process subtly trains their emotion regulation ability to learn to find a transition and calming path for emotional changes in real situations and establish a healthier emotional expression mode.

3 The application strategy of music therapy in the emotion and behavior regulation of children with sensory integrative dysfunction

3.1 Designing music activities by Stages

Music activities should be designed according to stages according to the law of children's ability development to gradually improve the ability of children with sensory integrative dysfunction to adjust their emotions and behaviors. Initially, the therapist chooses music that the child is familiar with. Then, the therapist picks out rhythmically stable, structurally simple pieces and asks the child to tap his knees and rock his body to the rhythm. These movements are relatively simple, and the child only needs to synchronize the responses with auditory cues. Steady musical rhythms and repetitive movements help the brain develop predictable patterns that reduce the sense of chaos caused by external stimuli. The therapist can observe the child's breathing rate as the child continues to perform the basic tasks. If the breathing rate decreases, it indicates that an initial relationship of trust has been established, and the next stage of treatment can begin. The therapist can mix different rhythm speeds, superimpose various timbres, design action combinations that require quick reactions, and ask children to jump when they hear high notes and squat down when

they hear low notes. This is more complex than the first-stage movements and requires the brain to process auditory signals, visual cues, and body coordination simultaneously, thus allowing the ability to process multisensory information simultaneously in children with sensory integrative dysfunction to be trained. As the stage progresses, children gradually learn to actively anticipate musical changes and coordinate breathing and muscle control during action execution, forming an adaptive response to sudden stimuli^[4]. In the face of external stimuli, they can adjust their body movements to restore calm. At the end of each stage, the therapist systematically assessed the children's performance, recording changes in indicators such as attention span, emotional stability, and motor coordination accuracy to determine whether they could move on to the next stage of intervention training. The advantage of phased music therapy is that it can effectively avoid withdrawal behavior caused by overstimulation. At the same time, it can continuously activate the potential ability of children to gradually guide them to learn to regulate their aggressive behavior and emotions.

3.2 Choosing music according to children's preferences

Children will feel happy and optimistic about certain music types and sounds. This positive emotional response creates a key breakthrough for the follow-up treatment. The therapist should observe which music the child is interested in daily and prioritize using these materials in early activities. When children with sensory integrative dysfunction hear a familiar melody, their attention increases and physical tension decreases, so a therapist can incorporate the rhythm, timbre, and lyric structure of the music into a treatment plan in order to mobilize their participation in the treatment process, so that the intervention program can be carried out smoothly. For children with sensitive hearing, therapists should choose low, soothing cello music; xylophone sounds more stable and can reduce their auditory stimulation. Finally, a combination of music that provides a sense of security and moderately stimulates sensory integration should be selected. During the treatment, the therapist needs to pay synchronous attention to the children's spontaneous musical behaviors because these spontaneous behaviors imply the children's internal regulatory needs. Therefore, these spontaneous choices can be refined into future rules, gradually building a personalized music regulation toolbox. In the long-term intervention, children will unconsciously transfer these music strategies to daily life, constantly improve their behavior, and adjust their emotional fluctuations to better communicate with others and play.

3.3 Combination of play and interactive training

The game's fun can reduce the children's resistance to the intervention and make the therapeutic target naturally integrate into the interactive process. The therapist can design interactive games such as music role-playing and rhythm passing to let the child clap his hands, catch the ball to the music, and train his auditory tracking and hand-eye coordination. At the same time, the children imitated the therapist by playing emoticons on different musical instruments to learn to recognize emotional signals and adjust their body reactions indirectly. During this period, the therapist should adjust the difficulty of the game according to the child's immediate performance, and if the child can not keep up with the rhythm, slow down the movement so that the child can continue to play; when the child has adapted to the change of rhythm, the therapist can add improvisational modulations, challenges that inspire confidence in the child to overcome difficulties. In addition, the therapist should design music games in which the children have to repeat the same movements, such as taking turns to complete the melody with a puzzle of percussion notes and passing the rhythm in a group circle. This repetition helps children develop behavioral expectations and reduce negative feelings of fear and anxiety about the unknown^[5]. The game should match the stable background rhythm to maintain order. Children in the game need to listen to the direction of the drum to find the hidden sand hammer and adjust the jumping strength according to the keyboard's vibration; this multimodal integration training can significantly improve the brain's information processing efficiency. As the complexity of the game increased, children began to actively use the regulatory strategies they had mastered actively, taking deep breaths to stabilize the clapping frequency when the rhythm was chaotic and aligning auditory and kinesthetic signals by shaking the body, eventually in the face of daily emotional fluctuations, like the completion of the music game task, can automatically activate the body and emotional coordination mechanism. This not only lays a good foundation for their future development. It also proved the effect of music therapy on the emotions and behavior of children with sensory integrative dysfunction.

4 Conclusion

In summary, during music therapy, children can spontaneously adjust their breathing rate and body movements to a stable state through rhythm synchronization training in music games; they learn to actively use specific sound signals for self-soothing when their emotions are out of control. The resulting adaptive adjustment ability can be transferred to daily life scenarios to help them better cope with external disturbances. Future research needs to refine the correspondence

between music therapy programs and subtypes of sensory integrative dysfunction and explore the development of simple music intervention tools suitable for family environments to improve the sustainability of therapeutic effects.

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