

Research Paper

The Effectiveness of Music Therapy for Individuals Living with Cerebral Palsy

Shinjan Ghosh¹, Angana Nandy^{2*}

ABSTRACT

Introduction: Cerebral Palsy (CP) is a group of permanent movement disorders that appear in early childhood. It is caused by abnormal development or damage to the parts of the brain that control movement, balance, and posture. The process of rehabilitation in CP includes physical therapy, occupational therapy, speech therapy, psychological support along with should be multidimensional and unconventional modes of intervention technique which can help individuals lead fulfilling lives. Music therapy (MT) is one of the methods that apply a wide range of music to enhance health and the quality of a patient's life. The primary objective of this review is to critically evaluate the effectiveness of music therapy intervention for individuals suffering from Cerebral Palsy (CP). **Material and methods:** This review aims to explore research done with the help of Academia.edu, Pub Med and Google Scholar selected as primary databases for our review. Twelve studies were selected based on the inclusion and exclusion criteria for further analysis. **Results:** The findings revealed the most significant effects of music therapy on individuals suffering from spastic cerebral palsy children introduced changes in the underlying motor function. There was also a significant effect of music therapy on child's emotional state, self-confidence, reduced anxiety levels, and communication skills. **Conclusions:** The existing literature on music therapy for cerebral palsy children in India is limited and therefore, the present study tried to address the effectiveness of music therapy for individuals with cerebral palsy. As there is no cure for cerebral palsy, music therapy can provide a comprehensive care for individuals with cerebral palsy.

Keywords: Cerebral palsy, Music therapy, Comprehensive care, Unconventional Treatment Method

Cerebral Palsy (CP) is a group of permanent movement disorders that appear in early childhood. It is caused by abnormal development or damage to the parts of the brain that control movement, balance, and posture. The term "cerebral" refers to the brain, while "palsy" refers to the loss or impairment of motor function. CP is the most common motor disability in childhood, affecting approximately 2 to 3 out of every 1,000 live births worldwide (Centres for Disease Control and Prevention [CDC], 2020). The prevalence

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varies by geography, with higher rates observed in low-income regions due to limited access to prenatal and neonatal care.

Cerebral Palsy is classified into several types based on the nature and location of the movement issues. The primary types include:

1. **Spastic Cerebral Palsy:** This is the most common form, accounting for about 70-80% of cases. It is characterized by increased muscle tone, resulting in stiff and jerky movements. Spastic CP can further be classified based on the limbs affected:
 - **Spastic Hemiplegia/Hemiparesis:** Affects one side of the body.
 - **Spastic Diplegia/Diparesis:** Primarily affects the lower limbs, with less severity in the upper limbs.
 - **Spastic Quadriplegia/Quadriparesis:** Involves all four limbs, the trunk, and the face. This type is often associated with intellectual disability and seizures.
2. **Dyskinetic Cerebral Palsy:** This type involves problems with controlling limb movements, leading to involuntary and uncontrolled movements. It includes:
 - **Athetoid CP:** Characterized by slow, writhing movements.
 - **Dystonic CP:** Involves repetitive and twisting movements.
3. **Ataxic Cerebral Palsy:** This form affects balance and depth perception. Individuals with ataxic CP may exhibit unsteady, shaky movements and difficulty with precise movements like writing or buttoning a shirt.
4. **Mixed Cerebral Palsy:** Some individuals exhibit symptoms of more than one type of CP. The most common combination is spastic-dyskinetic CP.

Common Challenges Faced by Individuals with Cerebral Palsy

Individuals with Cerebral Palsy face a variety of challenges that can impact their quality of life. These challenges can be broadly categorized into motor, cognitive, and emotional aspects:

- **Motor Challenges:** These are the most apparent issues and include difficulties with movement, coordination, and muscle tone. Children with CP may experience delays in reaching motor milestones such as sitting, crawling, or walking. They might also have problems with fine motor skills, such as grasping objects, and may require assistive devices for mobility.
- **Cognitive Challenges:** While not all individuals with CP have cognitive impairments, about 30-50% may experience intellectual disabilities. These can range from mild learning disabilities to more severe intellectual impairments. Difficulties in attention, problem-solving, and processing speed are also common.
- **Emotional and Behavioural Challenges:** The psychosocial impact of CP can be significant. Individuals may experience social isolation, low self-esteem, and anxiety due to their physical limitations and the social stigma associated with disability. Behavioural issues, such as hyperactivity or aggression, may also be present and can be exacerbated by frustration from communication difficulties.

Understanding these challenges is crucial for developing comprehensive treatment plans that address the multifaceted needs of individuals with CP. Interventions, including physical therapy, occupational therapy, speech therapy, and psychological support, are essential to help these individuals lead fulfilling lives.

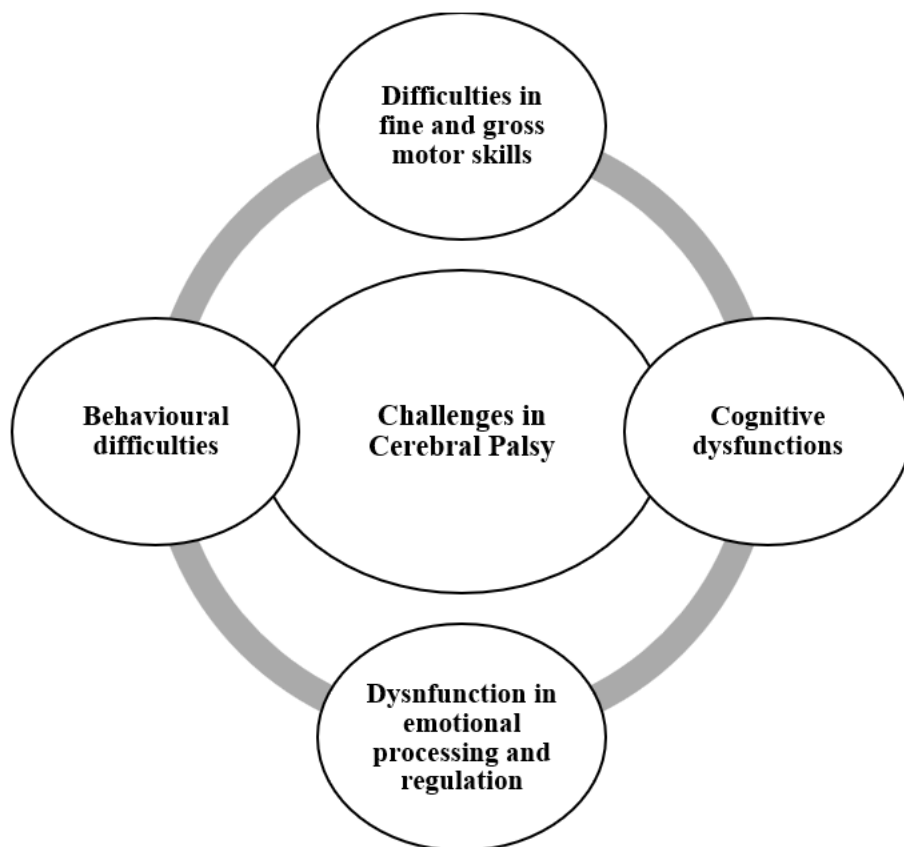


Figure 1: Challenges in Cerebral Palsy

Music Therapy

Music therapy is an evidence-based practice that uses music interventions to accomplish individualized goals within a therapeutic relationship. It involves a trained music therapist fusing music in various forms—such as listening, singing, playing instruments, and composing—to address physical, emotional, cognitive, and social needs of individuals. The American Music Therapy Association (AMTA) defines music therapy as the clinical and evidence-based use of music interventions to accomplish individualized goals within a therapeutic relationship by a credentialed professional who has completed an approved music therapy program (AMTA, 2021).

The principles of music therapy are rooted in the understanding that music can stimulate brain functions, facilitate movement, enhance memory, improve communication, and provide emotional support. Music therapy aims to:

- Improve motor skills through rhythmic and movement-based activities.
- Enhance communication abilities, especially in individuals with speech and language impairments.
- Provide emotional support and facilitate expression of feelings.
- Improve cognitive functioning through structured musical activities.
- Foster social interaction and engagement.

Historical Context

The use of music as a therapeutic tool date back to ancient civilizations where it was employed in healing rituals and ceremonies. The formalization of music therapy as a recognized clinical discipline, however, began in the early 20th century. The roots of

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modern music therapy can be traced back to World War I and World War II, where musicians played for veterans suffering from physical and emotional trauma. These early instances demonstrated the positive effects of music on soldiers' recovery, leading to increased interest and formal study in the field.

The first music therapy degree program was established at Michigan State University in 1944, and the formation of professional organizations, such as the National Association for Music Therapy (NAMT) in 1950 and later the American Music Therapy Association (AMTA) in 1998, solidified music therapy's place as a respected therapeutic discipline. Over the decades, research has continued to validate the efficacy of music therapy, expanding its application to a wide range of medical and psychological conditions.

Music Therapy in Medical Conditions

Music therapy is employed in various medical settings to address a broad spectrum of health issues. Here are some key applications:

- **Neurological Disorders:** Music therapy has proven beneficial in treating conditions such as stroke, Parkinson's disease, and traumatic brain injury. Rhythmic auditory stimulation (RAS) is particularly effective in improving gait and motor functions in patients with neurological impairments (Thaut et al., 2007).
- **Mental Health:** Music therapy is widely used in the treatment of psychiatric disorders, including depression, anxiety, and schizophrenia. It helps patients express emotions, reduce stress, and improve mood through structured musical activities (Silverman, 2011).
- **Developmental and Learning Disabilities:** For individuals with autism spectrum disorder (ASD) and other developmental disabilities, music therapy can enhance social skills, communication, and sensory processing. It provides a non-verbal medium for expression and engagement (Geretsegger et al., 2014).
- **Pain Management and Palliative Care:** Music therapy is effective in reducing pain perception and providing emotional comfort for patients in palliative care or those undergoing surgical procedures. It serves as a non-pharmacological intervention to manage pain and improve quality of life (Bradt et al., 2016).
- **Rehabilitation and Physical Therapy:** In rehabilitation settings, music therapy supports physical therapy goals by motivating movement and exercise. Techniques such as therapeutic instrumental music performance (TIMP) help improve motor control and coordination (Altenmüller & Schlaug, 2013).

Music therapy's versatility and holistic approach make it a valuable adjunct to traditional medical treatments, offering benefits across physical, emotional, and cognitive domains.

Aim of the study:

The primary objective of this review is to critically evaluate the effectiveness of music therapy interventions for individuals suffering from Cerebral Palsy (CP). While there is growing interest in complementary and alternative therapies for CP management, the evidence supporting the efficacy of music therapy remains heterogeneous and requires thorough examination. By synthesizing existing research, this review aims to provide insights into the potential benefits of music therapy in addressing the multifaceted needs of individuals with CP, including motor, cognitive, and emotional aspects. Additionally, we seek to identify gaps in the literature and propose avenues for future research to enhance the understanding and implementation of music therapy interventions in clinical practice.

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Research Questions

1. What is the effectiveness of music therapy interventions in improving motor functioning, cognitive abilities, and emotional well-being in individuals with Cerebral Palsy?
2. What music therapy types and techniques are used to treat Cerebral Palsy?
3. How do individual characteristics, such as age, severity of CP, and comorbid conditions, influence the outcomes of music therapy interventions?

METHOD

This review aims to explore research done on the effectiveness of different types of music therapy on people suffering from cerebral palsy. Academia.edu, PubMed and Google Scholar were selected as primary databases for our review. PubMed focuses mainly on biomedical science, Academia.edu covers important research articles uploaded by authors from most scientific fields and Google Scholar recognises a wide array of peer-reviewed papers. Next, key concepts were determined and search terms relevant to our theme were developed.

The search terms used were as follows:

- Music-based interventions in cerebral palsy
- Music therapy in cerebral palsy
- Music therapy techniques in cerebral palsy
- Factors affecting music therapy outcomes
- Factors affecting music therapy outcomes in cerebral palsy

To further narrow the number of studies, a few inclusion and exclusion criteria for the selection of research papers were also framed. These are as follows:

Inclusion criteria:

- Articles published between January 2014 to June 2024
- Written in English
- Extracted from Google Scholar, PubMed or Academia.edu
- Peer-reviewed articles

Exclusion criteria:

- Articles published in predatory or ingenuine journals
- Articles written in languages other than English
- Articles published before January 2014

Based on these inclusion and exclusion criteria, 12 articles have been selected for the final review (see Table 1). An overview of these articles is as follows:

Table 1: List of the research articles considered for this paper

Sr. No.	Author (s)	Title	Year	Results
1	Ana Alves-Pinto, V. Turova, T. Blumenstein, R. Lampe	The Case for Musical Instrument Training in Cerebral Palsy for Neuro rehabilitation	2016	The music therapy has shown significant changes in the internal mechanisms underlying motor function in cerebral palsy (CP) patients.

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Sr. No.	Author (s)	Title	Year	Results
2	Eugenio Marrades-Caballero, C. S. Santonja-Medina, J. M. Sanz-Mengibar, F. Santonja-Medina	Neurologic music therapy in upper-limb rehabilitation in children with severe bilateral cerebral palsy: a randomized controlled trial.	2018	Improvements in the “arm and hand position” as well as “activities” from the Chailey Levels of Ability among participants receiving music therapy.
3	J. Šinkūnienė	The role of a music therapist in a rehabilitation team in the health promotion of children with cerebral palsy	2021	<ol style="list-style-type: none"> 1. The proper selection of musical instruments – strengthened the child’s movement control and increased motivation. 2. Helped to develop the child’s communication skills and social interaction. 3. Individualized selection of music therapy helped in the child’s emotional state, develop their self-awareness, strengthen self-confidence, and reduce anxiety levels.
4	Sohei Yanagiwara, Tsubasa Yasuda, Minami Koike, Takatsugu Okamoto, Kenta Ushida, Ryo Momosaki	Effects of music therapy on functional ability in people with cerebral palsy: a systematic review	2022	Music therapy had a significant effect on the Gross Motor Function. Music therapy had no significant effect on any of the other items like functional Independence measure and goal attainment measure.
5	T. Duymaz	The effects of music therapy on gross motor functions, pain and level of functional independence in children with cerebral palsy	2020	Music therapy, applied additionally in the treatment of children with spastic CP, reduces the pain of children more and increases the gross motor functions and functional capacities.
6	M. Vinolo-Gil, E. Casado-Fernández, V. Pérez-Cabezas, G. Gonzalez-Medina, F. J. Martín-Vega	Effects of the Combination of Music Therapy and Physiotherapy in the Improvement of Motor Function in Cerebral Palsy: A Challenge for Research	2021	Results of meta-analysis suggested improvements in gait velocity in favour of the control group for cerebral palsy.
7	Marcin Girdwoyń, Mariusz Pawłowski, J. Gašior, Oddział Fizjoterapii,	Music therapy as a method supporting rehabilitation of patients with cerebral	2020	Music therapy has positive influence on gait performance, trunk and extremities control,

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Sr. No.	Author (s)	Title	Year	Results
	Wydział Lekarski, Warszawa	palsy – a review		vibratory perception as the result of playing the musical instrument therapeutically and reduction in the total number of seizures in patients with epilepsy.
8	Permaida Permaida, Allenidekania Allenidekania	The Effectiveness of Music Therapy on Stress in Children with Cerebral Palsy: Integrated Literature Review	2021	The results showed that music therapy given to children with cerebral palsy can reduce anxiety, reduce depression, overcome sleep problems, increase curiosity, focus, and interaction with other people.
9	Bilinc Dogruoz Karatekin & Afıtap İcagasioglu	The effect of therapeutic instrumental music performance method on upper extremity functions in adolescent cerebral palsy	2021	Therapeutic instrumental music performance method, helps functional gains can be achieved in the grip strength, strengths of the fingers, gross and fine motor skills of adolescent cerebral palsy patients.
10	Vasiliki Efraimidou ¹ , Vasileios Tsimaras ¹ , Miltiadis Proios ¹ , Kosmas Christoulas ² , Paraskevi Giagazoglou ³ , Maria Sidiropoulou ¹ , Anastasios Orologas ⁴	The effect of a music and movement program on gait, balance and psychological parameters of adults with cerebral palsy	2016	Results showed that the application of a music and movement program designed on the base of the theory of RAS method had a positive and significant influence in motor and psychological skills.
11	J. Kantor., & L. Džidová,	Speech production, music therapy and cerebral palsy	2016	There is significant effect of music therapy in development of communication skills particularly preverbal, semantic, and phonological and the stage of complex linguistic constructions.
12	H. Ben-Pazi, A. Aran, A. Pandyan, N. Gelkop, G. Ginsberg, Y. Pollak, Debby Elnatan	Auditory stimulation improves motor function and caretaker burden in children with cerebral palsy- A randomized double-blind study	2018	Auditory stimulation alleviated hypertonia and improved fine and gross motor functions.

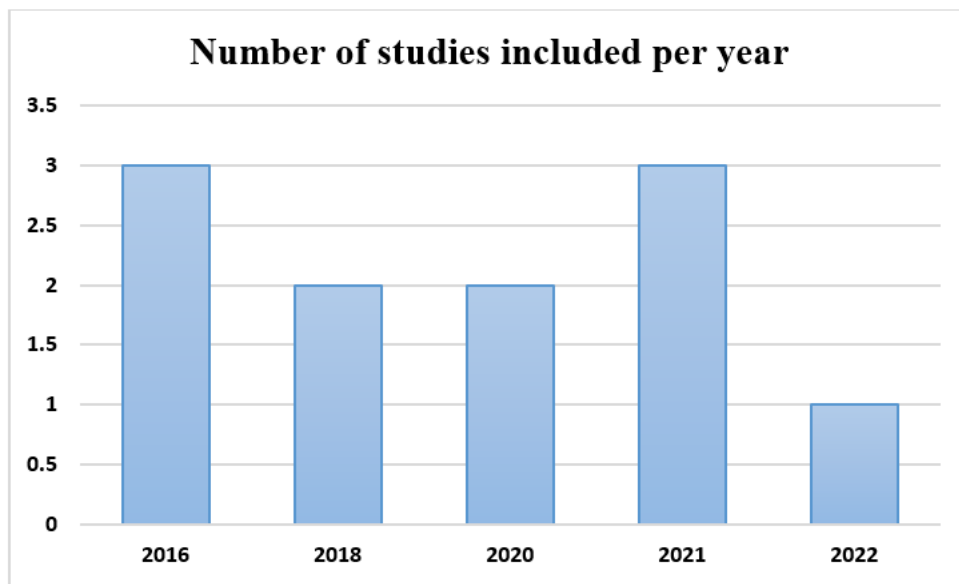


Figure 2: Graphical representation of the number of studies selected in this paper based on the year of publication

The selected studies were published between 2016 and 2022, reflecting that the literature considered is relatively recent but at the same time, there are less research work done on this topic in the last few years (Figure 2).

RESULTS

As mentioned earlier, 12 studies were selected based on the inclusion and exclusion criteria for further analysis. Some of these studies were done with empirical primary data while some were also based on secondary data. The major findings have been listed below under three major heads:

1. Effectiveness of music therapy interventions in improving motor functioning, cognitive abilities, and emotional well-being in individuals with Cerebral Palsy:

- Alves-Pinto et al. (2016) investigated the neuronal correlates of musical instrument therapy and motor function changes in cerebral palsy (CP) patients, particularly hand motor function.
- Eugenio et al. (2018) found improvements in the “arm and hand position” as well as “activities” from the Chailey Levels of Ability among participants receiving music therapy.
- Šinkūnienė (2021) found that musical instruments enhanced the child’s movement control and increased motivation. Music also helps to develop the child’s communication skills and social interaction, creating a new communication experience for the child.
- Results of the meta-analysis suggested improvements in gait velocity in favor of the control group for cerebral palsy (M. Vinolo, 2021).
- The results showed that music therapy given to children with cerebral palsy can reduce anxiety, reduce depression (Permaida, 2021)
- The therapeutic instrumental music performance method, helps functional gains can be achieved in the grip strength, strength of the fingers, and gross and fine motor skills of adolescent cerebral palsy patients (Bilinc, 2021)

2. Influence of individual characteristics, such as age, severity of CP, and comorbid conditions on the outcomes of music therapy interventions

From the literature review study, it is found that most of the research was done with severe cerebral palsy children between 4 and 16 years old. Music Therapy was more useful in the treatment of spastic CP children who had either spastic hemiplegic or spastic diplegic cerebral palsy. In a study by Vasiliki et al. (2016), 10 male adult athletes with Cerebral Palsy (CP) having spastic hemiplegia were chosen. The Intervention Group participated in music and movement program that was designed based on the theory of the RAS method had a positive and significant influence. MT has also been used in people with CP to determine its influence on muscle tone.

3. Music therapy types and techniques used to treat Cerebral Palsy

- Music therapists implemented a neurologic music therapy program of therapeutic instrumental music performance (Eugenio et al., 2018)
- The rhythmic music playing allowed the child to adjust the sequence of their movements and their range (Šinkūnienė, 2021)
- Functional independence and pain were also improved in Group Music therapy (MT) and neuro developmental techniques (Duymaz, 2020)
- The auditory stimulation facilitates cortical plasticity leading to improved motor function in children with CP. In the study by Ben-Pazi (2018), children would listen to the audio stimulation for at least 10 minutes each session preferably 30 minutes four times a week for 4 weeks. There was a vast improvement in function in individual children especially in walking, standing, etc.

DISCUSSION

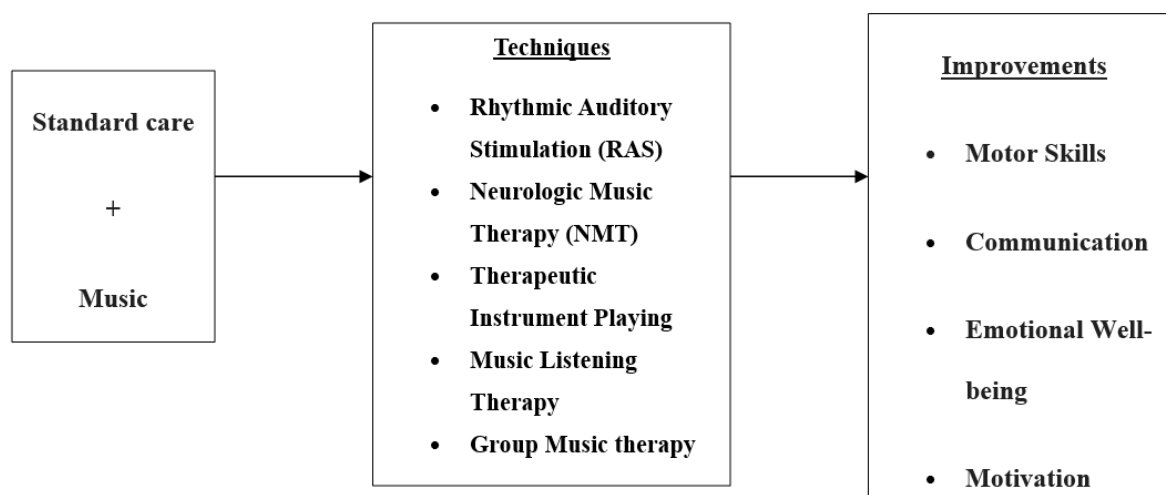


Fig 3: The techniques and effectiveness of music therapy for individuals with cerebral palsy in addition to standard care

1. Interpretation of Results

The findings on the effectiveness of music therapy for individuals with cerebral palsy are significant as they demonstrate improvements in movement control, motivation, communication skills, and emotional well-being. Among all, the most significant effects of music therapy on individuals suffering from spastic cerebral palsy children introduced changes in the underlying motor function, particularly arm and hand motor function. In

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cerebral palsy, from infancy the upper limbs are more affected influencing abnormal posturing of hand structure (Basu, 2015). There was also a significant effect of music therapy on child's emotional state, developing their self-awareness, self-confidence, reduced anxiety levels, and communication skills. Neurologic Music Therapy is an evidence-based system of clinical interventions for treatment of the sensory-motor area, speech and cognitive functioning that might be impaired. Additionally, Music Therapy can promote neuroplasticity especially by motor control learning through therapeutic instrumental music performance (Francois, 2015). Piano training with fingers also improved the child's fine motor function by pressing key with the help of the fingers. The application of a music and movement program designed on the base of the theory of the Rhythmic Auditory Stimulation (RAS) method, had a positive and significant influence. Transcranial-Magnetic-Stimulation (TMS) and Deep-Brain-Stimulation (DBS) have been shown to improve motor function in children with CP (Gupta, 2018). Therefore, through the use of rhythmic and melodic sounds and using harmonic musical compositions to reproduce sounds can improve communication, expression, organization, learning, and motor control in individuals with cerebral palsy.

2. Practical Implications

Clinicians and therapist can benefit by taking the help of music therapy to help individual needs of CP. By incorporating a comprehensive care for children with cerebral palsy like collaborating with other healthcare professional can significantly enhance effectiveness of treatment. By introducing adaptive instruments can enhance the motor skills, communication, emotional and psychological wellbeing for individuals with cerebral palsy (CP). Music therapy sessions need to be designed aligning specific needs and abilities of each individual to influence cognitive development and social development of people with CP (Moreno, 2021).

Therefore, music therapists and clinicians can come together to create comprehensive and individualized care plans for the children. Staying updated with the latest research and advancements in music therapy will help to evaluate the effectiveness of music therapy interventions on CP patients.

3. Limitations of the Review

Music therapy offers significant benefits for individuals with cerebral palsy. However, the existing literature has limitations like most of the studies in literature review analysis were done in specific clinical settings and in small sample sizes, therefore limiting generalizability. In this case, there might be chance of having high influence of the subjective bias of the researcher by overestimating the positive benefits only.

The existing literature on music therapy for cerebral palsy children in India is limited. This restricts the comprehensiveness of the review and the ability to draw robust conclusions. The Indian population is aware of the healing process of music for individuals with special needs (Karulkar, 2021) but without the presence of scientific evidence, it will be difficult for the healthcare system to bring a comprehensive care. Therefore, more robust scientific research needs to be carried out to show the effectiveness of music therapy for cerebral palsy patients.

4. Future Research Directions

Addressing the current limitations of the studies, more standardized, long-term studies on larger population can provide a more comprehensive understanding of the efficacy of music

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therapy. Expanding research in this area holds significant potential for improving the quality of life for individuals with CP in India.

Developing a more standardized intervention rules and objective measures would facilitate comparison across studies to improve the reliability of results. By incorporating objective measures, such as neuroimaging techniques can provide more robust evidence of the benefits of music therapy (Hunt, 2015).

CONCLUSION

The existing literature on music therapy for cerebral palsy children in India is limited and therefore, the present study tried to address the effectiveness of music therapy for individuals with cerebral palsy. Music therapy offers a promising, holistic approach to improving the lives of individuals with cerebral palsy. Since there is no cure for cerebral palsy, addressing motor, cognitive, emotional, and social challenges can enhance their quality of life. Music therapy can provide a multifaceted intervention which can significantly enhance overall well-being. However, to fully realize the potential of music therapy, extensive research, cultural adaptation, and interdisciplinary collaboration are essential. With these efforts, music therapy can become a more widely accepted and effective component of comprehensive care for individuals with cerebral palsy.

To conclude with the present study, music therapy can provide a holistic care for individuals with Cerebral Palsy. As the treatment for cerebral palsy is life-long and focuses mainly on enhancing their quality of life, music therapy can play a vital role in providing adequate training and fostering their maximum potentialities in motor functioning and overall well-being. Therefore, this research finding can add a significant contribution to the research analysis on the effectiveness of music therapy in cerebral palsy individual.

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Conflict of Interest

The author(s) declared no conflict of interest.

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