

# Sound therapy in children

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## Abstract

Sound remains largely under-evaluated in the field of therapeutic medicine. It produces the desired changes both by the sound as well as the vibrational energy. Various modes have been used to deliver the energy to the individual. But studies on use of sound therapy in adults and children are limited and of poor design. In children, it has been tested in various conditions such as autism, developmental delays, in neonatal intensive care units on preterm babies, during MRI to lessen the anxiety and use of GA and sedatives, in ADHD, in pediatric cardiac care units, in childhood asthma, in emergency room patients, in chronic pain, neurological disabilities, and in troubled adolescents with substance abuse or neurotic disorders. The outcomes have been generally positive. But more large-scale and properly-designed comparative studies would be required before the low cost technology and safe sound therapy could be incorporated in the therapeutic armamentarium in children.

**Keywords:** Children, Pediatric care, Sound therapy.

## INTRODUCTION

Sound is a vibroacoustic wave with diagnostic and therapeutic potential. But this has not been tapped enough and sound therapy in medicine remains largely underexplored. There are very few studies with small sample sizes done in this field and most of these are in adults [1, 2]. Nonetheless, results seem promising. Hence more extensive and large-scale studies are required for this unique modality to find a place in mainstream therapeutics.

Some studies exist that conclude that sonic therapy is beneficial for children with neurological, cognitive, psychosomatic, developmental, musculoskeletal, and such disorders [3]. The current review discusses this aspect of sound as a complementary therapy in children with health issues.

## REFRESHING THE PHYSICS OF SOUND

Sound, the sensation experienced through the special sense and organ of hearing, is a vibration that is transmitted as an acoustic wave through a solid, liquid, or gaseous medium. Acoustic waves with frequencies lying between 20 Hz to 20 KHz are audible to human ear (audio frequency). Above and below this range limit are the ultrasound and infrasound waves

respectively [4]. Thus sound is an oscillation and is propagated as a wave motion in an elastic media or air. It vibrates the media and the latter shows pressure, particle displacement, and velocity variations. But the media *per se* does not travel with the sound wave. The sound waves travel faster in solids than liquids or air. They excite the hearing mechanism (organ of Corti) and this is perceived as sound by the human ear. In simple description, sound is a sinusoidal plane wave with a frequency (waves per unit time), wavelength (inverse of frequency), amplitude, speed, and direction. Sound waves get reflected, refracted, or even attenuated by the transmitting media. This is dependent on the density, pressure, motion, and viscosity of the medium [5].

## SOUND THERAPY: MECHANISM OF ACTION IN DISEASES

Sound has frequency and amplitude and travels in a particular direction with a particular speed in that medium. It transmits its waves into a substance and makes it vibrate to its frequency. The substance particles have their own distinctive frequencies. On contact with the sound, they begin to vibrate to the tune of the sound waves.

Since ancient times, the sound therapists believe that during a disease, the body energy frequencies go out of tune. For

instance, the normal body has a frequency of 50-100 Hz. But in an autistic child, this frequency might go as high as 200-500 Hz leading to hyperactivity and other symptoms. But, pure sound produced by various gadgets can align these deranged frequencies and bring them back to normal. This is said to help in mitigation of the problem and bring relief to the diseased individual [6-9].

Various neuro-imaging techniques have shown how relaxing or stimulating sound and music produce specific brain wave changes on EEG [9, 10]. At the higher level, therapy in the form of sound can induce a sedative phase wherein theta waves predominate in the brain. This assists healing, creative and clear thinking, and enhances memory, awareness, and intuition [11, 12]. It is hypothesized that neural regenerative processes are enhanced [13]. It relaxes and removes stress and pain. Effect is deeper and prolonged [14].

The sound affects changes not only via the hearing mechanism and action on the brain areas but also by its vibratory role on the body parts. Placement of the sound-producing tools on the body regions passes these vibrations into the body tissues for the desired action. This leads to synchronization and equalization of the bodily frequencies and harmony [3, 15].

It has physical, mental, emotional, and claimed spiritual actions on the body and is thus supposedly a wholesome therapy. It can form a complementary therapy with other modes of treatment and is generally safe [16].

The actions of sound are on the nervous system (brain electrochemistry) and also locally on various organs (body physiology). Thus it is a mind-body intervention. The main physiological actions include:

1. Endorphin release and action on nervous tissue for a relaxing effect. Negative emotions are lessened and positivity and well-being increases [17].
2. Improvement of circulation and blood flow to body parts [18].
3. Insomnia, headaches, migraines are reduced [19, 20].
4. Joint and muscle and menstrual pains come down [14].
5. Digestive problems are decreased [21-23].
6. Self-healing and immunity is boosted [24].
7. Good sound liberates the emotional trauma and problems [6, 25].
8. Right and left brain synchronization is improved [26].
9. Cognition, memory, thinking is improved [27].
10. Energy level and well-being are improved [28, 29].

This all is also called 'psychoneuroimmunology'; a term that the American psychologist Robert Ader coined in the year 1981 [30]. It is used to imply the interactions that take place between psychology, neurology, and immunology in a person. These interplay is a complex one and also bilateral. This could be utilized to positively influence one's body through positive and good thinking.

## SOUND THERAPY VS SOUND HEALING AND THE TOOLS

Sound therapy is also termed audio therapy. When sound is organized into music, it is called music therapy. Besides, there are also recorded relaxation talks and Nature sounds (such as flowing water, leaves rustling) that could be utilized for the purpose of sound therapy. Various tools are used for the purpose to produce melodious and harmonious sounds and include Himalayan or Tibetan singing bowls, cymbals, crystal singing bowls, gongs, drums, bells, tuning forks, and binaural beat therapy. The binaural beat therapy is still semi-experimental and used for stress relief and treatment of anxiety [31]. These sounds are usually pre-recorded and available on CDs or any instrument that can play the sounds. They can be also performed live. This form of therapy is the 'receptive' or 'passive' sound therapy and can be administered self by the individual or may be facilitated by a practitioner. The other form is the 'active' or 'expressive' sound therapy in which the person self-produces the sound vocally or by means of a musical instrument [32]. Self-reading of poetry or fiction with the intent to experience a therapeutic action is called bibliotherapy and is also a form of sound therapy [33]. When vibrating tools are applied directly to the body, it is vibroacoustic therapy. Low frequency sinusoidal waves in the 30-120 Hz range assist in reducing rigidity and tremors in Parkinsonism and increase the speed of walking [34]. Similar benefits are observed of this low-frequency sound stimulation (LFSS) in fibromyalgia, Alzheimer's disease, and depression [7]. The circulation and movement is improved and pain and rigidity is lessened. The vibrations are administered as beds, mattresses, pillows, mats, chairs, wristbands, wearable backpacks and the like. In them, the sound files are played by means of transducers, bass shakers, or excitors. This has been tried in flat foot in children with good outcomes [3]. Thus sound therapy can be made prescribable and dosable in clinics and other centers.

Sound healing (Sonic healing) is similar but the term is reserved when the benefits are claimed to be more spiritual and explained on that basis. This includes Leonard Horowitz's Solfeggio frequencies and sound bath sessions. Creative visualization, guided imagery are components of such therapy [35]. But everything said and done, harmonious sound does have benefits on the physiology, psychology, and social life of a person.

## USES AND STUDIES IN CHILDREN

In adults, specific or organized sound form has been tried in several medical conditions with variable outcomes. These include cognitive and emotional problems, diminished conscious levels, neurological conditions, physical deformities, pain, cancer, fertility issues, to boost immunity, and for COPD. It has also been found to be useful in grief and bereavement [36].

A number of studies of sound therapy have been carried out in preterm babies in NICU [37]. Researchers noticed an improvement in physiological outcomes such as oxygen saturation, heart rate, respiratory rate, and blood pressure as well as in behavioural state (body movements, facial expression, crying) and in the pain scores. Evidence also reveals that music has positive impact in the long-term such as on duration of hospitalization, non-nutritive sucking, and weight gain. Lullabies have been found to soothe preterm babies and affect positively their sleep and eating [38, 39]. Scientists have also tried with sounds of womb fluids (Remo Ocean Disk) and two-tone heart beat rhythms (Gato box) on premature babies 32 weeks and older with positive outcomes. Their heart rates normalized and alert state quietness increased. They found that sucking was more with heartbeat rhythm and womb sounds enhanced sleep. For sound therapy administration, various techniques were employed. Live or recorded music with or without kangaroo care was found to improve oxygenation, regulate respiration, and decrease neonatal distress. It was found that female voice had better outcome [40]. Pacifier-activated lullaby device was also used and decreased heart rate, respiratory rate, and improved sleep patterns and sucking behavior. Multimodal stimulation (MMS) using auditory, tactile, vestibular, and visual stimulation led to earlier discharge from the neonatal intensive care unit. Music can also mask the disruptive noises of the NICU and lead to infant stimulation and enhance parent-child bonding. Music has also been tried in cardiac ICUs for infants and it led to a decrease heart and respiratory rate and blood pressure [41].

In case of toddlers or older children, they either listen to the music or sound or play with the instrument that emits the sound such as the singing bowls. The positive benefits are observed no matter what mode is used to reach the sound to the child. This applies particularly to autistic children who had appreciable positive impact with this therapy. It was seen that the hyperactivity and stereotypical behaviour lessened and their attention and focus improved [42]. The obedience increased and there was an improvement noticed in their verbal and non-verbal communication. Similar benefits were reported for other children with special needs [43-45]. Sound has also been found to help ADHD children. These children have raised catecholamines and music helped them to have better concentration and lesser hyperactivity. White noise (a random signal that has equal intensity at different frequencies) was useful and probably helped via stochastic resonance [46]. Music therapy also has benefits in pediatric emergency room patients who had less distress and less pain during intravenous insertion when music played in the background. The health care providers also felt that it was easier to do IV insertion in the music group patients [47].

During MRI in children, sedatives and GA are used to calm the anxious and crying child. Though effective, these suffer from their own side-effects. To minimize their use, sound therapy is one of the various non-pharmacological techniques tried to pacify the child. MRI-compatible audiovisual systems have been found to be useful. The other methods employed include better MRIs to decrease both scan times and motion artifacts, noise-reduction methods, optimization of the MRI environment, involvement of child life specialists, feed-sleep manipulation of the child, feed-and-bundle and distraction techniques, play

therapy, photo diaries, mock scanners, use of infant incubators/immobilizers, sucrose solutions, guided imagery, and artificial intelligence [48, 49]. Sound studies in older children with physical trauma have revealed that it lessens pain and hastens the rehabilitation in them [50]. Research in chronic pain in children revealed that they had lesser stress and music helped draw their attention away from it. Post-neurological damage rehabilitation process was accelerated with sound therapy and the lung function and speech clarity of such children improved drastically. It has also been found to offer some help in children with psychosomatic disorders such as bronchial asthma [unpublished observations of Dr. Shahid SK]. Vibroacoustic therapy has immense benefits in flat foot therapy [3].

French ENT surgeon Alfred Tomatis was working with sound for hearing impaired people and realized that the same sound led to visible changes in the mood and well-being of the person. The research was expanded in light of these new findings and now specific frequencies are delivered therapeutically to the brain via air and bone conduction depending on the person's disease, its severity, and duration of illness [51]. This is now being used for children for autistic spectrum disorders, behaviour issues, Down syndrome babies, learning disabilities, motor control problems, reading and writing delays, and speech delays with variable results [52].

Music therapy has been tried with good outcomes in troubled adolescents [53-56]. In children and adolescents with major depressive and anxiety disorders, the severity of the internalizing symptoms came down [57].

Sound therapy is also found to be a safe supplementary remedy in children. The research avenues for it are endless and need to be properly assessed. It can complement conventional therapy in cardiovascular ailments and also in major mental disorders but cannot substitute it. It is advisable to be careful in using this therapy in children with epileptic seizures lest the sound precipitates the seizure attack or worsen restlessness in them. Also, there is a possibility that it might aggravate headaches in some migraine patients.

## CONCLUSION

Sound therapy in its various forms; alone or in combination and in pure natural forms or artificially produced does show some promise in the treatment of various diseases in children. Its role in these conditions should be further evaluated and it could find a place as a major complementary mode in pediatric therapeutics. Its usefulness is immense but proper studies directed in the direction of revealing its hidden potential could reap benefits for child health.

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