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ORIGINAL ARTICLE

The effect of music therapy on children with autism as a therapeutic intervention

ATIYEH SADAT HASANI HELM[1], MAHDI RAMEZANI[2*]
[1]*Department of Occupational Therapy, School of Rehabilitation, Hamadan university of Medical Sciences, Hamadan, IRAN.*
[2]*Department of Anatomy, School of Medicine, Hamadan university of Medical Sciences, Hamadan, IRAN.*
***** *Corresponding Author at : Department of Anatomy, School of Medicine , Hamadan university of Medical Sciences , Hamadan , IRAN. Email:m.ramezani@umsha.ac.ir*

ABSTRACT

Objective: The global incidence of autism has rised up. It can appear the importance of interventions and family struggles, because music is attractive for children we can use it as an effective intervention. The goal of this article is a review of the ASD children problems and interventions and the music effects for treating children with Autism Spectrum Disorder (ASD). Finally, since music is always accessible and the human body utilizes it on a daily basis, we can use music as a complementary method in occupational therapy.

Materials & Methods: Comprehensive electronic search of keywords "music therapy", "autism interventions" and "vagus nerve stimulation" was done in international electronic databases such as PubMed, Scopus, Google Scholar and Google Books between 2000 and 2021. In the first part of the search, based on the considered keywords, 30,446 articles were obtained. After reviewing the abstracts of articles, 30,405 articles were discarded due to lack of entry criteria, and finally 41 articles were selected. Among these, 30 articles focused on autism and its interventions and another 11 articles focused on the vagus nerve.

Results: children with autism have lots of problems in different aspects and communicate with them is not like normal children. One best way to break this barrier is music. According to Physics, music is placed in energy spectrum as one part of sounds and volumes, which can affect on our body energy. On the other side the rhythmical and compositionality feature of music reinforce this consequence. Due to these features, music is more popular and we can utilize it for children with autism, who don't have enough eye contact and communication. We often use music in our daily lives, for example, from ringing the doorbell to using the phone or waiting in the elevator to reach the desired floor and etc. it is one common and available supplementary way that we can use it for treating beside the other methods. The music plays an important role in activation of Parasympathetic Nervous System via the vagus nerve stimulation. The vagus nerve is a tenth nerve of twelve pairs cerebral nerves. The tenth nerve is one of the most important nerves which originates from the brain and is responsible for innervating face, thorax, abdomen and etc. It is a motor sensory nerve. The vagus nerve is also involved in the Parasympathetic Nervous System. The parasympathetic nerves have a great effect on the relaxation of the body. Vagus nerve has two sensory ganglia that transmits sensory impulses: the superior and the inferior ganglia, by which we can affect on parasympathetic nerves for improvement. Generally these ganglions innervates different part of body such as: ear (where the most stimulations happen in this place) , larynx, heart, pulmonary system, abdomen and abdominal viscera. Because of this innervation vagus nerve stimulation can change the activity of pulmonary system, heart, abdomen, intestine and etc. and contributes to relaxation. The music stimulates the vagus receptors of the ear.

Conclusion: Since music is an accessible and attractive resource, it can be used as a complementary method along with medication and other methods, due to which the connection with the child with autism is established and under the shadow of relaxation, learning and more concentration is provided.

Keywords: Music Therapy, autism interventions, Vagus Nerve Stimulation

INTRODUCTION

Autism Spectrum disorder (ASD) is an umbrella term for several disorders such as: autism, Asperger, pervasive developmental disorder and disintegrative disorder which are brain and developmental disorders and related to society and communication difficulties [1]. Autism is caused by the epileptic process which interferes with the function of specific brain networks involved in the development of communication and social behavior [2]. ASD has no effect exactly on one particular region It involves another parts such as the limbic system, corpus callosum, temporal and frontal cortex, cerebellum, and basal ganglia [17]. Increasing in ASD global incidence indicates that environment may be a significant component for in its etiology [16]. Genetic also have important role beside non-genetic factors such as environment [19]. Recent studies appear this fact that genetic mutations occur in majority of people with autism [10].

Autism is revealed in early childhood [10]. Children with autism have repetitive patterns in their behaviors and activities and non-verbal communication [1, 10]. Lots of evidences show the importance of early interventions for improving cognitive ability, language, and adaptive skills [1]. Autism should be treated in childhood because patients usually do not reach the next stage of development without treatment [10]. 11-40% children with visual impairments have traits of autism but the relation between visual impairment in children and autism has not been conclusively proved. But one main dilemma is the ways of interventions for this kind of children to rehabilitation [3]. The parents of autistic children show the stress in higher level rather than the other parents and the daily challenges of child is endless [5]. On the other side these Parents

experience different stigmas which are varied with behaviors of autism and the severity of symptoms; it shows another reason for developing interventions to erase these stigmas [4].

Autism problems

Beside community and social problems, communication difficulties, stereotyped and repetitive activities and limited interests [1, 10, 20], 80% of children with autism spectrum disorders (ASD) also have sensory problems (hyper- or hypo sensor), who are hyper sensitive show distress, avoidance, and hyper vigilance in the face of stimulations such a sound, touch and movements and who are hypo sensitive show unaware or nonresponsive to sensory stimulations, which are so prominent for others. According to hyper and hypo response, children with ASD seek or avoid ordinary auditory, tactile, or vestibular stimuli [7, 8].

Along with behavioral, interactive and sensory problems, a majority of children with ASD suffer from a wide range of systemic aberrations like: increased serum serotonin (40% prevalence) [11, 12, 13], inflammatory bowel disease (IBD) [14] and gastrointestinal (GI) distress (up to 90%) [15], unfortunately the cause of these conditions has not yet been defined [16].

In total, there are two main criteria for diagnosing autism from a DSM-5 perspective, which are: social communication or interaction and restricted and repetitive behaviors [22, 23].

Autism interventions

Some interventions which are utilized are : at first step drug[20], massage , auditory integration training (AIT) , sensory integration therapy (SIT)(it can be utilized between ages 4-12 years old).[7, 8], cognitive behavior therapy (CBT) [24],omega-3 fatty acid and music therapy [21].

Some drugs that we mention are: sleep drugs, antipsychotics, psych stimulants, typical antipsychotics such as: haloperidol, antidepressants, selective serotonin re-uptake inhibitors (SSRIs), and atypical antipsychotics such as: risperidone and aripiprazole [20, 24].

Massage is important as one of interventions because we know children with ASD has sensory abnormalities that can leads to tactile abnormalities, motor delay and delay in milestones. Massage is one safe intervention that can be performed by therapist and parents [25].

Auditory integration training (AIT) or sound therapy is one technique for abnormal sound sensitivity treatment. In the work of Ning li et al, it appears that AIT can improve IQ score in children with ASD [26]. On the other hand, Yashwant Sinha et al explain that there is no evidence that AIT can be useful as a treatment [27].

Children with ASD may respond abnormally to certain stimuli. One intervention that we use in occupational therapy is sensory integration therapy (SIT) that is on the base of Ayres work. SIT is a play-based intervention that uses children in an active engagement, that can leads to better occupational performance in children with autism.[9]. The aim of SIT is altering in neurophysiological aspects, the functional behavior and sensory responses [28].

Cognitive behavioral therapy (CBT) is a short-term method that the aim of it is changing the unconventional emotional responses by changing in thoughts and behaviors. Besides ASD, CBT is useful for wide range of mental diseases [29]. CBT can be an effective treatment for anxiety disorder, beside this it may be more effective for higher functioning [24].

Music therapy

Music therapy (MT) is a clinical and executive interventions which the goal of it is achieving to individualized purpose and target. MT is performed by a reputable specialist who has undergone a music therapy program and gained knowledge and expertise in his or her work [30].

Music therapy uses music as a safe method.as one expression, music Is an organized combination which is different in some items with sound such as: intensity, rhythm, and pitch [31]. Music can change our emotions, thought and feelings[32]. Music is used in different areas.

Music therapy helps increase social adaptation skills in children with ASD and improves the quality of parent-child relationships. Music cues can be used to assist with waiting, impulse control during a social experience, with music structure outlining the social response time of the peer. Musical cues can teach children with ASD to wait and control motivations during a social experience, with a musical structure [33].

MT can engage ASD children in joyful interaction with others. The majority of children respond positively to music. Music therapy evokes them for social engagement and practice of social skills. In therapy sessions they are included to be active (singing or playing the instruments) or passive (just listening). Even in adults with ASD music therapy is effective. Music therapists develop music-based interventions that facilitate communication, social, motor, sensory, emotional, cognitive, and musical skills. Music therapy services are customized to the individual's priorities and abilities, and these services can be provided with the participation of families and treatment teams. People from different socioeconomic backgrounds, cultures and ages can be included in music therapy Music therapy may even be offered in schools, homes, music therapy clinics or hospitals. Music therapy can leads to joint attention and also help boost nonverbal communication skills in therapy procedure and socioemotional reciprocity. In addition, music therapy may help enhance social adaptation in children with ASD and improve parent-child relationships. Music cues can be used to increase patience and waiting for the turn to come during a social experience, with music structure outlining the social response time of the peer. Musical cues can teach children with ASD to wait and control motivations during a social experience, with a musical structure that designs peer-to-peer response time [30], [33].

How the music therapy affects?

Music therapy affect via its music and music affects via vagus nerve. Vagus nerve or Vagal Nerve is the tenth nerve of the cranial nerves (CNX) [34]. In addition, it was historically called Pneumogastric nerve, which is responsible for your good feeling, sufficient communication and optimal state of the body and the gut[35], [36], [37]. Anatomically, VN is an afferent (3/4 of fibers) an efferent (1/4 of fibers) nerve [34, 37]. The afferent component innervates tympanic membrane, infrantentorial dura, external ear and external auditory meatus, pharynx, larynx, trachea, esophagus and abdominal viscera. It also innervates the taste receptors in the epiglottic area. On the other side, the efferent component is the responsible for

innervating the pharyngeal muscles of larynx and pharynx, muscle of the upper esophagus, the muscle of the uvula, palatoglossus muscle and the levator veli palatini. Additionally, VN with its preganglionic parasympathetic neurons located in the dorsal motor nucleus of medulla play an important roll in innervating the viscera of the neck and thoracic (like heart) and abdomen[34].

Music and vagus nerve

Autonomous Nervous System (ANS) has two divisions, one of them is sympathetic nervous system and the other is parasympathetic nervous system which is more focused on in this section. The motor components of PNS are performed in the cranial nerves III, VII, IX and X and in the sacral nerves.

The responsibility of autonomic nervous system is regulating the body's unconscious actions. The parasympathetic system is responsible for stimulation of "rest-and-digest" or "feed and breed"[38] activities and this action is described as being complementary to that of the sympathetic nervous system, which is responsible for stimulating activities related to fight-or-flight response. Some PNS responsibilities are construction of pupils (miosis), decreased heart rate and blood pressure, constriction of bronchial muscles, lacrimation changes, increase in digestion, increased production of saliva and mucus, increase in urine secretion.

Music stimulates the vagus nerve, which in turn stimulates the ANS system via VNS and relaxes the body, it means music activates the PNS and have prominent roll in relaxation because of decrease heart rate, blood pressure, respiration rate, increase motility and relaxation of sphincters, Increase insulin and digestive enzymes (it can solve some gut problems), contraction of kidneys muscles, contraction of bladder muscles (more activation of kidneys and bladder) and relaxation of internal sphincter that aids to urination[39], [40], [41], [42], [43].

CONCLUSION

All beings produce, have, send and receive the energy from different sources. Energy makes human alert and defines whether you are sick or not. Music is one of energy that is utilized daily, consciously or unconsciously.

It appears clear that the use of music as a therapeutic tool is very useful in a number of different mental health conditions and in promoting general mental wellbeing. This is particularly true when music is an adjunct for treating depression, anxiety, schizophrenia, and also dementia. Music appears to be beneficial to both the individual, and also to the improvement of social cohesion. The reasons for this must reside in the nature of music itself as an art form which supports human interactions within society.

Depending on the characteristics of the music such as rhythm, frequency, amplitude, etc., different types of music affect the PNS which is responsible for energy building, food digestion, and assimilation. Light music for PNS has calming answers and calms the human being, while high-energy music like rock has reverse responses for the body. Music allows us to improve aggression, reduce muscle tone and treat constipation through the VNS process and PNS.

Generally music can stimulates VN and by this function affects on PNS activation. Because of this music feature, we can utilize it for some diseases which require to lower vagal tone for recovery.

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