The Potential of Music Therapy in the Treatment of Anxiety Emotion in Adolescents with Autism Spectrum Disorders: A Literature-Based Analysis

Xian Jing Qian[1,*]

[1] *Department of Integrated Arts Therapy, Dongduk Woman's University, 60 Hwarang-ro, Seoul 02748, Republic of Korea*
[*] *Corresponding author. Email: 861643205a@gmail.com*

ABSTRACT
Adolescence is a critical stage in human physical and psychological development as it transitions from infancy to maturity. One in seven adolescents is considered a mental health problem, and autism spectrum disorder (ASD) is one of the most common psychological disorders during this period. Communication problems and restricted repetitive behaviors (RRB) are the most common symptoms of ASD, and both can contribute to anxiety emotion. According to the clinical literature, music therapy is an effective tool for treating pre-autism, but research on music therapy to alleviate anxiety in adolescents with ASD is lacking. As a result, we investigated the possibility of music therapy in treating anxiety emotion in adolescents with ASD to give some theoretical support for its usage.

Keywords: *Music therapy, Adolescent, Autism spectrum disorder, Anxiety disorders.*

1. INTRODUCTION

Autism spectrum disorder is described as deficiencies in social communication and confined repetitive behaviors/interests, with social interaction impairment being the most prevalent and relevant clinical manifestation, according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-V) [1].

Interpersonal interactions, independence, and employment all require social skills [2], and they are essential for effective functioning in all parts of life, including family, school, and employment [3,4]. For this reason, modern people occupying various roles feel anxious because of their inability to master social skills well. In addition, restricted repetitive behaviors (RRB), one of the symptoms of ASD, seriously affect daily life. Available evidence suggests that anxiety, highly prevalent among adolescents with ASD, is associated with RRB in children with ASD [5-8]. Additional studies have shown that although RRB is present in early childhood [8], RRB for "higher-order" and "lower-order" behaviors is thought to persist into adulthood [5].

Anxiety Spectrum Disorders problems are common in children and adolescents with ASD, and anxiety emotion has worsened the severity of impairment [9-11]. Diagnostic determination of ASD and SAD may be one of the most problematic issues for clinicians due to the apparent overlap of phenotypes [6,12]. However, the main difference between the social communication symptoms of these two psychiatric disorders is that social phobia in SAD is a psychologically induced fear of self-embarrassing behavior, avoidance behavior motivated by negative comments from others, and fear of upsetting others. ASD, on the other hand, is a developmental abnormality resulting in a physical deficit that prevents regular communication with others.

One of the essential social roles of music is to convey emotions [13], yet music perception appears to be a relative strength for individuals with autism spectrum disorders[14, 15]. Lai et al. (2012) found that participants with the autism spectrum disorders showed reduced frontal and temporal activation to verbal stimuli but increased activation to musical stimuli [16]. These findings inspired researchers to use musical cues to intervene in emotion recognition experiments in autism. Results showed that reductions in autistic behaviors, more socially engaged behaviors, enhanced emotional involvement and understanding, and social competencies such as joint attention, social greeting procedures, and communication skills improved in individuals with autism spectrum through music therapy [17,18].

By reviewing the literature on the treatment of ASD with music therapy, the current research has the following shortcomings: 1) the lack of focus on ASD in adolescents; 2) the absence of studies on the treatment of ASD-induced anxiety emotion by music therapy; and 3) the unclear mechanisms of ASD-induced anxiety emotion. In this paper, the possibility of using music therapy to treat anxiety emotion in adolescents with ASD is analyzed through a literature review to provide some theoretical basis for related research.

2. METHODS

2.1. Searching Strategy

Research papers published in peer-reviewed journals between 2002 and 2022 were searched in the PubMed and Medline databases using 'adolescent anxiety emotion,' 'restrictive repetitive behaviors,' 'autism spectrum disorder,' and 'Music therapy' as keywords. Only full-text papers with randomized controlled trials (RCTs) and clinical trials (CCTs) were selected.

2.2. Inclusion and exclusion criteria

The inclusion criteria were as follows: 1) participants met the diagnostic criteria for DSM-V; 2) participants' data were extracted; 3) topic focused on treating adolescents with ASD using music therapy; 4) published in the English language.

The exclusion criteria were as follows: 1) duplicate published studies; 2) studies with incomplete data that could not be transformed or combined.

2.3. Data Extraction

A data extraction form was used to record and code the therapy methods, props, and empirical data reported in each treatment record. Each study was classified as a collection of information related to the review's goals.

2.4. Coding Categories

For each article, the following information was recorded: 1) Age range of participants, 2) Gender of participants, 3) Treatment period, 4) Tool(s)/Measures, 5) Treatment modality, 6) Population, and 7) Results.

3. RESULTS

The A search using the keywords yielded 23 valid documents. Based on the inclusion and exclusion criteria, 20 full-text articles were excluded, and only 3 articles (N = 26) met the inclusion criteria (Table 1). The use of music therapy to treat anxiety spectrum disorders issues in adolescents with ASD was not found in the literature.

Table 1. Music Therapy and Adolescent Autism Spectrum Disorder.

Author	Size	Sex		Age	Time	Tool(s)/ Measures	Treatment modal	Population	Result
		male	female						
Eren （2015） [19]	6	3	3	13-18	2 time a month 90 minutes Lasted 4 months for a total of 8 sessions	Playing; pair games; creativity activities	One-group pretest-posttest	Social interaction and the communication skills	Improvements were observed in turn taking, eye contact, listening, self-expressing, coordinated, movement in the group, decision making with others, and acceptance of others' differences
Gooding (2011) [20]	12	—	—	11-16	Once a week 50-minute Lasted 5 weeks for total of 5 sessions	Movement to music; drumming; instrument playing; improvisation activities; singing; music combined with poetic techniques	One-group pretest-posttest	Displayed language and perceptual difficulties, attention and/or concentration deficits, organizational	Social behaviors increased while the occurrences of both researcher prompted behaviors and off-task

								difficulties, and/or poor self-concept	behaviors decreased
Boso, et al. (2007) [21]	8	7	1	23-38	Once a week 60-miuntes 52 weekly	Each session consisted of a piano, electric, keyboards, and drums	One-group pretest-posttest	Behavor profile	—

Eren (2015) trained six adolescents aged 13-18 for 4 months in social interaction and communication skills through warm-ups and greetings, rhythm games, creative movement, and dance. The sessions were conducted twice a month for 90 minutes each, for a total of 8 sessions. During this process, although adolescents with ASD were initially reluctant to engage and interact with their peers, after each music therapy session, as determined by video, adolescents with ASD slowly began to develop openness and participation. Differences in contact and interaction with people of the same sex, to the point where such differences gradually disappeared, as well as differences in turn-taking, eye contact, listening, self-expression, coordination, group movement, decision-making with others, and acceptance of others, all improved as a result of the treatment [19].

Gooding (2011) conducted a five-week study of 12 adolescents aged 11-16 through movement to music, drumming, instrumental playing, improvisational activities, singing, and music combined with poetic techniques for perceptual difficulties, attention, and concentration deficits, organizational difficulties, and poor self-concept with ASD. A 50-minute session once a week for five sessions was conducted. School participant teacher ratings, participant self-ratings, researcher rating, and behavioral observations were all analyzed using an alpha level of 0.05 to determine social functioning changes. They were analyzed separately using the Wilcoxon Matched Pairsn on a researcher-created social skills rating scale with test results more minor than the mean of 0.05. Results indicated that music therapy increased the incidence of spontaneous social behaviors in subjects and decreased researcher prompted and non-behaviors in the task [20].

Boso et al. (2007) conducted a 52-week music therapy with seven males and one female with ASD using a behavioral trait symptom approach, who had a mean age of 30.2 years. Weekly sessions of 60 minutes each were conducted using piano, electronic, keyboard, and drums per session. Treatment results were assessed by changes in BPRS and CGI-I scores 3 times, and patients were found to have significantly improved BPRS scores compared to the first test (F 13, dF 2, 21, p 0. 001). For CGI-I, 87.5% of patients with scores "greatly improved" or "slightly improved" from week 1 to week 26, while from week 26 to week 52, 75% of participants were rated as slightly improved [21].

4. DISCUSSIONS

Music therapy is an effective measure for pain-free treatment of social communication and repetitive behavioral/interest-limiting symptoms in adolescents with autism spectrum disorder. Although gender, musical props, and performance symptoms were considered for the three experimental test groups, no systematic testing of genetic factors, family, social environment, education, and IQ levels of adolescents with autism spectrum disorder(N = 26) and previous exposure to music therapy was conducted before the experiment, nor was a comparison of testing methods between the experimental and control groups made.

Literature is abundant on the use of music therapy to treat childhood ASD, but very little in treating anxiety emotion induced by ASD in adolescents. On the one hand, this may be due to the long observation period from childhood to adolescence. On the other hand, it may be due to the lack of suitable patients. In addition, the physiology and cognition of ASD patients continue to change with age, so children and adolescents have different emotional responses to different types of music. Stephenson et al. (2016) tested music-induced emotional responses in children and adolescents in two experimental groups using happy, sad, and fearful music. However, each song was played for only 20 seconds (most electrophoretic skin responses occurred in the first few seconds of each music clip). The adolescents had an enlarged amygdala and a strong emotional response to sad music. These phenomena suggest that adolescents are more likely to have anxiety due to their emotions [22].

According to Rodgers et al. (2012), the intensity of restrictive repetitive behaviors (RRBs) is proportional to anxiety emotion in individuals with ASD [23]. According to Pickard et al. (2017), problems with social communication disorders may be a significant risk factor

for the development of social anxiety disorder [24]. Therefore, it is feasible to use music therapy to intervene in anxiety emotion in adolescents with autism spectrum disorders.

5. STRENGTHS AND LIMITATIONS

The strength of this study is that it is the first research to explore the possibility of applying music therapy to the treatment of anxiety emotion caused by ASD in adolescents. However, this paper has two significant flaws: first, the sample size is too small, thus, the findings may not be statistically significant, and second, while using a comprehensive search method, the current analysis only contained reports written in English.

6. CONCLUSIONS

The current review provides evidence regarding the impact of the significant symptoms of ASD on anxiety and the importance of the adolescent years with ASD. Given the successful implementation of music therapy and the reliability of outcomes, systematic testing prior to future treatment is recommended, including comorbidity, heritability, IQ level, family, school, social-environmental factors, whether music therapy has been received, and time of diagnosis. Finally, there is a need to develop a standardized music therapy program to ensure the effectiveness of music therapy and gain more insight into the moderating effects of music therapy on adolescents with anxiety disorde emotion with ASD.

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