Music Therapy and Hormonal Responses in Autism

Otizmde Müzik Terapisi ve Hormonal Yanıtlar

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ABSTRACT

Objective: Music therapy is used in the treatment of various psychiatric and physical disorders. This study aims to explore the efficiency of, and neurohormonal responses to, music therapy in children with autism.

Methods: The effect of music therapy sessions of five hours a month on the severity of autism, verbal and social communication, behavior, and neurohormonal responses were explored in 10 children and adolescents. Autism severity was assessed using the Childhood Autism Rating Scale (CARS).

Results: The results of the study indicate that music therapy decreases hyperkinetic activity and stereotypical-repetitive behaviors while increasing mutual social interaction and verbal communication. In addition, the severity of autistic symptoms assessed by CARS significantly decreased following the therapy. When pre- and post-therapy hormone levels were compared, cortisol, ACTH, adrenaline, and noradrenaline levels were not significantly different.

Conclusion: Music therapy is a means of communication without words in children and adolescents with autism, and is an effective and important treatment option when accompanied by special educational support and individual psychotherapy in the treatment of autistic disorder.

Key Words: Music therapy, autism, cortisol, ACTH, adrenaline, noradrenaline

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ÖZET

Amaç: Müzik terapisi çeşitli psikiyatrik ve fiziksel hastalıkların tedavisinde kullanılmaktadır. Bu çalışmada, otistik bozukluk tanıları almış çocuklarda müzik terapisinin etkinliğinin ve müzik terapisine nörohormonal yanıtların araştırılması amaçlanmıştır.

Yöntem: Otistik bozukluk tanıları almış 10 çocuk ve ergene ayda bir kez, beş saat uygulanan müzik terapi seanslarının otizmin şiddeti ve sözel iletişim, sosyal etkileşim, davranış alanlarına yönelik etkinliği ve terapiye nörohormonal yanıtların araştırılması amaçlanmıştır. Otitizmin şiddeti Çocukluk Otizmi Değerlendirme Ölçeği (ÇODÖ) ile ölçülmiştir. Müzik terapisinin stres hormonları üzerine etkisini incelenmesi amacıyla terapi öncesi ve sonrası plazma kortizol, ACTH, adrenalina ve noradrenalina düzeyleri incelenmiştir.

Bulgular: Çalışma sonuçları, müzik terapisinin hiperkinezik hareketliliği ve basmakalip-yineleyici davranışların azaltıldığını; karşılıklı sosyal etkileşimleri ve sözel iletişimleri artırdığını ortaya koymaktadır. Terapi sonrasında ÇODÖ ile değerlendirilen otistik belirtilerin şiddeti de anlamlı azalma saptanmıştır. Terapi öncesi ve sonrası hormon düzeyleri karşılaştırıldığında; kortizol, ACTH, adrenalina ve noradrenalina düzeyleri arasında istatistiksel açıdan anlamalı fark bulunmamıştır.

Tartışma: Müzik terapisi otistik bozukluğu olan çocuk ve ergenlerde sözcüklerin kullanılamadığı bir iletişim aracı ve otistik bozukluğun tedavisinde özel eğitim desteği ve bireysel psikoterapilerde eklenebilecek etkili ve önemli bir terapi seçeneğidir.

Anahtar Sözcükler: Müzik terapisi, otizm, kortizol, ACTH, adrenalina, noradrenalina

INTRODUCTION

Autism is a neurodevelopmental disorder characterized by the deterioration of verbal and non-verbal communication, and limited and stereotypic interest and behavior (1). It is usually diagnosed at 24 to 36 months; however, caregivers are often able to observe its symptoms at 12 to 18 months (2). In some cases, diagnosis may come later in life during adulthood (1).

The prevalence of autism has been estimated to vary from 5/10,000 to 63/10,000 (3,4). Clinical manifestations of the disorder are variable, from severe learning difficulties, to superior skills in specific functions due to differing levels of cognitive capacity. Despite the differences in both behavioral symptoms and functioning, restrictions can be determined early. Social interaction, verbal communication, behavior, and imagination are core domains of the disorder (5).

Conventional interventions such as therapy and special education support help increase verbal communication and social interaction. However, due to the numerous problems associated with these interventions, the search for alternative treatments continues (6). Music therapy has been used in the treatment of autistic children worldwide since reports that musical activity for the purpose of treatment positively affected communication, interaction, motivation, attention, and sustainability in autistic children (7).

Music therapy has been defined as “a systematic intervention applied by therapist to help adjusting for the patient’s health using musical experience and closeness (relationship) that develops between patient and him or herself” (8), and is used in the treatment of many psychiatric and physical disorders. Some studies have reported that when used for a supportive and palliative purpose, music therapy was found to be effective in decreasing agitation, anxiety, and depressive symptoms. Moreover, it decreased the need for the medical treatment of patients with Alzheimer’s disease, cancer, chronic pain syndromes, and those requiring gastroscopy or even more severe interventions (9-14).

Similarly, it has been reported that music therapy may improve symptoms of anxiety and depression, and increase functioning in patients with autism and schizophrenia (11). According to a study conducted by Kim et al. (2008), music therapy has been found to be more effective than play in decreasing levels of cognitive capacity. Despite the differences in both behavioral symptoms and functioning, restrictions can be determined early. Social interaction, verbal communication, behavior, and imagination are core domains of the disorder (5).

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It has been reported that music therapy decreases anxiety and neurohormonal responses to psychologic stress (18). A relaxing musical experience has been shown to decrease the response of the hypothalamic-pituitary-adrenal axis to stress, and the cortisol levels in saliva (19). There are some reports regarding a decrease in serum cortisol and norepinephrine (NE) levels in healthy volunteer subjects or applied stressful invasive procedures, such as surgery or gastroscopy as a response to classical or relaxing music (20,21). There have also been reports that found no difference in the levels of growth hormones, cortisol, NE, epinephrine, prolactin, and ACTH (22,23).

Music therapy has been reported to increase feelings of wellbeing, and decrease anxiety and stress, although these are controversial results (21,24).

The current study aimed to evaluate the effect of music therapy on autistic children, as well as any neurohormonal response. Interestingly, no studies evaluating neurohormonal response were found in the literature, and very few studies examined the effect of music therapy on autistic children. There are no studies evaluating the effect of music therapy on autism in Turkey. Thus, this research makes a valuable contribution to the literature.

METHODS

Samples

Fourteen of a total of 27 children diagnosed with autistic disorder at the Gazi University Medical School Child Psychiatry Department according to the DSM-IV met the criteria for inclusion in the study, and were followed by the outpatient clinic between August 2006 and August 2007. The 14 patients received regular music therapy sessions over the period between August 2007 and April 2008. Four patients were excluded from the study sample due to their irregular attendance.

The 10 remaining patients (6 male, 4 female) were between 6 to 15 years of age (mean age was 9.7 ± 3.74 years). The patients received one five-hour music therapy session per month, for a total of four to eight months (mean 5.40 ± 1.71). Patients diagnosed with neurodegenerative or metabolic disorders, infectious diseases, and severe visual, auditory, or motor deficits were excluded from the sample. Patients using psychotropic drugs were excluded as well in order to prevent the potential impact of drugs on study results.

Information on music therapy, and the aim of the study and its method was disclosed to the parents of the patients, and their approvals and the consent of Gazi University Medical School Ethic Board was obtained.

Tools

Patients followed by the Child Psychiatry outpatient clinic were evaluated in detail by two child psychiatrists, and diagnosis was confirmed to be autism using DSM-IV criteria.

The Childhood Autism Rating Scale (CARS) was used to determine the severity of the autism. The scale was developed in order to differentiate between autism and other developmental disorders (25). It consisted of 15 items which determine the severity of autism-related symptoms, categorized under the following headings: relationships with people, imitation, emotional reactions, use of the body, use of the object, adaptability to change, and general impressions. Every item is rated on a scale of 1 (normal) to 4 (severely abnormal), with a half-degree scoring (1, 1.5, 2, 2.5, 3, 3.5, and 4). A total score of 30 and above supports the presence of autism (25). A score of 30 to 36.5 indicates mild-to-moderate autism, and a score of 37 to 60 indicates severe autism (26). The Turkish version of CARS was established by Sucuoglu and colleagues (27). CARS scores for each patient were obtained pre- and post-therapy by the same interviewer.

Before starting the therapy sessions, a structured interview was carried out with parents which contained a grading scale ranging from 0 (normal) to 10 (severely abnormal) which concerned the limitations and difficulties of their childrens’ language/verbal communication, social interaction, and behavior.

In the field of language/verbal communication, lack of speech, limitation of meaningful vocabulary, inability to start and maintain spontaneous verbal communication, lack of appropriate verbal responses, the presence of speech disorders such as echolalia, speaking without subject, predicate, or emphasis, mismatch between words and meaning, and incorrect use of grammar were questioned.

In the social interaction domain, social unresponsiveness to smiling or calling, avoidance of physical contact, inability to start and sustain interpersonal non-verbal communication, lack of meaningful gestures and facial expressions, failure to join in with group play, and reluctance to participate in common activities were evaluated.

In the field of behavior, stereotypic and repetitive movements, inappropriate behavior that could harm the self and others, hyperkinetic activity, irritability, and resistance to change scores were determined. After the last therapy, the structured interview was repeated.

Music Therapy

A number of instruments such as the tar, dombra, rhythm equipment, ceng, violin, strings, kabak kemane (gicek, kemence), tanbur, kanun, ney, kikopuz, rubab (kokcarca), and gurgle (sound of water) were used to perform music therapy by the same interviewer. CARS scores for each patient were obtained pre- and post-therapy by the same interviewer.

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Blood Sampling

Serum cortisol, epinephrine, NE, and ACTH levels of all patients were analyzed pre- and post-therapy. ACTH and cortisol concentrations were studied with the immunochemicaliminocnessence method using the DiaSorin Liaison autoanalyzer kit (29).
Epinephrine and NE levels were determined with the radioimmunoassay method using the Labor Diagnostica Nord RIA kit. Normal range of hormones was accepted as falling between 4.5 and 24 µg/dL for cortisol, 0 and 100 pg/mL for epinephrine, 0 and 600 pg/mL for NE, and 4.7 and 48.8 pg/mL for ACTH.

Statistical Analysis

For statistics, the SPSS (Windows 11.5) programme was used. The Wilcoxon Signed Ranks Test was used to compare the biochemical parameters of pre- and post-therapy, and the scores of language/verbal communication, social interaction, and behavior fields. The relationships between variables were analyzed using the Pearson correlation test. p < 0.05 was accepted as statistically significant.

RESULTS

Ten patients (6 male and 4 female), between 6 to 15 years of age (mean age 9.7 ± 3.74 years) were evaluated. CARS were used to confirm clinical diagnosis, and evaluate the severity of each patient’s autism. The scale was applied again after the last music therapy session to determine the potential difference between autistic behaviors. CARS scores evaluated at the last therapy session were found to be significantly lower than the pre-therapy scores (z=2.652, p=0.008) (Table 1).

The structured interviews which evaluated the limitations and difficulties in language/verbal communication, social interaction, and behavior fields, using a grading scale from 0 (normal) to 10 (severely abnormal), were carried out with the parents. The degree of difficulties determined by parents in language/verbal communication, social interaction, and behavior fields was significantly lower after the last therapy session as compared with the pre-therapy session (Table 1).

Table 1

<table>
<thead>
<tr>
<th></th>
<th>Pre-therapy (Mean ± SD)</th>
<th>Post-therapy (Mean ± SD)</th>
<th>Z</th>
<th>p*</th>
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</thead>
<tbody>
<tr>
<td>CARS total score</td>
<td>40.95 ± 6.93</td>
<td>35.05 ± 7.65</td>
<td>-2.652</td>
<td>0.008</td>
</tr>
<tr>
<td>Language/verbal</td>
<td>7.00 ± 1.76</td>
<td>5.90 ± 2.60</td>
<td>-2.041</td>
<td>0.041</td>
</tr>
<tr>
<td>communication</td>
<td>6.20 ± 1.31</td>
<td>5.20 ± 1.81</td>
<td>-2.264</td>
<td>0.024</td>
</tr>
<tr>
<td>Social interaction</td>
<td>6.70 ± 0.94</td>
<td>4.30 ± 1.70</td>
<td>-2.680</td>
<td>0.007</td>
</tr>
<tr>
<td>Behaviour</td>
<td></td>
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SD: Standard deviation, CARS: Childhood Autism Rating Scale

Music therapy decreases subjective stress. In a study conducted by Leardi, plasma cortisol, ACTH, epinephrine, and NE levels were determined pre- and post-therapy to evaluate the effect of music therapy on levels of stress hormones, but no significant difference was found (21). A comparison between the results of the current study and the other studies evaluating the neurohumoral response to music therapy in children with autism could not be actualized due to lack of studies. Some studies found that music therapy appeared to improve the quality of life and mental health of these patients. However, increases in verbal communication, social interaction, and behavioral concordance were detected in patients who received music therapy. Results also showed that music therapy is correlated with a prominent decrease in autistic symptoms.

Music therapy enables communication without the use of words. Dialogue provided by music therapy has been shown to initiate and sustain personal and social interaction skills (33). Music therapy is an effective and important therapy option to complement specific education support and individual psychotherapy.

DISCUSSION

The current study investigated music therapy and its effect on verbal communication, social interaction, and behavior fields in patients with autism, as well as their stress hormone levels. To our best knowledge, this is the first study investigating music therapy on autism in Turkey. The results clearly show that music therapy decreased hyperkinetic movements and stereotypic-repetitive behaviors, while increasing reciprocal social interaction and verbal communication. With therapy, patient’s participation in common events, eye contact, meaningful vocabulary, and compliance with the environment significantly increased. In addition, the severity of autistic symptoms evaluated with CARS were found to have significantly decreased post-therapy.

These results are consistent with results conducted by Edgerton (1994) and Buday (1995) (30,31). Edgerton revealed that the communication skills of 11 children with autism between 6 and 9 years of age had significantly improved following improvised music therapy sessions once a week for 30 minutes over 10 weeks. Another study conducted by Buday compared music therapy with rhythm therapy (the repetition of a original song through speech using the same rhythm and speed but without music). Therapy was applied for four consecutive days in 10 children with autism between 4 and 9 years of age. Music therapy was found to be more effective than rhythm therapy, as children applied aspects of the music therapy to their vocabulary more, and imitated more behavior.

In another study, eight autistic adults who received active music therapy over 52 weeks for 60 minutes each session were evaluated using the Clinical Global Impression (CGI) and Brief Psychiatric Rating Scale (BPRS), and the severity of autism was reported as significantly lower (16). Despite different methods and numbers of sessions, results indicated a significant decrease in autism symptoms and severity post-therapy, consistent with the current study. A study with partially different results, Brownell (2002) followed four autistic children from 6 to 9 years of age over four weeks for sessions lasting five days (32). No therapy was applied in the first and third weeks. In the second week, children listened to a social story accompanied by music for five days. This was repeated, again for five days, in the last week but without music. A comparison between results of the music therapy with the no-music story sessions showed that music therapy decreased the repetitive behaviors of two children, whereas the other children’s behaviors were unaffected. However, it is highly difficult to interpret these results due to the limited number of subjects. The current study supports these results which reported that music therapy increases the communication skills of autistic children and decreases their repetitive behaviors.

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Table 2

<table>
<thead>
<tr>
<th></th>
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<th>Post-therapy (Mean ± SD)</th>
<th>Z</th>
<th>p*</th>
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<tbody>
<tr>
<td>Cortisol (µg/dL)</td>
<td>8.78 ± 3.83</td>
<td>8.00 ± 2.35</td>
<td>-0.968</td>
<td>0.333</td>
</tr>
<tr>
<td>ACTH (pg/mL)</td>
<td>24.63 ± 10.34</td>
<td>26.62 ± 14.27</td>
<td>-0.764</td>
<td>0.445</td>
</tr>
<tr>
<td>Adrenaline (pg/mL)</td>
<td>64.07 ± 39.21</td>
<td>74.46 ± 43.75</td>
<td>-1.632</td>
<td>0.103</td>
</tr>
<tr>
<td>Noradrenaline (µg/mL)</td>
<td>144.72 ± 45.62</td>
<td>115.52 ± 44.52</td>
<td>-0.051</td>
<td>0.959</td>
</tr>
<tr>
<td>Noradrenaline (µg/mL)</td>
<td>122.53 ± 49.05</td>
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</table>

SD: Standard deviation, ACTH: Adrenocorticotropic hormone

Wilcoxon Signed Ranks Test
The recent study has several limitations. The number of samples were restricted for the following reasons: a) the number of autistic children in the sample decreased over the study’s diagnosis and collection period, b) after diagnosis, the specific education programmes of the autistic children overlapped with music therapy sessions, c) it was difficult to find children who met the requirements for the study and could regularly attend the therapy sessions, and d) the blood collection process created difficulties for some parents due to their children’s behavioral difficulties.

**CONCLUSION**

Music therapy is an effective and important treatment option when accompanied by special educational support and individual psychotherapy in the treatment of autistic disorder. Further studies using larger samples and non-invasive methods, such as assessment of hormone levels in saliva, are required.

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**Conflict of Interest**

No conflict of interest was declared by the authors.

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