FT56

The Effect of Mozart's Music in Childhood Epilepsy: A Systematic Review

Dilek Şayık[1], Ayfer Açıkgöz[2], Deniz Yiğit[2]

[1]Eskisehir City Hospital, Training Unit, Eskisehir

[2]Eskisehir Osmangazi University Faculty of Health Sciences, Department of Pediatric Nursing, Eskisehir

ABSTRACT

Objective: This systematic review was carried out in order to systematically investigate the studies on the effects of Mozart's music (Mozart Effect) on reducing seizures in children with epilepsy.

Methods: The relevant search was made in Science Direct, EBSCOhost, Google Scholar, Wiley Online Library, Turkish Citation Index, PubMed, American Academy of Pediatrics, and National Thesis Center databases. As a result of the database search, 10 articles that were published in the past 10 years and that met the research criteria were included in the study.

Findings: It was determined that Mozart's music was applicable in children with epilepsy in various age groups. It was found that music was effective in reducing the number of seizures and the epileptiform discharges in EEG in children.

Conclusion: In the studies assessed, it was seen that Mozart's music is an effective application for controlling epilepsy in children. It is recommended to increase the use of Mozart's music for children with epilepsy.

Keywords: *Child, Çocuk, Epilepsi, Epilepsy, Mozart Effect, Mozart Etkisi.*

INTRODUCTION

Chronic disease is defined as a condition that causes permanent disability and requires special education, long-term care, and treatment (1). Epilepsy, one of the chronic diseases, is a neurological condition that affects 0.5-20% of children (2-5). The first seizure of 75% of epileptic patients is experienced under the age of 20 (3, 5, 6). The clinical appearance of seizures depends on which region of the brain they originate. During seizures, involuntary movements, changes in perception, behavior or posture, and epileptiform discharges in brain waveforms may be seen (6-8). Many negative situations such as injury, respiratory standstill, loss of consciousness may be experienced during or after a seizure (9-11).

In the treatment of epilepsy, antiepileptic drugs, ketogenic diet, vagal nerve stimulation, and epilepsy surgery are implemented (2, 6, 12). However, recently, it is seen that non-pharmacological methods have been used to reduce the number and duration of seizures. One of these methods is the use of music by Mozart, one of the most important composers of classical music. This systematic review was conducted to determine the effect of Mozart's music (Mozart Effect) on reducing seizures in children with epilepsy, to review the studies published, and to systematically examine the data obtained from the studies. In the review, answers were sought to the following questions.

What are the general characteristics of studies that used Mozart's music to reduce seizures of children with epilepsy?

What is the effect of Mozart's music on seizures of children diagnosed with epilepsy?

MATERIALS AND METHODS

This study was prepared in accordance with the 2009 guide of the Centre for Reviews and Dissemination (CRD) (13). In the research, which was conducted to determine the effect of Mozart's music (Mozart Effect) on reducing seizures of epileptic children, Science Direct, EBSCOhost, Google Scholar, Wiley Online Library, Turkish Citation Index, PubMed, American Academy of Pediatrics and National Thesis Center databases were searched using the keywords “epilepsy”, “child”, “Mozart Effect”, “epilepsi”, “çocuk”, “Mozart Etkisi” with a time limit between 01.01.2009 and 01.08.2019. During the literature search, among 186 articles published between January 2009 and August 2019, 10 articles that met the selection criteria were included in the study.

Inclusion criteria of the study: Articles with full-text access that were published between 2009-2019 and in which Mozart's music was used on children with epilepsy were included.

Exclusion criteria of the study: Review articles, abstracts, and panel presentations were excluded.

Ten articles that met the inclusion criteria were included in the study. The process of the systematic review is shown in Table 1.

Table 1. Article selection process of the systematic review

Number of articles reached in database search n= 186 Google Scholar (n=156) National Thesis Center (n=0) EbscoHost (n=1) American Academy of Pediatrics (n=0) Science Direct (n=13) Pubmed (n=6) Turkish Citation Index (n=0) Wiley Online Library (n=10)
Number of studies excluded according to exclusion criteria n=171 Google Scholar (n=148) EbscoHost (n=1) Science Direct (n=10) Pubmed (n=2) Wiley Online Library (n=10)
Number of articles related to the study n= 15 Science Direct (n=3) Google Scholar (n=8) Pubmed (n=4)
Number of articles repeated n=5
Number of articles used in the study n=10

FINDINGS

The objectives, sample sizes, measurement tools and statistical analyses of the studies included in the review are given in Table 2. It was found that the number of samples was at least 11 (16.21) and at most 64 (18). In our systematic review, it was seen that seven (14-19,22) of the ten studies used EEG in order to measure the effect of Mozart's music on brainwaves in epileptic patients, two (21,23) used video-EEG, and one (20) used qEEG. In addition, it was seen that Mozart K.448 composition was used in six (14-16,19,20,22) of the studies; Mozart K.448-Mozart K.545 was used in two (17,18) of the studies; Mozart composition was used in two (21,23) of the studies.

Table 2. Objectives, Sample Sizes, Measurement Tools of the Studies Examined and Characteristics of Statistical Analyses

Authors	The objective of the study	Place, Universe, and Sample	Age	Intervention	Research Type / Result
Lin et al. (2010) (14)	To investigate the effect of two versions of Mozart Sonata D Major K.448 on epileptic discharges.	Taiwan, N:58, 30 male and 28 female children,40 of them had an IQ ≥ 70; 18 of them had an IQ< 70.	1-19 years (mean 98.46±37.90 months)	EEG was measured before, during and after 8-minute Mozart's piano K.448 (60-70 db) music application. MozartString K.448 version was played one week after the first measurement and the same measurements were taken.	Single-group pretest-posttest/ Epileptiform discharges continued to decrease after music in 76.1% of the patients.
Lin et al. (2011a) (15)	To investigate the effect of Mozart K.448 on epileptic discharges in children with epilepsy in the long term.	Taiwan, N:18, 8 male and 10 female children,11 had an IQ ≥ 70; 7 had an IQ< 70.	7 ay-14 years (mean 7 years 10 months± 3 years 6 months)	Mozart K.448 was played to the children with epilepsy who had not previously listened to Mozart K.448 once for 8 minutes before going to bed for 6 months. The first EEG measurements were taken 15 minutes before Mozart K.448 application, later measurements were taken at 1st, 2nd and 6th months when the patients were in the same state of wakefulness.	Single-group pretest-posttest A decrease was determined in epileptiform discharges in EEG chronologically with long-term Mozart K.448 application. The highest recovery was found in patients with normal intelligence level.
Lin et al. (2011b) (16)	To investigate the effect of Mozart K.448 applied in addition to the treatment of children with	Taiwan, N:11, 6 male and 5 female children diagnosed with refractory epilepsy who used 2 and more antiepileptic drugs more	2-14 years (mean 9 years 1 month ± 4	Mozart K.448 was played to the children with refractory epilepsy 1 time for 8 minutes before going to bed for 6 months. The parents recorded the frequency of seizures on a daily basis. Assessments on the frequency of seizures were made monthly before	Single-group pretest-posttest The number of seizures decreased by 53.6±62.0% after Mozart K.448 application.

	refractory epilepsy.	than 1 year, 2 had an IQ ≥ 70; 9had an IQ< 70.	years 5 months)	and after music. Antiepileptic treatments remained the same for 6 months.	
Lin et al (2012) (17)	To investigate the effect of Mozart K.545 and K.448 on epileptic discharges in epileptic children.	Taiwan, N:39, 19 male and 20 female children diagnosed with epilepsy, 32 had an IQ ≥ 70; 5 had an IQ < 70; 22 with unidentified IQ.	2-17 years (mean 7 years 3 months ± 3 years 5 months)	EEG was measured before, during and after Mozart K.448 (60-70 db) music application. Mozart K.545 version was played one week after the first measurement and the same measurements were taken. The frequency of epileptiform discharges was compared.	Single-group pretest-posttest No active seizure was seen in any patient during the study. A significant decrease was observed in epileptiform discharges after Mozart's music.
Lin et al (2013) (18)	To investigate the effect of Mozart's music on epileptiform discharges and parasympathetic activation.	Taiwan, N:64, 31 male and 33 female children diagnosed with epilepsy, 54 had an IQ ≥ 70; 9 had an IQ< 70; 1 with unidentified IQ.	2-15 years (mean 7 years 10 months ± 3 years 1 month)	EEG and ECG were measured before, during and after Mozart K.448 or K.545 music application. 41 children chose to listen to Mozart K.448 and 23 children chose Mozart K.545.	Single-group pretest-posttest No significant difference was found between the results of the two music. The frequency of interictal discharges decreased during music application in most of the patients.
Lin et al. (2014a) (19)	To investigate the effect of Mozart K.448 music on seizure recurrence in children with epileptiform discharge who had the first non-	Taiwan, N:48, Treatment (n:24) and control (n:24) groups, 25 male and 21 female children (in total 46) with first non-provoked seizure who did not use antiepileptic drugs until the second seizure, 43	Treatment group 9 years 6 months ± 3 years 10 months, Control group	The children in the treatment group listened to Mozart K.448 music before going to bed for at least 6 months. The control group received routine care. EEG was measured before music and at 1st, 2nd, 6th months.	Randomized controlled There was a significant decrease in epileptiform discharges after Mozart K.448 application (at 1st, 2nd, 6th months)

	provoked seizure.	had an IQ ≥ 70; 2 had an IQ< 70; 1 with unidentified IQ.	8 years 7 months ± 3 years 10 months	Seizure recurrence and epileptiform discharge reduction rates were compared.	
Lin et al. (2014b) (20)	To estimate the effect of Mozart K.448 music on children with epilepsy using the qEEG method.	Taiwan, N:19, 8 male and 11 female children diagnosed with epilepsy with effective EEG segments (n:10) (*over 25% reduction in epileptiform discharges*) and with ineffective EEG segments (n:9) (*less than 5% reduction in epileptiform discharges*) çocuk,17 had an IQ ≥ 70; 2 had an IQ< 70.	4-12 years Effective group 8 years 7 months ± 3 years 3 months, Ineffective group 8 years 10 months ± 3 years 9 months	EEG was measured before and during music application in two parallel periods and the results were compared with qEEG.	Single-group pretest-posttest The therapeutic effect of music in patients with epilepsy was confirmed with qEEG.
Coppola et al. (2015) (21)	To determine the effect of Mozart's music in epileptic children diagnosed with Drug-Resistant Encephalopathy.	İtaly, N:11, 7 male and 4 female children diagnosed with Epilepsy with Drug-Resistant Encephalopathy	1-21 years	EEG was recorded for 20 minutes on the same day (TIME 0) before, during and after the application of Mozart compositions. Children were given electronic ear" device to listen to music. An epilepsy diary was given to the caregivers to record the data. With the website password given to parents, children were allowed to listen to music at the desired time for 2 hours a day for 15 days. After 15 days (TIME 1), the EEG of the patients was re-	Single-group pretest-posttest The decrease in the total number of seizures (11/11) from baseline value was -≥51.5% in 15-day music therapy and -≥20.7% within post-treatment 2 weeks.

				measured. After 1 month (TIME 2), the EEG of the patients was re-measured.	
Grylls et al. (2018) (22)	To investigate the effect of Mozart's music on EEG in children diagnosed with epilepsy.	Scotland, N:45, 22 male and 23 female children with epileptiform activity	2-18 years (mean 7 years 10 months)	EEG was measured before, during and after Mozart K.448 (60-70 db) music application. Then children's songs were played and the same measurements were taken. The frequency of epileptiform discharges was compared.	Single-group pretest-posttest A significant decrease was seen in epileptiform discharges during Mozart's music application.
Coppola et al. (2018) (23)	To compare the two protocols of Mozart's music in children with epilepsy diagnosed with Drug-Resistant Encephalopathy.	İtaly, N:19, First group (n:9) and Second group (n:10), 13 male and 6 female children diagnosed with Epilepsy with Drug-Resistant Encephalopathy	1-24 years 1st group mean=14.2 years 2nd group mean=12.1 years	TIME 0- The video-EEG was taken before the music started. Children were given an “electronic ear” device to listen to music. An epilepsy diary was given to the caregivers to record the data. With the website password given to parents, children were allowed to listen to music at the desired time for 2 hours a day for 15 days. The first group was allowed to listen to Mozart (K.448) sonata. The second group was allowed to listen to Mozart's compositions. After 15 days, the video EEG was taken again.	Randomized two-group pretest-posttest / Mozart's different compositions were found to be more effective in reducing the number of seizures compared to K.448.

DISCUSSION

When the findings of the ten studies discussed in this systematic review were examined, it was found that listening to Mozart's music was beneficial in reducing seizure efficacy in childhood epilepsy (14-23). The epileptiform discharges (14,15,19,22) and the number of seizures (16,19,21,23) were found to decrease in children diagnosed with epilepsy after Mozart K.448 music application. In studies where music application continued for 6 months, there was a more chronological decrease in epileptiform discharges (15) and the number of seizures (16). In the study in which the effects of Mozart K.448 and Mozart K.545 music were compared, it was found that there was a significant decrease in epileptiform discharges of children diagnosed with epilepsy during and after music application and that there was no difference between the two music (18). However, in two other studies, it was seen that Mozart compositions were more effective in reducing epileptiform discharges and the number of seizures compared to K.448 (21, 23).

It was seen that there was no significant difference between the Mozart effect used in reducing epileptic children's epileptiform discharges and seizures and age (15), sex (14-17,19), IQ (14,16,17,19), state of consciousness (14), and etiology (16,17,19). However, in only one study, Mozart K.448 music was provided to children diagnosed with epilepsy for 6 months and the highest recovery in seizures was found in those who had a normal intelligence level (15). There was a positive relationship determined between listening to Mozart's music long-term and intelligence level. It was found that the Mozart effect provided the greatest recovery in epileptic children with generalized (14,15,17,18), central (14,15,17) and frontal (15) discharge.

CONCLUSION

It was seen that the number of studies conducted on the Mozart effect to reduce the negative effects of epileptic seizures on the development of the child has increased in recent years and that the Mozart effect had a positive role in the management of diseases. It is recommended to increase the use of Mozart's music in the treatment of children with epilepsy and to inform the health personnel and their families on this subject.

Referans

1 *Fazlıoğlu K, Hocaoğlu Ç, Sönmez FM. Çocukluk çağı epilepsisinin aileye etkisi. Psikiyatride Güncel Yaklaşımlar 2010;2(2):189-205.*

2 *Efe E, İşler A. Sinir sistemi hastalıkları. Conk Z, Başbakkal Z, Bal Yılmaz H, Bolışık B, editörler. Pediatri hemşireliği. Akademisyen Tıp Kitabevi: Ankara; 2013. s. 611-58.*

3 *Aaberg KM, Gunnes N, BakkenI J et al. Incidence and prevalence of childhood epilepsy: a nation wide cohort study Pediatrics 2017;139(5): e20163908.*

4 *Çavuşoğlu H. Çocuk sağlığı hemşireliği. 10. Baskı Sistem Ofset Basımevi: Ankara;2011.s. 330-48.*

5 *Baykan B, Bebek N, Gürses C, Gökyiğit A. Epilepsi. Öğe AE, Baykan B, Bahar ZS, editörler. Nöroloji içinde. Nobel Tıp Kitapevleri: İstanbul; 2011.s. 311-54.*

6 *Rodgers CC. The child with cerebral dysfunction. Hockenberry MJ, Wilson D, editörs. Wong's nursing care of ınfants and children. 10th ed. Elsevier Mosby: Canada; 2015.p.1425-92.*

7 *İşler A. Epileptik çocuklarda semiyolojik nöbet sınıflamasında modüler eğitim. Ege Üniversitesi Sağlık Bilimler Enstitüsü. Doktora Tezi. İzmir; 2006.*

8 *Werhahn KJ, Hartl E, Hamann K, Breimhorst M, Noachtar S. Latency of interictal epileptiform discharges in long-term EEG recordings in epilepsy patients. Seizure: European Journal of Epilepsy 2015;29: 20-5.*

9 *Ünal AS. Epilepsili çocuğu olan ailelerin problem çözme becerileri. Gülhane Askeri Tıp Akademisi Sağlık Bilimleri Enstitüsü Doktora Tezi. Ankara; 2004.*

10 *Turan FD. Epilepsi hastalığı olan çocuk ve ebeveynlerine yönelik hazırlanan modüler eğitim programının hastalık yönetimine etkisi. Akdeniz Üniversitesi. Doktora Tezi. Antalya; 2015.*

11 *Zararsız M. Epilepside güvenliğin sağlanmasına ilişkin çocuğa ve ebeveynlere verilen eğitimin etkinliğinin değerlendirilmesi. Mersin Üniversitesi Sağlık Bilimleri Enstitüsü. Yüksek Lisans Tezi. Mersin; 2009.*

12 *Hockenberry MJ, Wilson D, Rodgers CC. Wong's Essentials of Pediatric Nursing–Ebook Elsevier Health Sciences; 2016.p. 558-691.*

13 *CfRa D. Systematic reviews: crd's guidance forunder taking reviews in health care. University of York. Centre for Reviews & Dissemination; 2009.*

14 *Lin LC, Lee WT, Wu HC, Tsai CL, Wei RC, Jong YJ, Yang RC. Mozart K.448 and epileptiform discharges: effect of ratio of lower to higher harmonics. Epilepsy Res 2010; 89(2-3): 238-45.*

15 *Lin LC, Lee WT, Wu HC et al. The long-term effect of listening to Mozart K. 448 decreases epileptiform discharges in children with epilepsy. Epilepsy Behav 2011a; 21(4): 420-24.*

16 *Lin LC, Lee WT, Wang CH et al. Mozart K. 448 acts as a potential add-on therapy in children with refractory epilepsy. Epilepsy Behav 2011b; 20(3): 490-93.*

17 *Lin LC, Lee MW, Wei RC, Mok HK, Wu HC, Tsai CL, Yang RC. Mozart K. 545 mimics mozart k. 448 in reducing epileptiform discharges in epilepticchildren. Evidence-Based Complementary and Alternative Medicine 2012; doi:10.1155/2012/607517.*

18 *Lin LC, Chiang CT, Lee MW et al. Parasympathetic activation is involved in reducing epileptiform discharges when listening to Mozart music. Clin Neurophysiol 2013; 124(8): 1528-35.*

19 *Lin LC, Lee MW, Wei RC, Mok HK, Yang RC. Mozart K.448 listening decreased seizure recurrence and epileptiform discharges in children with firs tunprovoked seizures: a randomized controlled study. BMC Complementary and Alternative Medicine 2014a; 14(1): 17.*

20 *Lin LC, Ouyang CS, Chiang CT, Wu HC, Yang RC. Early evaluation of the therapeutic effectiveness in children with epilepsy by quantitative EEG: A model of Mozart K.448 listening-a preliminary study. Epilepsy Res 2014b;108(8): 1417-26.*

21 *Coppola G, Toro A, Operto FF, Ferrarioli G, Pisano S, Viggiano A, VerrottiA. Mozart's music in children with drug-refractory epileptic encephalopathies. Epilepsy Behav 2015; 50: 18-22.*

22 *Grylls E, Kinsky M, Baggott A, Wabnitz C, McLellan A. Study of the Mozart effect in children with epileptic electro encephalograms. Seizure 2018;59: 77-81.*

23 *Coppola G, Operto FF, Caprio F, Ferraioli G, Pisano S, Viggiano A, Verrotti A. Mozart's music in children with drug –refractor yepileptic encephalopathies: comparison of twoprotocols. Epilepsy Behav 2018; 78: 100-3.*