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The Effect of Listening to Mozart K.448 Music for Individuals with Spasticity – A Randomized Controlled Trial

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Abstract

Objectives: This study aimed to compare the effects of listening to Mozart K.448 music and general relaxing music on limbs' spasticity level in people with spasticity, who were living in a Care and Attention home for Severely Disabled Persons (C&A/SD).

Design: The study was a randomized controlled trial. The sample consisted of 40 residents with spasticity recruited from a C&A/SD in Hong Kong. They were randomly assigned to the Mozart group and Relaxing music (Control) group.

Interventions: The Mozart group listened to Mozart K.448 first movement while the relaxing music group listened a randomly searched relaxing music three days in a week during 8 weeks.

Main outcome measures: Spasticity level of the four limbs were assessed using the Modified Ashworth Scale (MAS). Both of the elbow flexor muscles and the knee flexor muscles were assessed at baseline (week 0, pretest), follow up in the fourth week (post 4th week) and in the eighth week (post 8th week).

Results: It was found that the difference in spasticity level between the Mozart group and the Control group was statistically insignificant. Numerically decrement was observed in the spasticity levels in both groups after the eight weeks: changes in the MAS in Mozart *vs* Control group - left elbow -0.5 *vs* -0.17, right elbow -0.6 *vs* -0.58; left knee -0.45 *vs* -0.3 and right knee -0.5 *vs* -0.43.

Conclusion: Our study provides preliminary findings suggesting that both Mozart K.448 and a general relaxing music may reduce the spasticity level. This study suggested that more research is required to strengthen the scientific knowledge of the effects of music intervention on spasticity level in individuals with spasticity.

Keywords: Mozart K.448; Spasticity; Modified Ashworth scale; Music therapy

Background

Music therapy has been developing systematically from ancient to now. Starting with thousands of years ago, there was a legendary musician in the ancient Greeks, who could play music that vibrated all living things [1]. In 1993, Rauscher et al. found that Mozart music improved the cognition of college students [2]. Afterwards, the term 'Mozart effect' has been coined. Some studies suggested the ability of music in modulating neurological and cardiac functions in our bodies [3]. Currently, music therapy was then defined as "a systemic process of intervention wherein the therapist helps the client to promote health and so develop dynamic forces of change" [4]. Music therapy has been applied on neurological clients with epilepsy with positive impact [5-7]. Epilepsy often coincides with the spastic cerebral palsy due to the developmental disorder with a certain extent of brain damage. However, studies on the music therapy on spasticity are limited. While the common spasticity managements include the use of medications such as Baclofen or Botulinum toxins injections and physical rehabilitation such as pain-control, stretching and positioning, if more options of therapy are provided, it could be glad tidings to the individual with spasticity. Mozart K.448 was chosen to be the music group in a number of studies with positive effects found on cognition, stress and epilepsy [5-7]. Mozart K.448 is the sonata for two pianos in D major, which is composed by Wolfgang Amadeus Mozart in 1781.The first movement of the music is a fast tempo with a strong introduction. The main melody of the music is exposed by two pianos, whereas the theme is presented by both plays simultaneously. The first movement lasts for about 8 min with lots of variations in the dynamic, melody and tempo. Based on prior scientific evidence in music therapy, Mozart music, especially K.448 [5-10], therefore, the Mozart sonata K.448 was adopted in this study to examine the effect on clients with spasticity. The objective of this study is to examine the effect of Mozart K.448 on reduction of spasticity. We hypothesized that Mozart music is more effective than control music in reducing spasticity in individuals with spasticity.

Method

This study was conducted at a Care and Attention Home for the Severely Disabled Persons (C&A/SD) in Hong Kong from December 2016 to February 2017. Residents of the C&A/SD with spastic limb(s) were invited to participate in this study. Patients with hearing impairment, decelerate rigidity and recent limbs fracture was excluded from the study. This study is a single-blinded randomized controlled trial. Participants were randomized into the Mozart or Control group by means of drawing lots from a concealed box. Written informed consent was given by the participants prior to study entry.

Study Intervention

Mozart group- the first movement of the Mozart K.448 was selected in the Mozart group, whereas a piece of smooth, soft relaxing music was

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chosen in the control group. The two types of music were 8 min long each. The music was played through a portable music player with the same volume in the quiet areas in the C&A/SD. Subjects listened to the music three times per week for the consecutive 8 weeks.

Control music group-the control group music was a piece of relaxing melody randomly searched on the internet with keywords 'relaxing music, 8 min'. A music composed by Michael in 2011, was chosen, the music is played with electronic piano mixed with different sounds effect. The music pattern is characterized by soft, slow, smooth and with repeated patterns. The control music is available on the internet (https://www.youtube.com/watch?v=MAjXiyKPBu8).

The Modified Ashworth Scale (MAS) is used to measure the resistance during passive soft-tissue stretching for grading subjects' spasticity level. Interrater reliability of the MAS was reported to be high as 86.7% [11]. The MAS is different from the original Ashworth Scale as it has one more item 1+ measure which allows a better differentiation of the increased muscle tone when the catch is happened at the end range or the nearly half of the range [12]. Bilateral elbow flexor muscles group and knee flexor muscles group were assessed in this study. The elbow flexor group includes the muscles of brachialis, biceps brachii and brachioradialis. The knee flexor group includes the muscles of biceps femoris, semimembranous and semitendinous. During the assessments, subjects lay supine on bed. In assessing the MAS of the elbow muscles, therapist held the olecranon with one hand and another hand to hold the distal forearm, moved from available or full elbow flexion to end range of elbow extension and repeated 6 times. In assessing the MAS of the knee muscles, therapist held the calcaneus and another hand to support the calf, moved from available or full knee flexion to end range of knee extension and repeated 6 times. The assessments were done at pre-test, post 4 weeks and post 8 weeks. Demographic and clinical diagnosis of the groups was compared using independent samples t tests for continuous variables or Fisher's Exact Test for categorical variables. Analysis of Covariance (ANCOVA) was used to contrast changes in the MAS between the two groups while adjusting for the baseline MAS. Statistical analyses were performed using IBM SPSS version 22 with alpha set at 0.05 (Table 1).

Results

Forty subjects were recruited, with equal number of participants randomized into Mozart and Control groups. Table 2 shows the demographic and diagnosis of the participants. No significant difference in these factors was found between the groups in these variables. There was no significant group difference in the baseline MAS (Table 3). The changes of the MAS from baseline to after treatment (8th week) were also insignificant (Table 4). Numerically decrease was observed in the spasticity levels in both groups after the eight weeks: changes in the

Grade	Description
0	No increase in muscle tone
1	Slight increase in muscle tone, manifested by a catch and release or by minimal resistance at the end of the range of motion when the affected part(s) is moved in flexion or extension
1+	Slight increase in muscle tone, manifested by a catch, followed by minimal resistance throughout the remainder (less than half) of the ROM
2	More marked increase in muscle tone through most of the ROM, but affected part(s) easily moved
3	Considerable increase in muscle tone, passive movement difficult
4	Affected part(s) rigid in flexion or extension

Table 1: The classification of the Modified Ashworth Scale (Bohannon and Smith, 1987).

	Mozart	Control	p-value
Age in years (mean [SD])	40 (15.9)	37 (16.3)	0.655
Female	9 (45%)	10 (50%)	0.752
Male	11 (55%)	10 (50%)	
Head injury	3 (15%)	1 (5%)	0.568
Stroke	5 (25%)	6 (30%)	
Cerebral palsy	12 (60%)	13 (65%)	

Table 2: Group comparison of demographic characteristics and clinical diagnosis.

Muscles group	Mean of the MAS at pre-test		p-value*
	Mozart group	Control group	
Left elbow	1.850	1.875	0.939
Right elbow	1.650	1.750	0.785
Left knee	1.750	2.250	0.182
Right knee	1.750	2.150	0.322

Table 3: Group comparison of pre-test MAS.

	Mean of the MAS							
	Left elbow		Right elbow		Left knee		Right knee	
	Mozart	Control	Mozart	Control	Mozart	Control	Mozart	Control
Pre -test	1.85	1.87	1.65	1.75	1.75	2.25	1.75	2.15
4th week	1.60	1.92	1.30	1.72	1.45	2.05	1.45	1.90
8th week	1.35	1.70	1.05	1.17	1.30	1.95	1.25	1.72
Change	-0.50	-0.17	-0.60	-0.58	-0.45	-0.30	-0.50	-0.43
p-value*	0.161		0.260		0.740		0.917	

Table 4: Group comparison on change of the MAS from pre to post 8th week.

MAS in Mozart *vs* Control group - left elbow -0.5 *vs* -0.17, right elbow -0.6 *vs* -0.58; left knee -0.45 *vs* -0.3 and right knee -0.5 *vs* -0.43. (Table 4, Figures 1-4).

Discussion

In this study, it showed that Mozart K.448 was not more effective than general relaxing music although both groups' music had reduced the spasticity level of the participants during the eight weeks. Although the rhythm of Mozart music is more robust than general relaxing music, the result of the study prompts us not to ignore the power of general relaxing music as prior studies showed that in general music may be associated with changes in biomarkers including heart rate, respiratory rate and levels of serum cortisol and oxytocin [13, 14]. In addition, it is hypothesized that music characterized by a rhythm of the 6 cycles per minute may exert an effect upon blood pressure and heart rate as well [15]. Spasticity is the consequence of neurological disorders, if music could help improve functions by modulating the underlying neurophysiological mechanisms, further studies would be worthwhile to develop music intervention as a cost effective way to improve their quality of life in these patients. There are important limitations in this study. Firstly, the sample size was small and the sample was selected as participants were residents with high spasticity level living in the C&A/SD. Secondly, the intervention only lasted for 8 weeks, and therefore, the long-term effect of Mozart music or music listening in general upon spasticity were not examined. Thirdly, only one outcome measure was adopted in this study and this may not be sensitive enough to show the benefits of the intervention in other potential outcomes. Lastly, patients might have listened to additional music such as Christmas songs and New Year songs from radios or televisions during the study period and such exposures might have confounded the results.

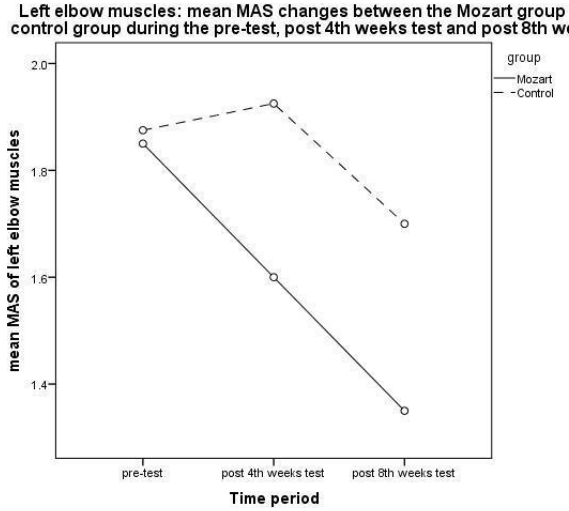

Figure 1: Left elbow muscles: Mean MAS changes between the Mozart and Control group.

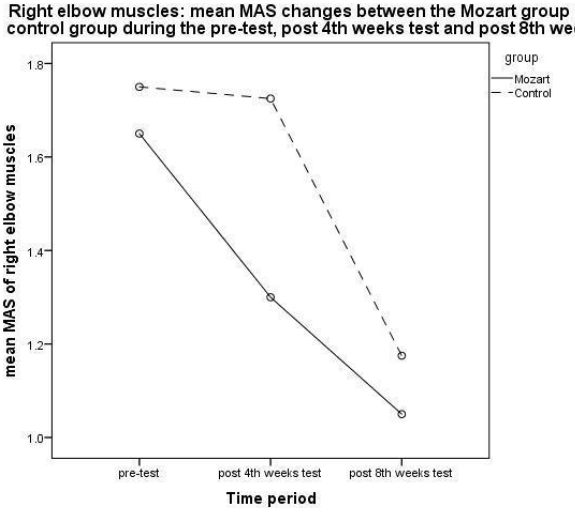

Figure 2: Right elbow muscles: Mean MAS changes between the Mozart and Control group.

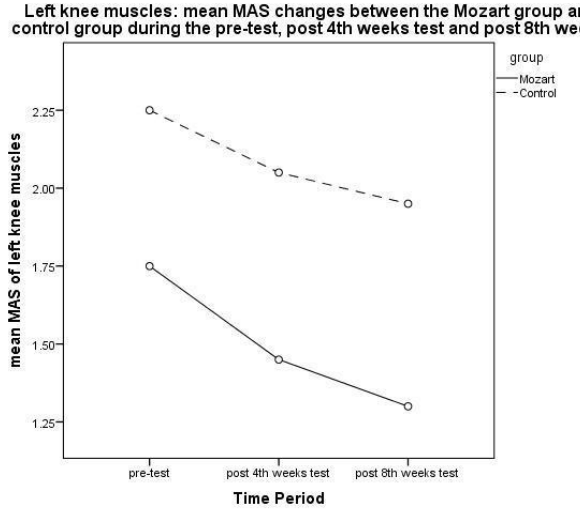

Figure 3: Left knee muscles: Mean MAS changes between the Mozart and Control group.

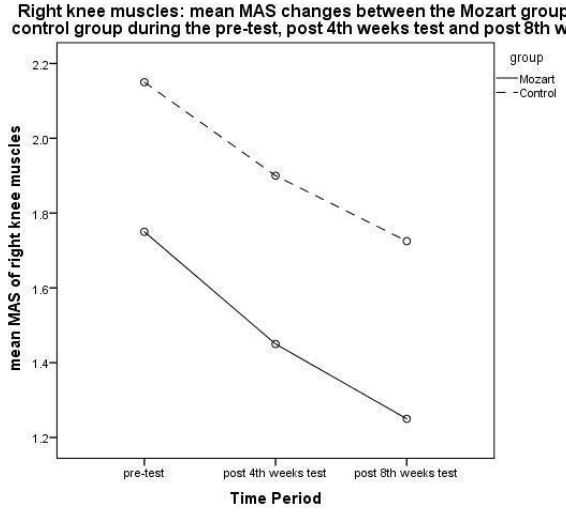

Figure 4: Right knee muscles: Mean MAS changes between the Mozart and Control group.

Conclusion

This study demonstrated that listening to Mozart K.448 or Control music 8 min per day, 3 times weekly for consecutive 8 weeks exerted no significant difference in terms of the changes of the MAS of the subjects; Mozart music K.448 is not more effective than Control music in reducing spasticity. However, there was an overall numerical decrease in the limbs' spasticity level regardless of the type of music listened, so further studies are needed to find out the effect of music on individuals with spasticity.

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