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THE EFFECT OF ACTIVE AND SILENT MUSIC INTERVENTIONS ON PATIENTS WITH TYPE 2 DIABETES MEASURED WITH ELECTRON PHOTONIC IMAGING TECHNIQUE

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ABSTRACT

Background

Patients with type 2 Diabetes Mellitus (DM2) may have autonomic imbalance. Studies have found that music influences the autonomous nervous system. The effect of Indian music on the autonomous imbalance of the patients with DM2 has not been investigated so far. The present study aims at comparing the difference of the effect of active and silent music interventions on the activation coefficient (shows the autonomous balance) of DM2 patients using Gas Discharge Visualization (GDV), a technique of imaging photonic light.

Methods and Materials

The study design is a single group repeated measures pre-post design with two kinds of music (active and silent) intervention. Written consent was obtained from the participants of Arogyadhama, the holistic health home of SVYASA, a Yoga University, Bangalore, South Karnataka. The time duration for both the interventions was 45min.each. 29 participants (mean age ± SD, 56.83 ± 7.85) men (mean age ± SD, 57.75 ± 8.24) and women (mean age ± SD, 54.78 ± 6.89) were analyzed using SPSS.

Results

Both the interventions showed significant effect on GDV parameters. But, there was a significant difference ($p = 0.007$) in the effect between the two types of intervention. It appears that silent music intervention (SMI) lead to boredom compared to active music intervention (AMI).

Conclusions

A single session of AMI achieved the significant change in the parameters towards improvement in the health condition which may be helpful in achieving autonomous balance of the DM2 patients.

KEYWORDS: Autonomous Imbalance, GDV, Music Intervention, Type 2 Diabetes Mellitus

INTRODUCTION

Background

There are 62.4 million people living with diabetes in India and the growing prevalence of DM2 is a major concern for the individual as well as the government (International Diabetes Federation, (IDF, 2013). Lack of self efficacy to change life style and manage stress contributes to poor control of DM (Alipour et al 2012).

Stress and Diabetes

The autonomic imbalance that results from inadequate stress coping skills leads to several complications

(McEwen, 2007) in diabetics. This imbalance leads not only to an array of distressful symptoms such as persistent tachycardia/ bradycardia, digestive disturbances, bladder problems but also contributes too many lethal complications like nephropathy, neuropathy and/ or retinopathy that result from long term narrowing of the blood vessels (Kodl and Seaquist, 2008).

Stress Management in DM

Several stress management techniques have been tried with varying results both in diabetes and other life style diseases. Among these, exercise therapy has been found to be effective as it brings about autonomic balance by increasing parasympathetic tone and decreasing sympathetic activity (Routledge et al., 2010). Heat and massage therapy decreased serum cortisol in healthy adults pointing to reduction in stress levels (Lee, Y.-H., Park, B. N. R., & Kim, S. H. (2011). Meditation reduced sympathetic activity and increased parasympathetic activity in healthy male subjects (Telles et al., 2013).Yoga with combined physical postures, breathing techniques and meditation when used as an adjuvant therapy, reduced the autonomic dysfunction in patients with refractory epilepsy (Satyaprabha et al., 2008).

Music Therapy for Stress

The beneficial effects of Music as an art therapy to manage stress has been recognized since nineteen seventies (American Association for Music Therapy, 1970). Relaxing music reduces not only subjective anxiety, but also the potentially harmful stress reactions (Wendy, Nikky, & Richard, 2001). Subjective anxiety reduced in normal healthy men and women after listening to relaxing music (Knight & Richard, 2001). State anxiety reduced in the students after exposure to a stressor (Labbe, Schmidt, Babin, Pharr, 2007). Both joyful and relaxing music together and independently with different combinations reduced hyperglycemia (Cioca, 2012).

GDV as a Measure of Stress

Measurement of stress has been a major challenge to physiologists. Over the past two decades several psychological tools have been used starting from those that document the stressful life events to those that document the perception of stress by the individual. Heart rate variability, derived from Electrocardiogram records, is one of the accepted objective methods of measuring the responses of the autonomic nervous system to stress (Thayer 2012). A technique called gas discharge visualizer (GDV) that can detect abnormalities in the physiology and the effects of stress on autonomic balance, by tracking the changes in photon emission from the body surface has been investigated over several years by Korotkov et al. GDV is a technique of imaging the photonic light caused by the ionization of gas molecules around any object produced by the excited electronic emission from the object created under a low electrical current of high frequency (1024 hertz) and high voltage (10 KV) (Korotkov, 2004)**.**

Studies on GDV

Studies have shown that GDV is sensitive to both the physiological changes and also changes in environment. Korotkov et al observed by a series of experiments on musical performances using remote sensors of GDV. Differences were observed in area, intensity and entropy of the environment during the performance compared to the time of interval. (Korotkov, 2009). Significant changes in area and intensity were observed after music therapy in patients with different ailments as compared to normal volunteers (Gibson, 2004).

GDV to Measure Autonomic Balance

The images captured by using some filters have been used to assess the physiological changes during stress. Cioca et al compared different variables from the GDV output with that of HRV and demonstrated good correlations between some of the outputs (Activation Coefficient) from GDV with that of autonomic balance (LF/HF ratio) of HRV (Cioca, 2004). Korotkov et al have used GDV measurements to assess autonomic balance (activation coefficient) before and after Osteopathy based relaxation treatment for stress management (Korotkov et al., 2012).

Need For Present Study

There are studies that have shown the benefits of music therapy in reducing stress in normal healthy men and women (Knight & Richard, 2001), students after the exposure of a stressor (Labbe, Schmidt, Babin, Pharr, 2007) and elderly demented patients (Sakamoto, Ando, & Tsutou, 2013). There are no studies that have looked at the effect of music therapy in diabetics as measured by GDV. Hence the present pilot study was designed to assess changes in autonomic balance after music therapy in patients with DM2 using this new technology of GDV measurement.

Aim

To find out the effect of music on the patients with type2 diabetes.

Objectives

To find out the effect of active and silent music interventions on the coefficients of activation, integral area and front projection form and entropy, which are some of the parameters of GDV. Activation coefficient shows the autonomic balance, integral area shows the adaptability of the system to the internal and external influences. Zero distance between the ideal image and the image drawn shows the perfect image. Form coefficient gives an account of the conservation and depletion of energy in the system. The internal disorderliness or chaos can be measured with entropy.

MATERIALS AND METHODS

The study design is a single group repeated measures pre-post design with two kinds of music intervention. One is AMI and the other is SMI conducted at Arogyadhama, the holistic health home of SVYASA, a Yoga University, Bangalore, South Karnataka, India.

Inclusion Criteria

Patients with type2 diabetes willing to participate in the study of both genders in the age range of 35 to 70 years who came from different parts of India for treatment between May and July 2013 were recruited.

Exclusion Criteria

Participants with fingers having obvious visible lesions such as cuts or cracks, moles or tattoos, less number of fingers than the normal, hearing and speech impaired, severe back-ache and skin irritation were excluded from the study.

The project was approved by Dr. R. Nagaratna (Chief Medical officer) of Arogyadhama (health home). The written consent was obtained from the participants before conducting the experiment and the demographic data forms were filled by them.

Methods -Procedure

The experiment was conducted on the first day (AMI) and second day (SMI) of the arrival of the participants, on both the days from 5.45 to 6.30p.m. The interference of yoga was negligible. The participant was given the time of 5 min to sit and settle down mentally. The participant was asked to keep his each finger of both the hands, one by one on the glass plate of GDV and the images were captured by inbuilt CCD camera.

Intervention

Five participants were taken in each batch of AMI and SMI. A wash out period of a day was given between the two exposures. The AMI session had singing devotional songs in lead and follow manner. (Choir singing enhances positive emotions (Kreutz et al., 2004**).** Group singing enhanced mood and coping with pain (Dianna T. Kenny and Gavin Faunce, 2004). Group singing improved the mental health and well being. (Clift et al., 2010). The participants also sang the songs of their own choice. Listening to preferred music decreased agitated behavior in older people with dementia (Christina and Marie, 2005). The individual singing of the participants was followed by 10 minutes listening to recorded flute music of Hariprasad Chourasia without rhythm in raag Darbari Kanada. Darbari Kanada (Hindustani) is used for devotional singing and it is of shanta (calming) rasa.(Ravikumar, 2002, p, 122, 130)

The SMI session consisted of writing the experiences of music, likes and dislikes of music and the songs they know (check list was provided) followed by listening to 10 minutes drone sound (shruti).

Data Extraction

GDV Pro instrument was used to capture the data. Images without filter show the psycho-physiological state and with filter, the physical state.

Gas Discharge Visualization (GDV) is a technique of imaging the photonic light caused by the ionization of gas molecules around the object due to the excited electronic emission from the object created by low current with high frequency (1024 hertz) and high voltage (10 KV) (Korotkov, 2004**).** This imaging is captured with filter (a thin sheet of plastic) and without filter to measure the stress level. The information with filter shows the physical functional state of a person i.e. parasympathetic system, filtering the sweat and other secretions and without filter provides the sympathetic nervous system i.e. the psychosomatic state. The activation coefficient is a quantitative assessment. It gives the person's stress level, based on sympathetic/parasympathetic balance evaluation (Korotkov et al., 2012). The dysfunction of the body can be found with the abnormality in the flow of energy which can be identified by obstructed flow of electrons to the tissues of the affected part. The parameters that are taken for this study are integral area (deviation of the image from the ideal image) activation coefficient (balance of sympathetic and parasympathetic systems), entropy (disorderliness) and form coefficient (harmonious working of the inner systems together) (Korotkov, 2002).

Data Assessment

The images with and without filter were considered for the assessment of activation coefficient and for other parameters the images without filter were considered. The images without filter give the information about the psycho-physiological state of a person.

Data Analysis

Excel and SPSS 19 were used for analysis. Shapiro-Wilk's Test was done for checking the assumption of normality. Paired sample t test was done for the pre and post differences and for the difference between the sessions post data was compared. Wilcoxon non- parametric test was done for not normally distributed variables. GDV diagram data gave the details of the activation coefficient, integral area, integral entropy and GDV energy diagram gave the details of form coefficient. This data was used for the tests.

RESULTS

42 patients wanted to participate in the study. 6 patients were excluded for reasons like hearing and speech impairment, severe back-ache, skin irritation and 4 participants did not turn up for the post data. The data of 3 participants was not taken into consideration as there were mistakes in data taking. The data of 29 participants was analyzed. Except the right (right side of the body) integral area and left (left side of the body) integral entropy, other variables were normally distributed. AMI has brought a significant change in the integral entropy of the right side and front projection form coefficient and SMI has brought a significant change in the integral area of right side and front projection form coefficient of the participants. (Table 1). But both the interventions differed in their influence on the activation coefficient parameter. (Table 2).

Table 1: Pre Post Values of the Effect of Active and Silent Music Interventions

Variable		Active Music Session	Pre- Post		Silent Music Session	Pre-Post		Sig: between Sessions
		Mean ± SD	p	Effect size	Mean ± SD	p Value	Effect Size	p
IA L	Pre	0.104 ± 0.07	0.130	0.29	0.119 ± 0.08	0.713	0.06	0.576
	Post	0.136 ± 0.09			0.125 ± 0.09			
IA R	Pre	0.094 ± 0.08	0.411	0.24	0.094 ± 0.08	0.008**	0.54	0.316
	Post	0.117 ± 0.09			0.140 ± 0.10			
IE L	Pre	1.489 ± 0.21	0.130	0.35	1.969 ± 0.16	0.92	0.008	0.102
	Post	1.940 ± 0.15			1.881 ± 0.16			
IE R	Pre	1.992 ± 0.15	0.011*	0.05	1.932 ± 0.14	0.474	0.131	0.548
	Post	1.881 ± 0.16			1.905 ± 0.17			
ACC	Pre	2.334 ± 0.70	0.565	0.15	2.056 ± 0.72	0.523	0.12	0.007**
	Post	2.411 ± 0.78			1.950 ± 0.75			
FPFC	Pre	18.406 ± 3.66	0.032*	0.41	19.688 ± 4.77	0.028*	0.43	0.073
	Post	19.611 ± 4.57			18.664 ± 5.15			

IA- integral area, **IE-** integral entropy, **L**-left, **R**-right, **ACC**-activation coefficient, **FPFCOE-** Front projection form coefficient

AM- active music, SM-silent music

*p<0.05, **p<0.01

Table 2: The Difference between the Active and Silent Music Interventions for Activation Coefficient (ACC)

Interventions	ACC Mean ± SD	P value
Active music	2.4411 ± 0.78	0.007**
Silent music	1.950 ± 0.75	

**p<0.01

DISCUSSIONS

Integral area coefficient shows how much the GDV gram (the image area) of the examined participant deviates from the ideal model. '0' indicates that the area of the test image and the ideal model are the same. -0.6 to 1.0 corresponds to a good health state. (Korotkov, 2002, p.275). Good tolerance of the pilots was observed with lower values of right integral area compared with left integral area (Korotkov, 2011, p. 55). In the present study, the significant increase in the right integral area with silent music activity may denote low tolerance (0.094 ± 0.08 to 0.140 ± 0.10, p value= 0.008), left integral area being (0.119 ± 0.08 to 0.125 ± 0.08). With active music intervention also the integral area increased but the left right balance is maintained, left (0.104 ± 0.07 to 0.136 ± 0.09) and right (0.094 ± 0.08 to 0.117 ± 0.09).

A stationary state of the system is characterized by the minimal dispersion of entropy. The deviation from the stationary condition requires additional energy consumption which leads to the growth of entropy. The entropy from 1.5 to 2.0 shows the normal healthy state. More entropy is related with more expenditure of energy (Korotkov, p 80, 2011). With active music intervention the right entropy decreased significantly (1.992 ± 0.15 to 1.881 ± 0.16, p value= 0.011) showing the conservation of energy. Korotkov reports Prigogine's conception that in the process of growth and development of the organism a decrease occurs in the speed of entropy production (Korotkov, 2002, p.219).The left right imbalances are larger in diabetic patients (Sharma, 2014). Active music influenced the left right imbalances towards healthy condition of the patients.

For analyzing the psycho-physiological state of a person, the parameter activation coefficient is an important measure. A calm even tempered and healthy person has an anxiety index in the range of 2-4 (Korotkov, 2002, p 36).

Though the change is not significant, the activation coefficient of the silent music decreased below normal (2.056 ± 0.72 to 1.950 ± 0.75). "Activation coefficient 0-2: absolutely calm and totally relaxed person. It could be for several reasons: deep meditation, the effect of psychedelics; deep sleep in the peaceful phase; at the same time it may be the case of chronic depression or severe diseases." (Korotkov, 2002 , p 42). When 2-4 is the normal range, 3 may be taken as the ideal. Towards 3 shows healthy state. Going below 2 may be because of boredom or depression in case of patients with DM2 as stated by Korotkov, because studies also found that depression is a co-morbidity of type2 diabetes. With active music the change is towards 3 (2.334 ± 0.78 to 2.411 ± 0.75) which shows a shift towards the healthy condition.

Both active and silent music activities showed significant changes in the front projection form coefficient. The front projection form coefficient shows the degree of irregularity of the GDV image's external contour (Korotkov, p 274, 2011). The range is 15-25. Here also the ideal may be taken as 20. Less than15 shows exhaustion of the system and greater than 25 shows excessive work of the regulatory systems (Korotkov, 2011). Active music lead towards 20, may be taken as preservation of energy (18.406 ± 3.66 to 19.611 ± 4.57, p value=0.032) where as silent music decreased the form coefficient showing towards depletion of energy (19.688 ± 4.77 to 18.664 ± 5.15, p value= 0.028).

CONCLUSIONS

Participation in the active music session preserved energy level and decreased right side entropy and helped to maintain left right balance in integral area. A single session of active music achieved the significant change in the parameters towards improvement in the health condition which may be helpful in achieving autonomous balance of DM2 patients.

IMPLICATIONS

Music as a therapy may be used to improve the balance of autonomic nervous system.

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