Original Article

Effect of Classical Instrumental Music on Successive Divided Attention Tests in Indian and Malaysian First Year Medical Students – A Randomized Control Trial

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Abstract

In stressful life of medical students, an active coping strategy is must which helps them relax faster and concentrate better. Our study compared the effect of instrumental music on successive divided attention test in 60 Indian and 60 Malaysian first year medical students who were randomised into equal number of music and control group each, creating four subgroups. 3 different forms of SDMT were tested as pre test, during music session and post test, using total, correct and error score. Music group showed significant results for correct (p=0.02) and total (p=0.029) scores in post test session while errors reduced (p=0.002). Malaysian music group performed the best in correct and total score while their control group performed the worst. Indian music group showed decline in their error score in post test session (p=0.002). These findings suggest that performance improves with soft music irrespective of nationality, preference and with short duration of music.

Introduction

Medical education is extremely stressful academically and psychosocially being highest among first year medical students compared to other years (1). Some amount of stress is needed for learning, called "favourable stress" but too much or chronic stress can affect mental and physical health causing higher prevalence of psychological morbidity among medical students (2). International medical education is an increasingly active component of medical education (3). With increasing joint ventures, Indian medical schools, for many years, have offered opportunities to Malaysian students to obtain medical education in India. These students may perceive additional stressors like being very far from home, environmental factors, food change etc.

"Active coping" strategies are used to remove or circumvent the stressor which includes acceptance of the situation, positive reframing, yoga, meditation, listening to music and others. Denial can be another outcome. There has been a strong relation of medical students using alcohol, tobacco and drugs as coping strategies instead of active coping (2). An efficient coping strategy has to be such that it is easily

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available, affordable and mobile, bring a change within short time, help relieve anxiety and increases task performance. Music can be one such strategy (4). Because of its *entrainment effect*, (5) subtle music like classical and instrumental, has shown to cause physiological changes (6), and also positive mood enhancement, better cognition, calmness and positive social behaviour (7). Soft music enhanced performance in some students (8), while others report that it hinders their concentration (9). Also, lacunae remains whether a common type of music can be used as active coping in different ethnic groups. Thus this study intends to evaluate the effect of soft instrumental music on divided attention tests and if the response varies between Indian and Malaysian students.

Objectives:

To assess the effect of classical instrumental, background music on successive divided attention tests in Indian and Malaysian first year medical students.

Materials and Methods

an RCT was conducted from May 2012-April 2013 in research laboratory of Department of Physiology J. N. Medical College, Belgaum, Karnataka, India on 60 Indian (30 males + 30 females) and 60 Malaysian students (30 males + 30 females) in the age group of 18-20 years studying in Phase-I MBBS. Permission to conduct the study was obtained from institutional ethical committee on human subject's research of J.N. Medical College, Belgaum and Director-KLEs USM International School of medicine for recruitment of Malaysian medical students. Students with history of hearing impairments, history of drug abuse, smokers, alcoholics, suffering from cognitive disorders were excluded. A brief history of preference of music and whether they used music while studying was taken from all 120 students. Randomisation was done by opaque sealed sampling which nullified the effect of preferred music and whether music was used while studying. Based on the pilot study conducted, the effect size was 20. Minimum of 30 students were selected with α error = 0.05 and β error = 0.2.

Test/music Group: 60 medical students in music group which included 30 Indian (15 Indian girls + 15 Indian boys) and 30 Malaysian students (15 Malaysian girls + 15 Malaysian boys).

Control Group: same as test group, but without any music. Thus there were total of 4 subgroups i.e Indian music group, Indian control group, Malaysian music group and Malaysian control group.

Music used for intervention:

Classical instrumental music consisting of flute, raga Malkauns, by Hariprasad Chaurasia from the album "Ragas" was used, CD being manufactured by Cynosure Infotech New Delhi. Music was played for a period of 30 minutes selected for its meditative nature without strong rhythmic changes. Player used was Mitashi DVD player; model number TFD7607VERV1 along with Zebronics over the ears headphones. The volume was kept at a comfortably constant level for all the subjects. The room was maintained at minimum noise.

Symbol digit modality testing (SDMT) (10):

This test was used to assess concentration ability and divided attention along with visual scanning, tracking, and motor speed. Each sheet consists of 8 lines with 15 symbols in each line. A coding key is provided which consists of 9 abstract symbols each paired with a number from 1-9. The students were asked to scan the key and write down the number corresponding to each symbol as many as possible within 90 seconds. Three different forms were used where the visual array of the test was maintained, but symbol pairs were varied in all the forms.

• Form A – used during pre test in all subjects, performed without music.

• Form B – used during exposure to music/control.

• Form C – used during post test in all subjects, performed without music.

Interpretation: Scores were considered for three outcomes.

- CORRECT = indicates number of correctly marked digits. It indicates the accuracy with which the student performed the test i.e. without errors.

- ERROR = indicates number of mistakes or wrongly marked digits. A decline in error score points towards higher concentration and better performance.

- TOTAL = total digits marked that is correct + error. It indicates the speed with which student performed the test. This score is irrespective of the number of correctly marked digits or errors made.
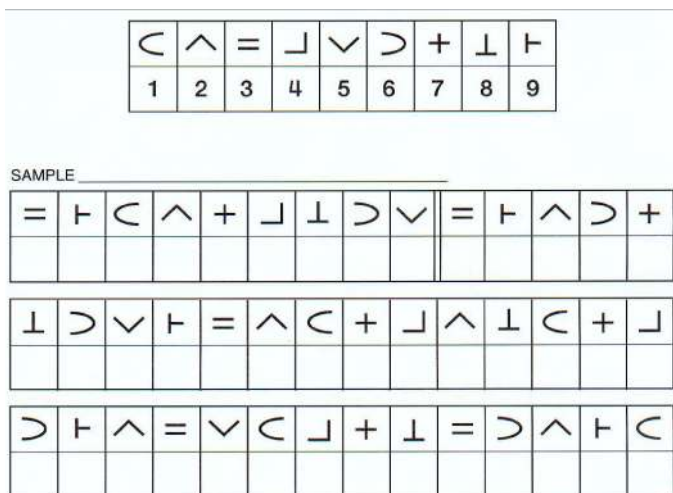

Fig. 1 : Sample of symbol digit modality test.

Results

Students paired and unpaired t test was used to analyse the data. The data was tabulated in Microsoft excel 2007 and statistical analysis was carried out using SPSS software (version 20). p value < 0.05 was taken as statistically significant. Following results were obtained.

- There was no statistically significant difference between music and control group in pre test and during the exposure to music. Post test scores showed TOTAL scores (p=0.02) and CORRECT (p=0.029) scores being higher in music group compared to control group (Table I).

TABLE I : Symbol Digit Modality test scores in Music and Control group.

	Test parameter	Music group	Control group	p-value
Pre test	Correct	56.5±9.01	54.4±7.68	0.156
	Error	0.95±1.32	0.86±1.08	0.706
	Total	57.5±8.67	55.2±7.55	0.129
During the exposure	Correct	59.4±9.49	58.8±7.04	0.703
	Error	0.75±1.20	1.05±1.89	0.302
	Total	60.2±9.35	59.9±7.07	0.843
Post test	Correct	66.1±9.16	62.4±7.91	0.020*
	Error	0.45±0.72	0.75±1.27	0.115
	Total	66.5±8.96	63.1±7.73	0.029*

- When paired t test was applied to pre and post test scores of music and control all the values were significant except the error scores of control group p = 0.264. There was significant decline in error in music group p = 0.002 (Table II).

TABLE II : Symbol Digit Modality test- comparison of Pre and Post test score in Music and Control group using paired t test.

	Music Group	Control Group
Pre test and post test	p-value	p-value
Correct	< 0.001*	< 0.001*
Error	0.002*	0.264
Total	< 0.001*	< 0.001*

- On comparing results during the music session, Malaysian students in music group showed *"correct"* score being higher (63.9±7.17) compared to Indian music group (54.9±9.46) and also Malaysian control group (59.4±6.59) as values (p < 0.001; p=0.013 respectively). *"Total"* score for Malaysian music group was 64.4±7.26 compared to Malaysian control group 60.5±5.99 (p = 0.027) and Indian music group 56±9.42 (p<0.001). Highest error was seen in Malaysian control group 1.1±2.12 (Table III).

- Malaysian music group performed the best compared to all the other three groups in respect to correct and total score in post test session (Table IV).

- When paired t test was applied to each of the subgroups, significant decline in error score was seen in Indian music group (p=0.002) (Table V).

TABLE III : Symbol Digit Modality Test scores recorded DURING music/rest in subgroups of Indian and Malaysian students.

(Mean±SD)	Subgroup	Subgroup	p-value
	Indian music group	Indian control group	
Correct	54.9±9.46	58.3±7.54	0.129
Error	1.06±1.5	1±1.66	0.871
Total	56±9.42	59.3±8.06	0.150
	Malaysian music group	Malaysian control group	
Correct	63.9±7.17	59.4±6.59	0.013*
Error	0.43±0.68	1.1±2.12	0.107
Total	64.4±7.26	60.5±5.99	0.027*
	Indian music group	Malaysian music group	
Correct	54.9±9.46	63.9±7.17	< 0.001*
Error	1.06±1.5	0.43±0.68	0.040*
Total	56±9.42	64.4±7.26	< 0.001*
	Indian control group	Malaysian control group	
Correct	58.3±7.54	59.4±6.59	0.550
Error	1±1.66	1.1±2.12	0.840
Total	59.3±8.06	60.5±5.99	0.516

TABLE IV : Symbol Digit Modality Test scores recorded POST TEST in subgroups of Indian and Malaysian students.

(Mean±SD)	Subgroup	Subgroup	p-value
	Indian music group	Indian control group	
Correct	62.2±9.82	61.4±7.36	0.734
Error	0.43±0.62	0.7±1.11	0.261
Total	62.6±9.52	62.1±7.36	0.821
	Malaysian music group	Malaysian control group	
Correct	70±6.53	63.4±8.44	0.001*
Error	0.46±0.81	0.80±1.42	0.271
Total	70.4±6.39	64.2±8.08	0.002*
	Indian music group	Malaysian music group	
Correct	62.2±9.82	70±6.53	0.001*
Error	0.43±0.62	0.46±0.81	0.860
Total	62.6±9.52	70.4±6.39	<0.001*
	Indian control group	Malaysian control group	
Correct	61.4±7.36	63.4±8.44	0.340
Error	0.7±1.11	0.80±1.42	0.763
Total	62.1±7.36	64.2±8.08	0.305

TABLE V : Symbol Digit Modality test- comparison of PRE and POST test score in subgroups using paired t test.

Pre Test and Post Test	Indian Music Group p-value	Indian Control Group p-value	Malaysian Music Group p-value	Malaysian Control Group p-value
Correct	< 0.001*	< 0.001*	< 0.001*	< 0.001*
Error	0.002*	0.132	0.132	0.398
Total	< 0.001*	< 0.001*	< 0.001*	< 0.001*

- Graph-1 shows sustained and marked reduction in error scores in Indian music group in post test compared to its control group. Though pre test values are same in both Malaysian groups, later errors are much less in Malaysian music group compared to its control group.

Discussion

Successive Symbol digit modality test was used to assess concentration by visual scanning method (10). The baseline scores did not show any significant difference between music and control groups while, repetition of the test (done during and post exposure) showed improvement in scores in both the groups, and was significantly high in music group in post test sessions. These findings suggest that performance improves with repetition of a task or training and can be further improved when associated with soothing background music. These findings correspond to that of Savan A (1991) (6). Also the number of errors committed by the music group on repeated tests were progressively lesser (and statistically significant) compared to control group showing enhanced attention on the concentration task performed. Soothing music facilitates positive mood enhancement, reduces anxiety and causes optimal mental arousal which are all the requirements for best possible performance (11-13).
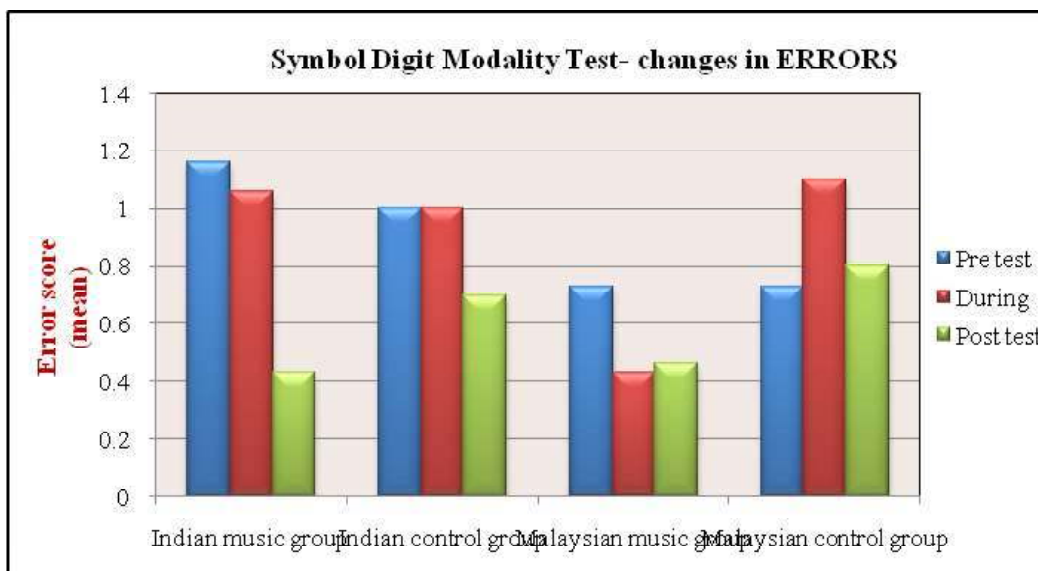
Graph-1: Symbol digit modality test - changes in ERRORS score in pre, during and post test in all 4 subgroups.

The results obtained in our study can be justified based on the "*modality effect*" which states that "*Individuals who receive both auditory and visual information, both of which are processed in different parts of brain, learn better than those who use only resources involving visual system. Thus individual can perform two complex tasks with different modalities at the same time*" (14, 15). Students in our study received both auditory and visual information, which increased their cognitive load and enhanced their performance. Our study contradicts the findings of Johnson (2000) (16) which recorded better results in the no-music conditions.

When the baseline scores of concentration were compared in the two ethnic groups, it was seen that Malaysian students had better concentration capacity than Indian student. Indian music group showed a significant effect of music on errors made in the concentration tests i.e. errors reduced significantly in post test sessions compared to pre test sessions, again upholding the concept of modality effect (14) Malaysian students in music group showed consistently better concentration ability throughout the protocol compared to all the other groups. Darrow et.al (2006) (17) and Bulatao RA (2004) (18) suggests that better concentration and the effect of music on

concentration may be due to an acquired skill or a personality trait which is further influenced by genetic makeup, economic, social, environmental, behavioral and many other factors. The favorable outcome of music on concentration test may be a personality trait of Malaysian students.

Conclusions

Performance improves with repetition or practicing a specified task, the improvement can be further enhanced by associating it with background instrumental music. Performance is best seen at the end of music session showing that, music can increase the required arousal to an optimal level. In Indian students, music decreases the number of errors. A predominant beneficial effect of music is seen in Malaysian students. It improved their concentration ability and divided attention significantly, and is probably related to either their personality trait or to their acquired skills.

Applications of the study:

If students are given soothing music sessions in between their classes for few minutes, their fatigue may decrease and enhance their concentration level for subsequent lectures.

Strength of the study:

Malaysian students had never used the above said music before neither had any of the Indian students in our study. All the students in music group (Indian and Malaysian) expressed that they enjoyed the music session of 30 minutes for its soothing nature and expressed that it relaxed them.

Future scope:

A larger and more diverse population of students can be used as subjects. Also multiple sessions of music, different genera's of music along with its effects on various other physiological parameters, effect of music on long standing performances can be the future scope of this study.

Acknowledgements

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