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Repeated Measure Analysis in Raga Therapy: A Case Study on Head Injury Patients

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ABSTRACT

The paper focuses on Randomized Control Trail that was conducted to assess the impact of north Indian ragas in rehabilitation phase of the CVA and diffuse head injury patients at Rajendra Institute of Medical Sciences (RIMS) hospital, Ranchi. A total of 60 patients were investigated. Case group of 30 patients received both medicine and ragas while control group of 30 patients received medicine only. Ten ragas were taken up and four follow ups with baseline were conducted. Mini Mental State Examination (MMSE) scale was used to assess the status of cognitive function of the sixty patients in different time intervals. Univariate Repeated Measures Analysis revealed that the MMSE score to be statistically significant between the two groups, implying that listening to ragas did improve the cognitive impairment of these patients and also reduced their recovery time.

Keywords: Randomized Control Trial, Cerebrovascular accident, Diffuse head injury, Mini Mental State Examination, Univariate Repeated Measures Analysis

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INTRODUCTION

Music therapy has a long history dating back to the ancient Orphic school in Greece. Pythagoras, Plato and Aristotle, all were aware of the prophylactic and therapeutic powers of music. It is a scientific method of effective cure of a disease through the power of music that acts as a catalyst to the ongoing medical treatment given to the patient. Hence it is not an alternative medicine. Rather, it is supplementary**.**

The paper focuses on Randomized Control Trail that was conducted to assess the impact of north Indian ragas in rehabilitation phase of the CVA and diffuse head injury patients at RIMS hospital, Ranchi. It was found that, in the rehabilitation phase, in addition to medicine, listening to ragas played a vital role in improving the cognitive impairment of the patients as also cognitive and behavioral disturbances not to speak of the brain dysfunction for the patients as well as verbal and non-verbal memories of the patients.

Literature Review

Although there is an extensive literature on music therapy applications, there is a general absence of valid clinical research material from which substantive conclusions can be drawn. An article by D. Aldridge is a good source of review on music therapy literature [1]. Regarding raga therapy, the book by T. V. Sairam titled Raga Therapy and the references cited therein can be referred [2]. Music therapy has been reviewed in medical & nursing press; the principle emphasis is on the soothing ability of music & the necessity of music as antidote to an overly technological medical approach. Most of these articles are concerned with passive music therapy and playing of prerecorded music to patients emphasizing the necessity of healthy pleasures like music, fragrance and beauty sights for the reduction of stress and the enhancement of well being. The overall expectation is that the recreational, emotional and physical health of the patients is improved [3]. After the Second World War music therapy was intensively developed in American hospitals [4]. Since then some hospitals, particularly in mainland Europe, have incorporated music therapy carrying on a tradition of European hospital-based research and practice [5, 6]. Continental Europe has encouraged the use of music particularly in terms of individual and group psychotherapy to encourage awakening of the patient's emotions and in helping them cope with unconscious intrapsychic conflicts [7-15].

In many cases neurological diseases become traumatic because of their abrupt appearance resulting in physical and/or mental impairment [16]. Music appears to be a key in the recovery of former capabilities in the light of what at first can seen like hopeless neurological devastation [17-19]. For some patients with brain damage following head trauma , the problem may be temporary in the loss of speech(aphasia) Music therapy can play valuable role in the aphasia rehabilitation[20]. See also [21] for more information of music therapy in the context of Indian music. The present study in continuation of our previous study published in [24].

Classification of Cerebrovascular accident (CVA) cases

Cerebrovascular accident (CVA) is the rapidly developing loss of brain functions due to disturbance in the blood supply to the brain. This can be due to ischemia (lack of blood flow) caused by blockage (thrombosis, arterial embolism), or a hemorrhage (leakage of blood)[22]. As a result, the affected area of the brain is unable to function, leading to inability to move one or more limbs on one side of the body, inability to understand or formulate speech, or an inability to see one side of the visual field According to WHO It is a "neurological deficit of cerebrovascular cause that persists beyond 24 hours or is interrupted by death within 24 hours". [22]. Diffuse injuries, also called **multi-focal injuries**, include brain injury due to hypoxia, meningitis, and damage to blood vessels. Unlike focal injuries, which are usually easy to detect using imaging, diffuse injuries may be difficult to detect and define; often, much of the damage is microscopic. Diffuse injuries can result from acceleration/deceleration injuries. Rotational forces are a common cause of diffuse injuries; these forces are common in diffuse injuries such as concussion and diffuse axonal injury [23].

CVA (popularly called strokes) can be classified into two major categories: ischemic and hemorrhagic. Ischemic strokes are those that are caused by interruption of the blood supply, while hemorrhagic strokes are the ones which result from rupture of a blood vessel or an abnormal vascular structure. About 87% of strokes are caused by ischemia and the remainder by hemorrhage. [22]

Risk factors for CVA

High blood pressure and atrial fibrillation, High blood cholesterol levels, Diabetes, Cigarette smoking, heavy alcohol consumption and Drug use, Lack of physical activity, Obesity and unhealthy diet [22]

Epidemiology

Stroke could soon be the most common cause of death worldwide. Stroke is currently the second leading cause of death in the Western world, ranking after heart disease and before cancer and causes 10% of deaths worldwide. The incidence of stroke increases exponentially from 30 years of age, and etiology varies by age. Advanced age is one of the most significant stroke risk factors .95% of strokes occur in people age 45 and older, and two-thirds of strokes occur in those over the age of 65. A person's risk of dying if he or she does have a stroke also increases with age. However, stroke can occur at any age, including in childhood [22].

Treatment

Treatment varies according to the underlying cause of the stroke, thromboembolic (ischemic) or hemorrhagic. A non-contrast head CT scan can rapidly identify a hemorrhagic

stroke by imaging bleeding in or around the brain. If no bleeding is seen, a presumptive diagnosis of ischemic stroke is made.[22]

Care and rehabilitation[22]

It is the process by which patients with disabling strokes undergo treatment to help them return to normal life as much as possible by regaining and relearning the skills of everyday living.

It also aims to help the survivor understand and adapt to difficulties, prevent secondary complications and educate family members to play a supporting role.

Objective

To study the impact of Hindustani ragas on cognitive function of CVA and head injury patients.

Material and Methods

A randomized control trial was conducted to assess the impact of north Indian ragas in rehabilitation phase of the CVA and diffuse head injury patients at RIMS hospital, Ranchi with collaboration to Birla Institute of Technology (BIT), Mesra, Ranchi. A total of 60 patients of above 18 years of age were taken up for the investigation after establishing rapport and receiving written informed consent from the patients or head of his/her family. Case group of 30 patients were those to whom both medicine and prerecorded north Indian ragas were administered, while implements of the other control group of 30 patients received medicine only. Ten Hindustani ragas were selected for the case group patients as detailed below along with their suitable time of rendition:

Table1: Ragas and their suitable time of rendition

S.No.	Ragas administered to patients	Suitable Time of Rendition
01	Bhairav	5 AM to 8AM
02	Ahir Bhairav	5 AM to 8AM
03	Bilaval	6AM to 9 AM
04	Todi	9AM to 12AM
05	Bhimpalashree	1 PM to 3 PM
06	Pilu	1 PM to 3 PM
07	Multani	3PM to 6PM
08	Yman	6 PM to 9 PM
09	Bhairavi	6 PM to 9 PM
10	Bageshree	9 PM to 12 PM

Case group of 30 patients were given ten ragas to listen to as per schedule. One slot of 20 minutes was recommended to the patients for listening of music in the given time interval of the corresponding ragas as mentioned in table 1 up to six months.

Baseline data were collected of all the 60 patients. First follow up was conducted at the time of discharge of the patients, second follow up after one month, third follow up after three months and the fourth follow up after 6 month were conducted.

Tool and Techniques used

Mental State Examination (MMSE) scale was used to assess the status of cognitive function of the sixty patients in different time intervals.

MMSE Scale:

Mini Mental State Examination (MMSE) instrument is used for assessing and monitoring cognitive impairment of patients in different prescribed time interval. This simple standardized examination provides a numerical score that gives an estimate of severity of impairment and reference point for later comparison. The maximum score of MMSE is 30 points. A score more than 25 points is taken as normal, 22-25 as borderline and less than 22 as definite impairment.

The MMSE is used as a screening tool that provided a brief, objective measure of cognitive function. MMSE scores were useful in quantitatively estimating the severity of cognitive impairment and in serially documenting cognitive change. The MMSE instrument is also recommended as one of the important measures by the National Institute of Neurological and Communicative Disorders and Stroke and the Alzheimer's disease and Related Disorders Association (NINCDS-ADRDA) to document the clinical diagnosis of probable Alzheimer's disease.

The MMSE consists of a variety of questions which has a maximum score of 30 points, and is ordinarily administered in **5-10 minutes**. The questions are grouped into seven categories; each representing a different cognitive domain or function. The six cognitive domains with their respective points/scores are provided below-

1. Orientation (10 points)
2. Registration of three words (3 points)
3. Attention and calculation (5 points)
4. Recall (5 points)
5. Language (6 points)
6. Copying (1 point)

It tests the individual's orientation, attention, calculation, recall, language and motor skills. Each section of the test involves a related series of questions or commands. The individual scores one point for each correct answer. The total score of MMSE is 30.

Data Analysis

Proper template in MS-excel was generated for data entry and 10% data were randomly checked to assure the quality of data. Data Analysis was done by using SPSS version 12 .We checked the normality of data by Kolmogorov-Smirnov test to MMSE score in different follow ups. Univariate Repeated measures analysis using a split plot design was used to see if the MMSE score was statistically significant or not between the two groups in different follow ups.

Experimental Results

A total of 60 patients were studied, majority (37) of patients were male (61.7%). Average age of the patients was observed as 55.52 years. In the Education status of patients, it was found that majority (54) of patients were 5th pass (i.e. 90%). Details of socio-demographic profile of the patients are provided in table 3.

Table3: Socio-demographic profile of the patients

Variables	Category	Group		Total(N=60)
		Case(N=30)	Control(N=30)	
Sex	Male	21(70.0%)	16(53.3%)	37(61.7%)
	Female	9(30.0%)	14(46.7%)	23(38.3%)
Age(yrs)	Mean(SD)	55.23(17.7)	55.80(12.5)	55.52(15.2)
Education	5th Pass	28(93.3%)	26(86.1%)	54(90%)
	10th Pass	1(3.3%)	2(6.7%)	03(5%)
	Graduation	1(3.3%)	2(6.7%)	03(5%)

Table 4 reveals that at the time of recruitment of the patients in the study, MMSE scores of patients of both groups are no statistically significant difference.

Table4: Baseline –Mean and Std. Deviation of MMSE Score of the patients

Different domain of MMSE	Case group (N=30)	Control group (N=30)	P value
Orientation	3.7667(.89763)	4.0000(0.00)	160
Registration of three words	1.8333(.37905)	1.8000(.40684)	.744
Attention and calculation	2.0333(41384)	2.0333(.41384)	.161
Recall	2.4000(.56324)	2.1333(.93710)	.187
Language	2.5000 (1.61352)	3.1333(.73030)	.055
Copying	0.5667(.50401)	0.3333(.47946)	.071
Total	13.10(2.50998)	13.3000(1.26355)	.698

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Table 5 shows that total MMSE scores of different follow up with baseline are normally distributed (By using Kolmogorov-Smirnov test)

Table5: One-Sample Kolmogorov-Smirnov Test

		Total Score -Baseline	First follow up MMSE orientation	Second Follow Up	Third Follow up	Fourth Follow up
N		60	60	60	60	60
Normal Parameters(a,b)	Mean	13.2000	14.5833	18.0167	20.1667	24.6500
	Std. Deviation	1.97269	2.13360	2.57426	3.02064	3.47790
Most Extreme Differences	Absolute	.160	.106	.170	.128	.134
	Positive	.114	.106	.170	.067	.110
	Negative	-.160	-.094	-.117	-.128	-.134
Kolmogorov-Smirnov Z		1.236	.820	1.319	.992	1.041
Asymp. Sig. (2-tailed)		.094	.511	.062	.279	.229

a Test distribution is Normal. b Calculated from data.

Table 6 depicts that MMSE score is statistically significance in different assessment period

Table6: Mean and Std. Deviation of MMSE scores of the patients in different assessment.

Assessment	Case group (N=30)	Control group (N=30)	P value
Baseline	13.1000(2.50998)	13.3000(1.26355)	0.698
First Follow up	15.7667(1.90613)	13.4000(1.65258)	0.000
2nd Follow up	19.6000(2.55424)	16.4333(1.33089)	0.000
3rd Follow up	22.1000(1.97135)	18.2333(2.63509)	0.000
4th Follow up	27.5667(1.63335)	21.7333(2.08332)	0.000

Tables 7 and 8 give the output of Univariate Repeated Measures Analysis using a split plot design.

Table7: Univariate Analysis of Variance- Tests of Between-Subjects Effects (Dependent Variable: MMSE score

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power(a)
Intercept	Hypothesis	98319.203	1	98319.203	14044.447	.000	14044.447	1.000
	Error	406.033	58	7.001(b)				
GROUP	Hypothesis	696.163	1	696.163	99.444	.000	99.444	1.000
	Error	406.033	58	7.001(b)				
subject(GROUP)	Hypothesis	406.033	58	7.001	2.101	.000	121.863	1.000
	Error	773.000	232	3.332(c)				
Follow up	Hypothesis	4935.447	4	1233.862	370.318	.000	1481.272	1.000
	Error	773.000	232	3.332(c)				
Follow up * GROUP	Hypothesis	309.153	4	77.288	23.196	.000	92.786	1.000
	Error	773.000	232	3.332(c)				

Computed using alpha = .05, b MS(subject(GROUP)), c MS(Error)

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Notice from the foot note for the error term of the group effect (footnote c) that the mean square of the subject –within group effect is used as the error term in testing the group effect. The F statistic is 99.444 which is significant. Both the follow-up effect and follow-up *group effect use the error mean square as the error term. The F statistic for the follow-up effect is 370.318 which is significant with p=0.000. The F statistic for follow-up* group effect is 23.196 which is also significant.

Table 8: Expected Mean Squares(a,b)

Source	Variance Component		
	Var(subject(GROUP))	Var(Error)	Quadratic Term
Intercept	5.000	1.000	Intercept, GROUP, follow up, follow up * GROUP
GROUP	5.000	1.000	GROUP, follow up * GROUP
subject(GROUP)	5.000	1.000	
Follow up	.000	1.000	Follow up, follow up * GROUP
Follow up * GROUP	.000	1.000	Follow up * GROUP
Error	.000	1.000	

a For each source, the expected mean square equals the sum of the coefficients in the cells times the variance components, plus a quadratic term involving effects in the Quadratic Term cell.

b Expected Mean Squares are based on the Type III Sums of Squares.

CONCLUSION

The present study revealed that male people are more vulnerable to the CVA and diffuse head injury due to life style of the individuals. Univariate Repeated Measures Analysis using a split plot design reveals that MMSE score is statistically significant between the two groups in different follow ups. Hence this study concludes that ragas as a therapeutic tool do act as a catalyst in improving the cognitive function of the CVA and diffuse head injury patients as well as in reducing the time of recovery of the patients.

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