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Medical Science**Journal homepage: www.Sjournals.com**Original article****Efficacy of music listening with conventional physiotherapy management on sub-acute stroke patients****S.J. Kachanathu^{a,*}, P. Bhatia^b, S. Nuhmani^b, V. Venu^d**^{a,d} *College of Applied Medical Sciences, King Saud University, Riyadh, KSA.*^b *Department of Physiotherapy, Manav Rachna International University, Faridabad, India.*^c *Department of Physiotherapy, Jamia Hamdard, New Delhi, India.*

*Corresponding author; College of Applied Medical Sciences, King Saud University, Riyadh, KSA.

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ABSTRACT

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The use of melody and rhythm has long been recommended for music-based treatment. Current study was to determine the effect of music listening additions to the conventional protocol that aim to enhance stroke patient's responses to depression, balance, disability and fatigue. A total 10 subacute stroke patients with mean age of 55.2±4.3 years were participated in the current study. As per inclusion criteria the patients were randomly divided into two groups, group A and B (n=05) in each group. Group-A participants were undergone music listening for 20 minutes, and group-B as a control group, both groups were undergone a standard conventional physiotherapy regime. A total interventional regime consisted of 4 sessions per week for 28 days. Study outcomes such as depression, balance, disability and fatigue were assessed at baseline, 14th, 29th and 37th day follow up was done without music listening after 28 days lasted. The result of the study reported that disability, depression, fatigue and balance were improved in both groups. Although the patients in group A, who underwent music therapy showed the highly significant improvement ($p < 0.001$) than group-B, who underwent conventional physiotherapy only. Study concluded that music listening along with conventional physiotherapy management is more effective than conventional physiotherapy alone in the management of stroke.

1. Introduction

Over the past few decades, there has been growing evidence supporting the potential utility of music in medicine. Many studies have shown that music listening can enhance the emotional and cognitive functioning of patients affected by various neurological conditions (Chan et al. 2009; Forsblom et al. 2009). The 3000 year old Indian genre of music is basically melodic and is based on the principle of resonance, sruti, and rhythms. Raga is the sequence of selected notes (swaras) that lend appropriate mood or emotion in a selective combination. Depending on the nature, a raga could induce or intensify joy or sorrow, violence or peace and it is this quality which forms the basis for musical application. Playing, performing and even listening to appropriate ragas can work as medicine. Various ragas have been recognized to have definite impact on certain ailments (Sairam, 2006). According to Ancient Indian text, Swara Sastra, the seventy-two melakarta ragas (parent ragas) control the 72,000 important nadis or nerves in the body, which are believed to transmit life energy into every cell of the body. Listening to music is a complex process for the brain, since it triggers a sequel of cognitive and emotional components with distinct neural substrates (Sairam, 2006).

Stroke is the third leading cause of death and the most common cause of disability among adults. According to World Health Organization (WHO), stroke can be defined as 'rapidly developed clinical sign of a focal disturbance of cerebral function of presumed vascular origin and of more than 24-hours duration' (Hatano1976). The term cerebrovascular accident (CVA) is used interchangeable with stroke to refer to the cerebrovascular conditions that accompany either ischemic or hemorrhagic lesions. The incidence of stroke increases dramatically with age, doubling every decade after 55 years of age. The incidence of stroke is about 19 percent higher for males than females. According to the World Health Organization, 15 million people suffer stroke worldwide each year. Of these, 5 million die and another 5 million are permanently disabled. In developed countries, the incidence of stroke is declining, largely due to efforts to lower blood pressure and reduce smoking. However, the overall rate of stroke remains high due to the aging of the population (World Health Report, 2002).

Aphasia is a common and devastating complication of stroke or other brain injuries that results in the loss of ability to produce and/or comprehend language. It has been estimated that between 24-52% of acute stroke patients have some form of aphasia if tested within 7 days of their stroke; 12% of survivors still have significant aphasia at 6 months after stroke (Wade et al. 1986).

There are various physiotherapy approaches to the rehabilitation of stroke patient with hemiplegia. Physiotherapy treatment must commence immediately after its onset. Activities in lying, sitting, and standing, on mat and on tilt board are quite helpful. Proper positioning, bridging, rolling and weight bearing on the affected leg, climbing stairs at an early stage, even before independent gait is achieved, is both therapeutic and functional. Rehabilitation optimizes the patient's potential for functional recovery. Early mobilization prevents or minimizes the harmful effects of conditioning and the potential for secondary impairments. Functional reorganization is promoted through stimulation and use of affected side. Mental deterioration, depression and apathy can be reduced through the fostering of positive outlook on the rehabilitation process (Downie, 1993).

Current study was to determine the effect of music listening additions to the conventional protocol that aim to enhance stroke patient's responses to depression, balance, disability and fatigue.

2. Materials and methods

Ten patients with sub-acute stroke (6 males and 4 females) were enrolled in this study with mean age of 55.2 ± 4.3 years from various hospitals, Delhi NCR region. Obtained the ethical clearance prior to the study and subjects were given a verbal description of the application of the adjunct measures during the study and informed consent was obtained prior to the participation. These patients were diagnosed with moderate to severe nonfluent aphasia with relatively preserved comprehension and were at least 3-12 months of their clinical stroke since their first (and only) left-hemisphere stroke. Patients were selected based on following inclusion criteria, aged between 50-70 years, Mini Mental Status Examination Score (MMSES) at least 24, Orpington prognostic scale score of mild stroke.

Patients were excluded based on presence of uncontrolled hypertension, any medical contraindication for rehabilitation, hearing defects and MMSES below 24. Prior to the study, interventional procedures were explained to subjects and obtained consent form. After considering the inclusion criteria the patients were randomly divided into two groups, group A and B (n=05) in each group. Subjects in group-A were undergone listening of Indian classical music based on raga ‘Todi’ for 20 minutes, whereas group-B considered as control group. Both groups were undergone a standard conventional physiotherapy regime. The total interventional regime consisted of 4 sessions per week for 28 days. Interventions were observed and were corrected in case of any discrepancy to ensure consistent performance by experts in music. Patients were also instructed to avoid any other form of music listening during the study period and also not to increase the intensity or frequency of interventions during the study period. Study outcomes such as depression, balance, disability and fatigue were assessed by Hamilton Rating Scale for Depression, Berg Balance Scale, Barthel Activities of Daily Living Index and Fatigue Severity Scale respectively, were assessed at baseline, 14th, 29th and 37th day follow up was done without music listening after 28 days lasted.

3. Result

Statistical analysis was performed by using the software package of SPSS 16.0 version. The mean and standard deviation of all the variables were analyzed. The t-test analysis was done for both the groups for depression, balance, disability and fatigue variables. The result of the study observed that disability, depression, fatigue and balance were improved in both groups. Although the patients in group A, who underwent music therapy showed the highly significant result (p<0.001) than group-B who underwent conventional physiotherapy only. A follow-up effect improvement was retained in group-A, even after the music was not being given, conventional therapy being continued for all groups till 37th day of post intervention (Table 1).

Table1

Study outcomes among groups.

Group A	0 Day	14 Day	29 Day	37 Day	0-14	0-29	0-37
HRSD	70.0 ± 3.54	75.0 ± 3.54	81.0 ± 4.18	83.0 ± 4.47	<.001	0.00	0.00
BBS	31.0 ± 2.12	34.80 ± 2.28	38.4 ± 2.19	39.60 ± 1.67	0.01	0.001	0.001
BI	38.0 ± 1.87	35.2 ± 1.64	31.6 ± 2.30	30.2 ± 2.39	0.00	0.00	0.00
FSS	19.2 ± 1.48	16.6 ± 1.14	13.6 ± 1.14	11.8 ± 2.68	0.00	0.00	0.00
Group B	0 Day	14day	29 Day	37 Day	0-14	0-29	0-37
HRSD	67.0 ± 4.47	68.0 ± 4.47	71.0 ± 5.48	73.0 ± 4.47	0.37*	0.01	0.00
BBS	32.8 ± 2.28	33.6 ± 2.88	34.8 ± 3.03	35.8 ± 2.68	0.10*	0.02	0.00
BI	38.4 ± 2.07	37.2 ± 2.28	36.6 ± 2.30	36.0 ± 1.58	0.11*	0.03	0.02
FSS	20.4 ± 2.88	19.2 ± 2.59	17.8 ± 2.28	16.8 ± 2.17	0.03	0.02	0.001
Group A And B P-Value	<0.001	<0.001	<0.001	<0.001			

*Non- significant.

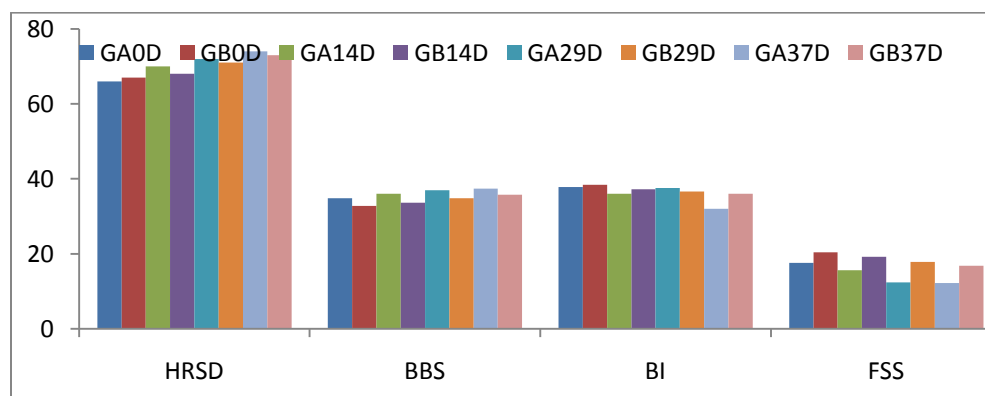


Fig. 1. Study outcomes among groups.

4. Discussion

The study showed that disability, balance, fatigue and depression improved in both music listening and conventional physiotherapy alone groups (Fig. 1). However the improvement was more in music listening group. The result of present study is supported by previous researches, in which patients listened everyday music were improved cognitive, mood, independence of ADLs, decreases depression (Gibberson,2005; Maratos and Gold,2003). Music therapy is also used as adjunct with other therapies in fatigue (Suzzane et al. 2007).

Study observed that patients benefits with music therapy in physiological and psychological aspects. Music causes changes in neuronal activity in lateral temporal lobe and cortical areas devoted to movement. Steady rhythms entrain certain respiratory patterns. Listening to classical music increases heart rate variability, a measure of cardiac autonomic balance (Kathi and Suzanne 2005).

Functional imaging tasks targeting the perception of musical components that require a more global than local processing strategy (e.g., melodic contour, musical phrasing, and/or meter) tend to elicit greater activity in right-hemispheric brain regions than in left-hemispheric regions. It has been shown that tasks that emphasize spectral information over temporal information have shown more right- than left-hemispheric activation (Zatorre and Belin, 2001.) Thus, it is possible that the melodic element of music engages the right hemisphere, particularly the right temporal lobe. It is very clear that for the therapy to work well, the temporal lobe must strengthen its connections with the frontal lobe in order to provide fast feedback mechanisms for vocal articulation and for auditory-motor coupling to take place in the right hemisphere. Mapping sounds to vocal motor actions is more of a left-hemisphere function, but that function is typically destroyed as part of the stroke that causes Broca's aphasia. Furthermore, the inferior frontal lobe needs to connect quickly with the premotor and motor regions in order to plan, prepare, and execute vocal actions. This feedforward system may be under corrective and/or adaptive control of the sensory feedback system in order to improve the auditory-motor mapping (Lahav et al.2007; Bangert and Altenmuller. 2003; Bangert et al. 2006).

The therapeutic effect of music is also evident in neuroimaging studies showed reorganization of brain functions. Music therapy resulted in increased activation in a right-hemisphere network involving the premotor, inferior frontal, and temporal lobes (Schlaug et al. 2008), as well as increased fiber number and volume of the arcuate fasciculus in the right hemisphere (Schlaug et al., 2009).

Music therapy can have effects that improve the psychological and physiological health of individuals. Music can automatically capture attention (Sussman, 2007; Koelsch, 2009) and thus distract attention from stimuli prone to evoke negative experiences (such as pain, anxiety, worry, sadness, etc.). This factor appears to account, at least partly, for anxiety-, and pain-reducing effects of music listening during medical procedures (Nelson et al.2008; Klassen et al. 2008), as well as for beneficial effects of music therapy in the treatment of tinnitus or attention-deficit disorders (Hillecke et al. 2005).

Studies using functional neuroimaging have been shown that music can modulate activity of all major limbic- and paralimbic brain structures, that is, of structures crucially involved in the initiation, generation, maintenance, termination, and modulation of emotions. These findings have implications for music-therapeutic approaches for the treatment of affective disorders, such as depression, pathologic anxiety, and post-traumatic stress disorder (PTSD) because these disorders are partly related to dysfunction of limbic structures, such as the amygdala, and paralimbic structures, such as the orbitofrontal cortex. This factor is also closely linked to *peripheral physiological effects*. Emotions always have effects on the autonomic nervous system, the endocrine system, and the immune system. Systematic knowledge of the effects that music listening and music making have on these systems is still lacking, but because of the power of music to evoke and modulate emotions, it is conceivable that music therapy can be used for the treatment of disorders related to dysfunctions and dysbalances within these systems (Thaut *et al.* 2009).

Cognition includes memory processes related to music (such as encoding, storage, and decoding of musical information, and of events associated with musical experiences), as well as processes related to the analysis of musical syntax and musical meaning. A study also supported the effects of music therapy on the facilitation of Alzheimer's patients' adaptation to residing in a long-term care facility (Gerdner and Swanson, 1993). This factor also might contribute to the effects of music listening to the positive results of study outcomes of the present study. With regards to emotional processing, previous functional neuroimaging studies have shown that listening to music can have effects on the activity of all limbic and paralimbic structures i.e. Core structures of emotional processing in both musicians and in so-called nonmusicians (Blood et al., 1999).

Blood and Zatorre, (2001) used naturalistic music to induce extremely pleasurable experiences during music listening, such as “chills” or “shivers down the spine.” Participants in the present study were presented with a piece of their own favorite music by using normal CD recordings; as a control condition. Increasing chills intensity correlated with increases in regional cerebral blood flow (rCBF) in brain regions thought to be involved in reward and emotion, including the insula, orbitofrontal cortex, the ventral medial prefrontal cortex, and the ventral striatum. Also correlated with increasing chills intensity were decreases in rCBF in the amygdala and the hippocampus. Thus, activity changes were observed in central structures of the limbic system (amygdala and hippocampus). It strengthened the empirical basis for music-therapeutic approaches for the treatment of affective disorders, such as depression and pathologic anxiety, because these disorders are partly related to dysfunction of the amygdala (Stein et al.2007; Drevets et al. 2002). The small amount of empirical data available supports a bihemispheric role in the execution and sensorimotor control of vocal production for both speaking and singing (Ozdemir et al. 2006). There may be a set of shared neural correlates that control both hand movements and articulatory movements (Uozumi et al. 2004), could have improved the balance components. Based on the current result, it is recommended that music plays a significant role adjunct to conventional physiotherapy in the rehabilitation of the stroke patients. For future researches, the sample size must be increased and variety of biochemical analysis can be incorporated in order to see the effect of music.

5. Conclusion

Study concluded that music listening along with conventional physiotherapy management is more effective than conventional physiotherapy alone in the management of stroke. Thus, in post-stroke rehabilitation music therapy can be incorporated along with the other management regimes of stroke patients.

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