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Effectiveness of eurythmics on dynamic balance and fear of fall in subacute stroke patients

Apurva Kadam[1], Dr. Abhijit Satralkar[2]
[1] BPTH, Modern College of Physiotherapy, MUHS, Pune, Maharashtra, India
[2] BPTH, MPTH- Neuroscience, Modern College of Physiotherapy, MUHS, Pune, Maharashtra, India

Abstract
Introduction: Stroke survivals have difficulty in maintaining balance. Fear of falling is an important issue which needs to be dealt with in stroke rehabilitation.
Aim: To study effectiveness Eurythmics on dynamic balance and fear of fall in sub-acute stroke patients.
Method: 40 samples were collected by random sampling between the age of 30-60 years.
Outcome Measures: Outcome measure used for dynamic balance was Timed Up and Go Test. (r=0.99). Tinetti Fall Efficacy Scale(r=0.85) was used for fear of fall.
Results: Eurhythmics is proved to be more effective. Data was analysed using paired t test. Mean difference of 8.67, P<0.05 for TUG and Mean Difference of 68.8, P<0.05 for TFES both with confidence interval 95% were observed.
Conclusion: Eurhythmics is effective in improving in dynamic balance and fear of fall in sub-acute stroke patients.

Keywords: stroke, eurhythmics, balance, fear of fall

1. Introduction

WHO defines clinical syndrome of stroke as "Rapidly developing clinical sign of focal (or global) disturbance of cerebral function with symptoms lasting 24 hours or longer or leading to death, with no apparent cause other than vascular origin"[1].

The location and extent of brain injury, the amount of collateral blood flow present and early acute care management are the factors which determine the severity of neurological deficits in that individual stroke patient [2]. Ischemic stroke is the most common type of stroke which results when a clot blocks or impairs the blood flow, depriving the brain of essential O2 and other nutrients. Hemorrhagic stroke occurs when blood vessels rupture, which causes leakage of blood in and around the brain [3].

The prevalence of stroke in India varies in different regions from 40 to 270 per 1, 00, 000 population [4]. Recent studies have determined the stroke subtypes, based on neuroimaging findings, and also the ratio of cerebral infarct to hemorrhage range as 1.86:1-2.21:1. Hence, cerebral hemorrhage is proportionately much higher in the Indian community than in Western countries, where the ratio of infarct to hemorrhage is 5:1 [5]. Most commonly observed ischemic stroke in 80.2%, hemorrhagic stroke in 17.7%, and unspecified stroke in 2.1% cases based on cerebral computed tomography (CT) [6].

Clinically a variety of focal deficits are possible including changes in level of consciousness and impairments of sensory, motor, cognitive, perceptual and language functions [3]. Stroke survivals have difficulty in balance and postural control for standing upright because they are impaired by asymmetric posture, body imbalance and deficit of weight transfer [7]. Balance is the result of interactions among the visual system, vestibular system, proprioceptive system, musculoskeletal system and cognitive ability. Dynamic balance is the ability to maintain postural stability in orientation with center of mass over base of support while parts of body are in motion.[8] Different studies have been done to improve balance in stroke patients like Mirror Therapy, Pilates, Otago, conventional exercises. Improving dynamic balance includes musculoskeletal responses necessary for movement and balance. Perturbations are used to provide COM displacement [9]. Focuses are made on obtaining symmetrical balanced weight bearing.

Falls were defined as "unintentionally coming to rest on ground, floor, or other lower level [10]." Fear of fall is defined as "low perceived self-efficacy at avoiding falls during essential, nonhazardous activities of daily living [11]." Low fall-related self-efficacy in stroke patients is significantly associated with increased age, female sex, earlier falls, visual and cognitive impairment, low mood and impaired physical function. Twenty percent of the patients scored low fall-related self-efficacy without having experienced a fall, and 11% who experienced a fall scored high fall-related self-efficacy. Impaired physical function due to stroke was significantly associated with scoring low fall-related self-efficacy [12]. Falls are so frequent, they are the major problem in stroke rehabilitation. Hence, fall prevention strategies should be developed and included in rehabilitation programs. Falling and fear of falling is an important issue which needs to be dealt with by the multidisciplinary team [13].

Composer Emile Jaques-Dalcroze (1865-1960) in Geneva, Switzerland, in the early 20th century, developed Jaques-Dalcroze eurhythmics, a music education through movement method. Special emphasis on musical rhythm and body movements through various multitask exercises which are performed to the rhythm of improvised piano music were

introduced by Eurhythmics practitioners to music basic elements. Key feature of this program are the integrated motor and cognitive components. A key component of a rhythmic education, is that the movement provides another way of reinforcing rhythmic concepts - kinesthetic learning serves as a supplement to visual and aural learning [14].

The Smartphone metronome app provides constant beat via auditory cueing on mobile phone. Individuals receive a prescribed sound signal which overrides dysfunction in a brain generating cognitive impulses [15]. Metronome trained subjects showed significant patterns of improvements in cognitive processing [16]. Results suggest the Metronome can produce positive changes in subject's internal timing and external capacity for movement [17]. A smartphone metronome application improved the dynamic balance and gait abilities of patients with subacute stroke [18]. It appears from earlier studies that Metronome was effective in improving visual motor control and coordination [19].

2. Need of Study

Post stroke balance impairments are very common making activities of daily living difficult. Different studies have been done to improve balance in stroke patients like Mirror Therapy, Pillates, Otago, conventional exercises. Eurhythmics has a goal – to provide the patient with a solid rhythmic foundation through movement in order to enhance movement and understanding the pattern. Effects of eurhythmics have been proved effective to improve balance in elderly people. But these studies have not been carried out in stroke patients. Balance disability is common after stroke. Hence the present study aims to evaluate the effectiveness of eurhythmics on balance and fear of fall in stroke patients.

3. Aim

To check the effectiveness of eurhythmics on dynamic balance and fear of fall in subacute stroke patients.

4. Objectives

- To study the effectiveness of eurhythmics on dynamic balance in subacute stroke patients by using time up and go test.
- To study the effectiveness of eurhythmics on fear of fall in subacute stroke patients by using Tinetti falls efficacy scale.

5. Materials and Outcome measures

Materials used were Consent letter, Data collection sheet, Music playing app – metronome, Armchair, Stopwatch.

Outcome measure used for dynamic balance was Timed Up and Go Test. (r=0.99). Tinetti Fall Efficacy Scale (r=0.85) was used for fear of fall.

6. Method

6.1 Participation

Experimental study was done with 40 samples selected by random method. Study setting was hospitals and rehabilitation centers in and around Pune. Study population was subacute stroke patients. All study participants provided writtem informed consent.

6.2 Criteria

The inclusion criteria were a) 30-60 years of age b) 1-3 months post stroke patients c) Both male and female patients d) Brunstorm recovery phase 4 or more e) A score of 24 or higher on mini mental state examinations f) Single occuranece of stroke g) Fear of fall as assessed by TFES with a score higher than 70 of 100 h) A score of ≥ 14 seconds on TUG

Subjects were excluded if a) Any other neurological disease b) Any musculoskeletal injuries such as fracture, ligament injury, degenerative conditions. c) Patients undergoing any other balance training protocol simultaneously d) Patients having spasticity of 1+ or more according to Modified Ashworth Scale e) Visual and auditory deficits.

6.3. Intervention

Study began after the clearance from ethical committee. The intervention was a structured 1-hour class exercise program with 10mins rest period halfway through the session. It was carried 5 days a week. Exercises involved a wide range of movements and challenged the balance control system mainly by requiring multidirectional weight shifting, exaggerated upper body movements when standing, stepping forward and backwards, reach outs. Speed of metronome was progress with approximately 5 beats per minute each session. Patients were asked to avoid any new additional exercise programs during the course of the study. Adherence to the Jaques-Dalcroze eurhythmics program was verified by weekly attendance records.

7. Results

In paired t test TUG and TFES both the outcome measures showed the significant improvement. Table 1 shows extremely significant statistical difference ($p<0.05$) in stroke patients in TUG, post value (mean 19. 825) and post value (mean 11.15). With the mean difference 8.675

T value for TUG is 31.982 with 39 df. With 95% of confidence.

Similarly, Table 2 shows extremely significant statistical difference($p<0.05$) in stroke patients in TFES, post value(mean 87.725) and post value (mean 18.925) with mean difference 68.800

T value for TFES is 111.65 with 39 df. With 95% of confidence.

Table 1: pre and post TUG

Data	Mean±SD	T value	P value	Result
Pre	19.82±2.37	31.982	<0.05	Extremely Significant
Post	11.15±1.47			

Table 1: pre and post TFES

Data	Mean±SD	T value	P value	Result
Pre	87.72±5.44	111.65	<0.05	Extremely Significant
Post	18.92±2.47			

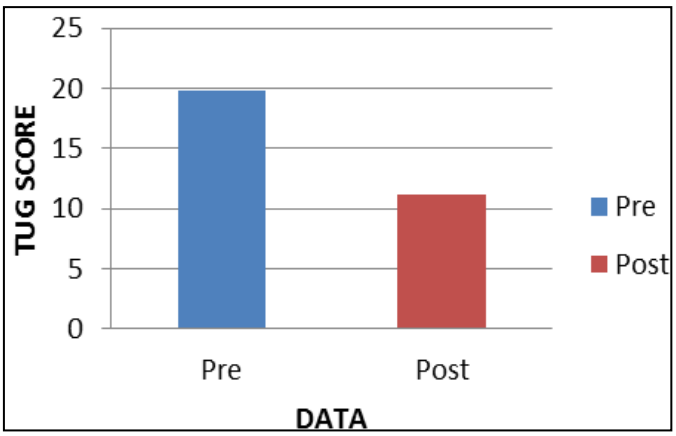

Fig 1: TUG pre and post mean comparison

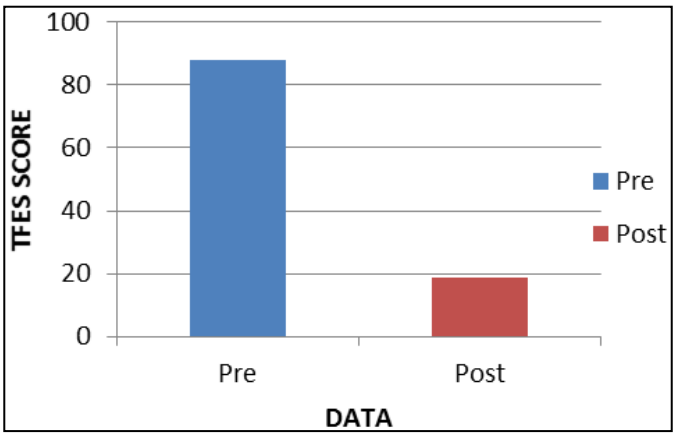

Fig 2: TFES pre and post mean comparison

The post mean data showed a significant improvement than the pre mean data, resulting that eurhythmics is effective.

8. Discussion

Stroke is associated with a risk of falling at home and affects the lives of patients with stroke was shown by a study Incidence and consequences of falls due to stroke: a systematic inquiry by BMJ 1995. The risk of falls increases disability producing social restriction and low mood which accelerates the background decline in mobility. Provision of physiotherapy both to prevent falls and after fall has been shown to be beneficial. Some effect, particularly in improving speed of gait, a factor associated with falling in study has also been studied by late intervention of physiotherapy [20].

The risk of falls is considerably high among stroke patients, and falling could be a major complication in stroke rehabilitation [21]. Theoretically, a program directed towards reducing falls for the stroke patients could, prevent 44% of first falls [22].

The aim of the present study was to check the effectiveness of eurhythmics on dynamic balance and fear of fall in subacute stroke patients. The study showed improvement in dynamic balance and reduction of fear of fall in subacute stroke patient after 4 weeks of training of eurhythmics.

An article "Effect of music multitask training on gait, balance, and fall risk in elderly people: a randomized controlled trial." By Trombetti A, Hars M, Herrmann FR, Kressig RW, Ferrari S, Rizzoli R. showed significant improvement of balance in elderly [23].

Motor recovery after stroke: a systematic review. An article by Peter Langhorne, Fiona Coupar, Alex Pollock showed that Balance disability is common after stroke [24].

Composer Emile Jaques-Dalcroze (1865-1960) in Geneva, Switzerland, in the early 20th century, developed Jaques-Dalcroze eurhythmics, a music education through movement method. It is now practiced worldwide in the field of music, as well as dance, theater, and therapy. Music's basic elements with special emphasis on musical rhythm and body movements through various multitask exercises performed to the rhythm of improvised piano music are introduced by the practitioners. Key features of this program are the integrated motor and cognitive components which involves a greater interest for dual- or multiple-task practice than other multicomponent attention-demanding exercise forms (eg, Tai Chi). In a cross-sectional study of older, long practitioners of Jaques-Dalcroze eurythmy, age-related increase in stride-to-stride variability in a very dual-task context seemed to be attenuated [14].

A musical idea through movement before the patients find out about its visual illustration is introduced by eurythmics. This sequence interprets to heightened body awareness associated with an association of rhythm with a physical experiment for the patient, reinforcing ideas kinesthetically. It has Wide-ranging applications and advantages and it can be taught to variety of age groups. Eurhythmics has a goal – "To provide the patient with a solid rhythmic foundation through movement in order to enhance movement and understanding the pattern [14]."

"Movement provides another way of reinforcing rhythmic concepts" - kinesthetic learning serves as a supplement to visual and aural learning which is a key component of Eurhythmics. It solidifies the concept through movement while the traditional balance exercises reinforce concepts visually and encourages patients to develop balance. Gross motor skills and musculature is also developed in stroke patients by movement aspect of rhythmic curriculum. Ideally, most activities that are explored in eurhythmics include some sort of kinesthetic reinforcement. With repetitive task training, improvements in transfer ability or balance were seen, for improving motor recovery, particularly those that have focused on high-intensity and repetitive task-specific practice [14].

Forward weight shifting tasks, presents a challenge to the motor systems of individuals with stroke. It may account for the poor balance that is often observed in these individuals [25]. Neuroplasticity as well as motor learning have exerted a great influence and have provided a stimuli for motor rehabilitation research [26].

Crucial for motor recovery includes repeated motor practice. One of the most elementary rules for the optimization of motor ranging from elementary force pulses to complex movement strategies is repetition of a particular activity.[26] A fixed memory in the patient's mind about the song and its timing may stimulate the improvement of activities even without the presence of an external pacemaker. The stroke patient's dynamic balance in selected parameters more than

conventional therapy is improved by musical motor feedback [27].

For the movement, and understanding the neurobiological basis of rhythm perception and reproduction can be helpful in addressing motor recovery after brain lessons, timing is very important. In this quest, the science of music would possibly offer interesting hints for higher understanding the brain timing mechanism. The neurobiological substrate of sensorimotor transformation of the time information, highlight the ability of sensory system, rhythmical stimuli in guiding motor acts is that the main focus of the reports. The cerebellar role of timing is addressed in subjects with cerebellar damage. Thus, cerebellar timing processing is highlighted through an fMRI study of professional musicians. The two approaches converge to demonstrate that different levels of time processing exist, one conscious and one not. And to support the thought that timing could be a distributed function. The hypothesis that unconscious motor responses to auditory rhythmic stimuli may be relevant in guiding motor recovery and modulating music perception is advanced and mentioned [28].

Motor planning by Christopher M. Harris & Daniel M. Wolpert in the year 1998 determines a study Signal-dependent noise. There is an infinite variety of attainable trajectories that the eye or arm may take to reach the target, after we do saccadic purposeful arm movement. A unifying theory of eye and arm movements supported the only physiological assumption that the neural control signals are corrupted by noise whose variance will increase with the scale of the control signal is therefore presented A study propose that within the presence of such signa-dependent noise, the form of a trajectory is chosen to reduce the variance of the ultimate eye or arm position. This minimum-variance theory accurately predicts the trajectories of both saccades and arm movements and the speed–accuracy trade-off described by Fitt's law. Dynamics of the eye or arm, as found empirically, are the profiles which are robust to changes. Moreover, the empirical 'two-thirds power law' is the relation created between path curvature and hand velocity during drawing movements. A simple and powerful unifying perspective for both eye and arm movement control is provided by this theory [29].

Thus, present study is effective in improving dynamic balance and fear of fall in subacute stroke patients.

9. Conclusion

On the basis of statistical analysis, we conclude that Eurhythmics is effective in improving in dynamic balance and fear of fall in subacute stroke patients.

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