Original Research Article

EFFECT OF CODUSE VS EXERGAMING EXERCISE TO IMPROVE BALANCE IN MULTIPLE SCLEROSIS PATIENTS: A COMPARATIVE STUDY

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ABSTRACT

Background and Objectives: Multiple Sclerosis is a chronic, inflammatory disease of brain, optic nerve and spinal cord mediated by immune system. In India, MS prevalence has increased from 1.33/10, 0000 to 8.35/100,000. People are most diagnosed at age 20-50 years with an average age of 30. People with MS frequently reports balance and walking impairments.

Therefore it is necessary to improve balance in MS .In recent advance it is shown that exergaming and CoDuSe exercise have positive roll to improve balance in patient with Multiple sclerosis. Thus aim of this study is to compare the effect of CoDuSe exercise and Exergaming program, on Balance performance & balance confidence, in People with multiple sclerosis.

Methods: A comparitive study was done on 30 Multiple Sclerosis patients, selected by purposive sampling technique and those meeting inclusion criteria were divided into 2 groups, Group A and Group B. Baseline balance assessment was taken in both the groups by Berg Balance Scale (BBS). Group A (n= 15) underwent CoDuSe exercise &Group B (n=15) underwent Exergaming protocols respectively for 6 weeks. Post intervention balance assessment was obtained at the end of 6weeks using BBS. Results thus obtained were statistically analysed using SPSS 16.0, MS Word and MS Excel.
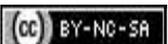
Results: Group A who were given CoDuSe intervention improved much better than Group B who were given Exergaming .The unpaired t-test was performed between the two groups which showed moderately statistical significance with p-value <0.001.

Conclusion: In conclusion, CoDuSe is more effective than Exergaming exercise to improve balance in people with Multiple Sclerosis.

KEY WORDS: Multiple Sclerosis, Balance imapairment, CoDuSe, Exergaming.

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BACKGROUND

Multiple Sclerosis is a chronic, inflammatory disease of brain, optic nerve and spinal cord mediated by immune system. It is characterized by lesions of disseminated focal demyelination accompanied by variable axon damage and destruction and reactive gliosis. Multiple Sclerosis was thought to be disease of the white matter (WM).

However recent investigations have shown that the grey matter is significantly involved [1].

MS is theprimary cause of non-traumatic disability in young and middle -aged adults and the most common condition of CNS. In India, MS prevalence has increased from1.33/10,0000 to 8.35/100,000 [2].

It is reported that approximately 3,50,000 – 4,00,000 people in the United States and overs 2.5 million people worldwide have the disease [3].

The incidence of Multiple sclerosis is 2 or 3 times higher in women than in men [4].

The pathophysiology of MS is discussed, with emphasis on the axonal conduction properties underlying the production of symptoms, and the course of the disease. Demyelination occurs during the inflammatory phase of the lesion. An important mechanism determining persistent neurological deficits is axonal degeneration, although persistent conduction block arising from the failure of repair mechanisms probably also contributes [5].

The main physiologic effect of demyelination is to impede saltatory electrical conduction of nerve impulses from one node of Ranvier where sodium channels are concentrated to the next node. The result in failure of electrical transmission is thought to underlie most of the abnormalities of function resulting from demyelinating disease of both the central and peripheral nerves.

Remyelination probably does occur, but it is a slower process and partial at best, and its functional effects in the CNS are possibly expressed as a slowing of nerve conduction, which if present in an eye with normal vision may account for the reduction in flicker fusion and in the perception multiple visual stimuli.

Another typical feature of MS is the temporary induction, by heat or exercise,of symptoms such as unilateral visual blurring(Uhthoff phenomenon) or tingling and weakness of the limb.

A rise of only 0.5c can block electrical transmission in thinly myelinated or demyelinated fibers. Smoking ,fatigue,hyperventilation and arise of environmentory temperature are all capable of briefly worsening neurologic function and are

easily confused with relapses of the disease [5].

The exact cause of the disease is unknown.It is believed that an abnormal immune response to environmental triggers in people who are genetically predisposed, results in immune mediated acute and chronic inflammation.

Weakness or numbness sometimes both in one or more limbs is the initial symptoms. Symptoms of tingling of extremities and tight band like sensation around the trunk or limbs can be seen. The tendon reflexes are retained and later become hyperactive with extensor plantar reflexes, varying degree of deep and superficial sensory loss may be associated. In addition several syndromes that is typical of MS and may be initial manifestations.

This common modes of onset are optic neuritis, transverse myelitis,cerebellar ataxia and brunstons syndrome like vertigo, facial pain,dysarthria,diplopia etc [6].

MS is commonly classified into four major categories [7]

· Relapsing -RemittingMultipleSclerosis(RRMS)

· Secondary Progressive Multiple sclerosis (SPMS)

· Primary Progressive Multiple Sclerosis (PPMS)

· Benign Multiple Sclerosis (BMS)

The CoDuSe program is a feasible technique to perform in the clinical settings to improve balance in multiple sclerosis. The CoDuSe exercise is an concept including core stability,excercises, dual tasking and sensory strategies. The exercises are customized to fit the disability level of the population .The aim of CoDuSe exercises is to target factors of importance in maintain balance during activities, trunk stability, dual tasking and sensory strategies [9].

As activation of trunk muscle is of importance for balance the aim focus of the program is on core stability exercise. The number of web-based exercise program is growing and a further development of the CoDuSe concept is to transfer the program into an interactive exercise module. This could increase the number of persons who can take part in these exercises [8].

Studies suggest that the CoDuSe programme improve dynamic balance more than no intervention

This exercise program targets visual, somatosensory and vestibular aspects of balance.

Exergames appear promising for home-based balance and strength training for healthy elderly. Exergaming devices have several advantages compared to conventional exercises; exergaming can motivate people to practice and by performing dual tasks users can train both cognitive and motor skills. An additional advantage of exergames is motivation. The reviewed studies showed that exergame intervention groups found the technique was more motivated than conventional exercise and showed better improvements than control on clinical outcome measures.

Previous studies of balance training have had differences in content and the results have not been conclusive [10].

Therefore, it was necessary to improve balance in Multiple Sclerosis and as CoDuSe exercise and Exergaminghave positive role to improve balance in patient with Multiple sclerosis.

Also, it was useful to find out the best technique in physiotherapy to improve balance in patients with multiple sclerosis.

The aim of this study is to compare the effect of CoDuSe exercise and Exergaming program, on Balance performance in people with multiple sclerosis.

METHODOLOGY

Study Design: Comparative study.

Study Setting: People Tree Hospital, Multiple Sclerosis association of India

Study Duration: six weeks.

Sampling Technique: Purposive Sampling Technique.

· Sample size of n=30 was determined through power calculation based on prevalence rate of p=0,00835 for MS patients, obtained from previous studies. With the type 1 error alpha= 5%, and mean standard error d= 20%, substituting in the formula:

$$n = \left(Z\frac{\alpha}{2} + Z\right)^2 pq \div d^2.$$

Net sample =n*2

Inclusion Criteria: 1) Subjects who were willing to participate in the study and signed the written informed consent.2)Subjects diagnosed with Multiple Sclerosis. 3)Subject belonging to age group 20-50 years.4)Subjects with an ability to walk independently.5)Subjects with adequate visual, hearing and understanding ability.

Exclusion Criteria: 1)Subjects with known history of any underlying neurological conditions like Parkinsondisease, stroke, cerebellar dysfunction, etc. 2)Musculoskeletal ailments of lower extremity leading to instability and pain. 3)Presence of conditions like orthostatic hypotension and vestibular disorders.

Materials and Equipments: 1)Berg Balance Scale(BBS) 2)Balance Board 3)Couch4)Chairs 5)Stationaries 6)Device to play video games.

Ethical clearance: Permission to carry out the study was obtained from the concerned authorities of the above mentioned institutions. Ethical clearance from the Ethical Committee Review Board was obtained before carrying out the study. The test procedure was explained and signed informed written consent was obtained from each subject on their approval.

Procedure: The subjects from Multiple Sclerosis Society of India & People Tree Hospitals Bangalore were recruited for the study and permission from these authorities to carry out the study were taken.

· The study and test procedure were explained and signed written informed consent was obtained from each subject on their approval.

· Subject were recruited as per the inclusion and exclusion criteria and allocated into two different groups.

· Material and equipment's required for the procedure was arranged prior to the test. Demographic data of the subjects was collected and recorded.

· Prior to the intervention, Balance assessment was done by BBS. The Berg Balance Scale is a tool that can be used to systematically and thoroughly measure balance. The scale consists of 14 functional tasks. Score uses a 5point ordinal scale which score ranging from 0-4. Score 4 is indicated patient perform independently and

meets time and distance criteria and score 0 is used to unable to perform the tasks. A maximum score 56 points is possible.Following BBS score, the participants divided into 2 groups(Group A and Group B):

· Group A was given CoDuSe balance exercise program which consist of core stability exercises of 15 minutes, followed by Dual Task exercises for 15 minutes and 15 minutes exercises challenging different sensory strategies.

· Group B was given Exergaming training where they will were instructed to play video game on an Unstable platform.

· After 6 weeks, balance was measured using BBS scale for both the groups and results were compared.

Statistical Analysis: The statistical software SPSS 16.0 was used for the analysis of the data and MS- Word 2013 and MS-Excel 2013 have been used to generate graphs, tables, etc. Descriptive and inferential statistical analysis has been carried out. Results on continuous measurements are presented on Mean ± SD (Min-Max) and on categorical measurements are presented in Number (%). Pearson's correlation coefficient was applied with a confidence interval set at 95% between BBS.

RESULT

Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean ± SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5% level of significance.

Table 1: Gender Distribution.

S.NO	GROUP A	GROUP B	TOTAL
MALE	3(20%)	4 (25%)	7(23%)
FEMALE	12(80%)	11(75%)	23(77)
TOTAL	15	15	30

Table 2: Age Distribution.

GROUP	AGE	STANDARD DEVIATION
GROUP A	39.67	7.47
GROUP B	34.13	6.83

Table 3: Comparative assessment within the group A and Group B.

	Pre BBS Score	Post BBS Score	Difference	t-value	p-value
Group A	42+2.03	46.33+2.81	4.13	6.06	<0.001**
Group B	42.8+1.26	44.67+2.58	1.87	3.5	<0.001**

Table 4: Comparison between group a and group b post-intervention.

GROUP	MEAN	SD	t-value	P-value
GROUP A	46.33	2.81	1.68	0.05
GROUP B	44.67	1.87	0.68	0.05

DISCUSSION

The CoDuSe balance exercise is a concept including core stability exercise inspired by Freeman et al., dual tasking and sensory strategies. The exercises were customized to fit the disability level of the sample .The current study suggested that the CoDuSe exercise program improves balance which was measured by BBS .It also reduces the number of falls as well as near falls. This was an important finding particularly given the commonness of fall that may lead to injuries. These findings were supported by previous study done by Carling, Anette Forseberg et al in 2017.

With CoDuSe exercise program improvements were found in Dynamic balance and postural sway while walking .The result was same with the previous study done by Catteneo.Detal.They suggested that challenging exercise that promotes sensory compensation seem to have an impact on dynamic and static balance and also can reduce risk of fall.

Exergaming is a relatively new and promising option to encourage physical activity and improve balance. The current study suggested that the Exergaming exercise program improves balance which was measured by BBS & had found significant improvement in balance and lower limb muscle strength. The participants may have learnt to maintain stability in situations by this Exergaming intervention where they had previously lost balance or may have gained knowledge about their own limits and therefore avoided risks. These findings were in agreement with previous study done by Kramer a ,Dettmers C et al in 2014.Playing exergames on unstable

surface seems to be an effective way to improve balance and gait in patients with MS especially DT situations. The integration seems to have a positive adherence and its thus beneficial for the long –term effectiveness of rehabilitation programs.

However when we compared the improvement between the group it shows strong significance. Therfore it was concluded CoDuSe was more effective than Exergaming to improve balance in PwMS.

Impaired balance and trunk control and difficulty to perform dual tasks are common in people with multiple sclerosis (PwMS). Balance function can improve by specific exercise(like CoDuSe) thus possibly reducing fall frequency.

The exercise protocol used a standard manual and using small group made it possible for the physiotherapist to individually instruct the subject.

The exergaming encouraged the participant to go balance training while diverting their attention to play video game. Which was an advanced procedure and the difficulty level may be was higher than the CoDuSe . Also for few subjects there was little difficulty to follow the instruction and maintain the punctuality for the session.

Hence the CoDuSe exercise improved balance more than Exergaming intervention.

CONCLUSION

CoDuSe exercise is effective on balance in people with Multiple Sclerosis. Exergaming exercise has a positive effect on balance in people with Multiple Sclerosis. CoDuSe is more effective than exergaming exercise to improve balance in people with Multiple Sclerosis.

Future Scope: Long term effects of CoDuSe and Exergaming on balance. Future research should evaluate balance interventions that also include outdoor activities. Effect of CoDuSe and Exergaming interventions on fall risk and gait can be evaluated.

Limitations: Fall Assessment was not done in present study so there was a lack of pre intervention data on falls and near falls. It was only reported by the patients post intervention fall risk was reduced. Actual activity level for the subjects was not documented .The intention of Multiple Sclerosis case is to encourage people to be as active as possible. Therefore difference between activity level pre and post intervention was not evaluated. Lack of Control group.

ABBREVIATIONS:

MS - Multiple sclerosis
CNS - Central Nervous system
CoDuSe - Core Strengthening Dual Tasking Sensory stratergy
PwMS - Person with multiple Sclerosis
DT - Dual Tasking

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Conflicts of interest: None

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