ORIGINAL ARTICLE

EFFECTS OF MENTAL IMAGERY ON LOWER LIMB FUNCTION IN SUB-ACUTE STAGE OF STROKE PATIENTS; A RANDOMIZED CONTROLLED TRIAL

Wajiha Shahid[1], Maryam Shabbir[2], Anam Naz[3], Naveed Arshad[4], Umair Ahmed[3]

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Authors' Affiliation
[1]Central Park Medical College, Lahore
[2]Riphah International University, Islamabad
[3]The University of Lahore, Lahore
[4]Islamabad Medical and Dental College, Islamabad

Corresponding Author
Maryam Shabbir
Riphah International University, Islamabad
E-mail:
maryam.shabbir@riphah.edu.pk

ABSTRACT

Introduction: Stroke is the most common type of cerebrovascular injury caused by sudden decrease in blood supply that can lead to weaknesses and other associated problems. Many treatment options are available for stroke with promising results. This trial was designed to explore the role of mental imagery (visual) in the sub-acute stage, considering the stroke patient, especially in evaluating its effects on the lower extremities.

Material & Methods: An experimental randomized controlled trial was performed from July to August 2018 in physiotherapy departments of National Hospital and Aadil Hospital Defence Lahore. A total of 80 patients having sub-acute stroke with strong perceptions having a score of 25 or more in the Mini Mental Score Exam and a 3 +/5 manual muscle testing grade system in the lower extremity were taken using non-probability consecutive sampling procedure. All the patients were divided into 2 groups randomly. Conservative treatment including strengthening and balance training were given to one group and conservative treatment with addition of visual imagery to the second group. Independent t-test was used to assess significant differences between the two groups.

Results: Comparison of Berg Balance Scale at pre-intervention between the experimental group and the controlled group was not significant, 13.76 ± 2.85 vs 13.84 ± 3.26 (p=0.927), respectively. After intervention the effects of treatment were significant in both groups, 18.64 ± 2.33 vs 17.80 ± 2.94 (p=0.007), respectively. Comparison of Time Up and Go test at pre-intervention between groups was not significant, 6.28 ± 1.86 vs 6.68 ± 0.99 (p=0.347), respectively. The intervention effects after treatment in both groups were significant, 1.84 ± 1.28 vs 3.56 ± 1.26 (p=0.001), respectively.

Conclusion: It is concluded that mental imagery along with conservative treatment plays a vital role in construction of neural circuit in sub-acute stroke patients.

Key Words: cerebrovascular accident, lower limb, mental imagery, stroke, sub-acute haemorrhage, transient ischemic attack

The authors declare no conflict of interest and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All authors contributed substantially to the planning of research, question designing, data collection, data analysis and write-up of the article.

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INTRODUCTION

Cerebrovascular accident (CVA) refers to disease that involve cerebrovascular events and leads to blood deficiency in the brain which could be a transient ischemic attack or a stroke. Stroke is the most common type of cerebrovascular injury. It can be explained as a sudden decrease in blood supply due to vascular causes that can lead to weakness, dementia etc. In CVA the signs last for 24 hours or more.[1]

Mental training requires the participation of certain areas of the brain that are often overlooked during the preparation for exercise. However, the concept of movement is not dependent on skills of performing exercises; rather it depends on the organization of the neural circuits.[2] Regular use of mental exercise can help in organizing neural circuits. From the aspect of the 'neural circuit', it is emphasized that previous research on certain motor behaviours found that during brain activity, the neural network involved was repeated by training.[3] Therefore, by linking the movement patterns with mental images, the effectiveness of physical activity may be made better. Depending on the idea that "neural networks" remain unchanged, it is concluded that physical injury has no effects on central organization as it has been reported in the trials carried out on rehabilitation of patients with neurological conditions.[4]

Studies showed that after the completion of a particular course plan, the subjects under study got better outcomes in both trained and untrained tasks. The subjects' responses also indicate that it may improve their daily functions. Clinical trials have shown that subjects' attention and sequential analysis have increased due to this training. Mental training has proved to be significant in improving the functions of re-learning the tasks after brain assaults. Skills gained under the intervention program could be merged with other activities and the outcomes of treatment may be guided by improved concentration, better mapping of activity and high-quality activities with exercise.[5]

A study on 13 patients with upper extremity stiffness reported better scores after being assessed on Fegyl-Meyer sensory motor disorder scale following imagery trainings.[6]

Moreover, the subjects who did arm activities with occupational therapists along with mental training showed improved outcomes of rehabilitation program. Likewise, over the past 5 months, subjects having coronary artery diseases and myocardial infarction going through mental imagery regime reported improved arm activities.[7]

The rationale behind this study was to evaluate the theory that mental imagery in subacute stroke patients has a role to construct neural circuits, especially in evaluating its effects on the lower extremities.

MATERIAL AND METHODS

This randomized controlled trial was carried out in physiotherapy department of National Hospital and Aadil Hospital Defence Lahore from July to August 2018 after getting approval from ethical committee of Riphah International University, Lahore Campus (letter number REC/RCRS/16/2018). An informed consent was obtained from a total of 80 patients having sub-acute stage of stroke. Sample size was calculated by using WHO sample size calculator [$n = Z^2 \times P (1-P)/D^2$] while taking 5% level of significance, 95% confidence interval and 5.5% desired precision.[7] Patients were in 40-65 years range of age. Both male and female patients having strong cognition with more than 25 scores on Mini Mental State examination and having a 3 +/5 muscle test grading in the lower leg were eligible for this trial. The sample selection for the recruitment of participants was non-probability consecutive sampling. The sub-acute stage of stroke refers to the time when the decision to not employ thrombolytics is made up until two weeks after the stroke occurred. Patients with partial or no muscle contraction in the lower limb, who were having comorbidities like seizures in the last 12 months, neurological deficits other than stroke, critical illness, postural hypotension and history of fall were excluded from the study. Data was collected using the Berg Balance Scale (BBS) and Time Up Go test (TUG) questionnaires to determine the patient's performance rate in advance. These questionnaires help in determining balance and strength of patients.

The procedure followed were as follows: 2 groups were formed by using a chit method where the patient's names were written on the chit and wrapped at the same time, a third person was called to randomly select the chit to be added in the conservative treatment group and the mental imagery group. It enabled 40 patients in the experimental group (I) to go through mental imagery that included providing subjects with videos of the regime they would be given. Patients were then asked to practice the visual images, they saw, in their minds as if they were doing the tasks themselves. The visuals included showing them videos of ways to specifically improve strengthening of hip abductors, hip flexors and hip extensors as well as balance training. Followed by rehearsing visual images in mind for 20 minutes and then conservative treatment was given making a total of 50 minutes session as a whole.[8] It was given four days a week for eight weeks and the controlled group (II) was given conservative treatment only for 30 minutes having the frequency as that of experimental group. The tests were done for pre- and post-analysis of the treatment regime and were compared later on.

Data gathered was entered and then analysed in the SPSS version 16. Frequency distribution and sd and mean values were assessed. Kolmogorov–Smirnov and Shapiro–Wilk test was used for normality data between the groups. The two groups were compared by using an independent sample t-test at first and eight weeks. The p-value was considered significant when it was 0.05 or less.

RESULTS

Among the 80 patients, 25 (31.25%) were male and 55 (68.75%) were female. The mean age and standard deviation of 40 patients in the experimental group were 51.35 ± 5.16 years and the 40 patients in the control group were 51.10 ± 5.16 years with a minimum age of 40 and maximum 65 years. Data was normally distributed and therefore parametric tests were applied to compare the outcomes of experimental and controlled groups. Comparison on Berg Balance Scale at pre-intervention between the experimental group and the controlled group showed no differences, 13.76 ± 2.85 vs 13.84 ± 3.26 (p=0.927), respectively. After intervention the effects of treatment were significant in both groups, 18.64 ± 2.33 vs 17.80 ± 2.94 (p=0.007), respectively. Comparison of Time Up and Go test at pre-intervention between groups was not significant, 6.28 ± 1.86 vs 6.68 ± 0.99 (p=0.347), respectively. The intervention effects after treatment in both groups were significant, 1.84 ± 1.28 vs 3.56 ± 1.26 (p=0.001), respectively. These results

DISCUSSION

Numerous studies have been conducted on the effects of mental imagery on arm movements. It gave a view that, in combination with conventional physical therapy, activity-based regimes and mental imagery helps in improving the function of the upper extremities by creating new neural circuits and in turn central organization.[9] These skills are validated by patients themselves, and they have been able to perform daily tasks comfortably.[10] The researchers noted that these adaptations vary with time mostly taking place in 3 months of regime. Riccio et al.[11] found positive results in the sub-acute stage of stroke patients. Mental training has improved strength, quality of action and performance in patients with neurological disorders. These researchers documented the great power of mental imagery in patients who could not perform movement due to physical stresses associated the neurological disorders. Muller et al.[12] reported that in the case of pinching, each mental functioning worked as a repetitive exercise routine and improved function in the selected patients.

Most of the published data that we found was the result of mental performance on improvement of the upper limbs, but very few were found for lower limb regime. Verma et al.[13] found the beneficence of the training regime, which included performance-oriented gait training along with mental images. He reported evident improvements in most of the outcome measures and the independent gait proved to be better than that of the conventional group. It was also reported that after six weeks of treatment, the results keep on improving.

It was reported that subjects receiving conservative treatment along with mental imaging had better prognosis than the patients in conservative group. Moreover, it was also reported that this practice was causing minimum efforts on the physiotherapists' side and the patients developed neural circuits of the movements to be performed in a relatively short period of time. In addition, it was found that those patients who received mental imagery therapy reported better understanding of the treatment compared to those who received conventional physical therapy treatment. This was also evident by a

review of literature in which most of the studies agreed that psychological images must be included in the physical therapy program for better results. The outcomes of imagery therapy is equally beneficent in both acute and sub-acute phase of a stroke rehabilitation for both upper and lower limb in improving function, balance and gait training. Much of the work is done in the upper part in terms of its effects on the patient's performance in the acute stages. Some of the limitations of this study was segregation of female population in one group. One group contained almost equal number of males and females while the other group contained just females. The study was conducted in settings where female physical therapist were more in number and therefore the number of female patients was higher compared to male patients. That's one of the reasons that equal distribution of male and female patients in both groups was not possible. The video shown to the patients was gathered from 'youtube' so the setup shown in those clips was not familiar to the patients and might have not made better understanding of patients due to the difference in settings and language difference.

CONCLUSION

This study concluded that in the sub-acute stage of stroke patients' (visual) image of a given treatment plays a vital role in the formation of neural circuits. Therefore, with any treatment its image must be shown to the patients in advance followed by mental practice in his or her mind as if he or she were doing it in realty. It not only helps in the development of neural circuits but also enhances patients' understanding of the treatment they receive. The patients have the capacity to practice exercise if they are guided through images or videos.

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