Meditation effects on cognitive function and cerebral blood flow in subjects with memory loss: a preliminary study

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Background

Initial studies have suggested that specific cognitive practice programs may help improve memory.[1,2] Meditation has long been defined as a potential technique for improving memory and lowering levels of stress, depression, and anxiety. Until now, there have been a few treatment options for patients with early cognitive impairment. Several medications and vaccine trials are underway. In one of the studies conducted Lutz and their team showed that expert meditators were able to induce changes in their brain activity during meditation with the help of electroencephalography (EEG).[3] This study was designed to explore the effects of a very specific form of meditation in patients with cognitive impairment and to track potential changes with functional brain imaging using single photon emission computed tomography and to demonstrate improvements in variety of cognitive functions of brain.

Study Design

Fourteen subjects with memory impairement were selected and put to evaluation assessed on the first imaging day with a brief neuropsychological test battery that was adapted from the battery currently used by Memory Disorders Clinic at the University of Pennsylvania and comprising of a Category Fluency task in which subjects named as many animals as possible in a 60 second time period, the Wechsler Adult Intelligence Scale (WAIS) Digit Symbol Substitution Test, a Logical Memory task, and Trails A and B. These tests were also selected based upon other studies in which neuropsychological tests were used to evaluate changes in cognition associated with mental task interventions. Same set of tests were repeated on the 8-week follow up session and had an IV inserted and were injected with 250MBq of Tc-99m ECD while listening to a neutral stimulus CD. They then underwent a pre-program baseline SPECT scan. Then subjects were guided through their first meditation session with a CD during which they received an injection of 925MBq ECD, and underwent a pre-program meditation scan. Subjects completed an 8-week meditation program and underwent the same scanning protocol resulting in a post-program baseline and meditation scan. A region of interest (ROI) (Inferior Frontal, Superior Frontal, Superior Parietal, DLPFC Sensorimotor, Posterior Cingulate, Orbitofrontal, Anterior Cingulate, Superior Frontal Thalamus, Superior Parietal, Medial Frontal, Amygdala Precuneus : areas were selected due to their activity as these regions are involved in executive decisions, learning, emotions spatial memory, self awareness and self position according to the surrounding environment) template obtained counts in each ROI normalized to whole brain to provide a CBF ratio. Baseline and meditation scans and neuropsychological testing were compared before and after the program. When neuropsychological test scores were compared between the pre and post training program sessions, there were a several improvements observed. This group did significantly better than the control group in Category Fluency in naming of animals ($p < 0.05$). However, several of the other neuropsychological tests demonstrated similar improvements between the meditation and control groups even though the changes observed in the music group were not significant.

Implications

In general meditation may be called as complex neurocognitive tasks which may or may not related with the alterations in the brain's response to a stimulus often provided in the form of excitatory signals through nerves. As a pilot study, the data does not provide important information regarding general effect sizes and the comparable result for CBF changes and neuropsychological test changes associated with a meditation practice yet data proves more effective if done on a large group. With more and more exploration of CAM approach these types of studies may initially provide a platform to understand the phenomenon behind these therapies.

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References

1. Mahncke HW, Connor BB, Appelman J *et al*. Memory enhancement in healthy older adults using a brain plasticity-based training program: a randomized, controlled study. Proc Natl Acad Sci. 2006; 103: 12523–12528.
2. Willis SL, Tennstedt SL, Marsiske M *et al*. Long-term effects of cognitive training on everyday functional outcomes in older adults. JAMA. 2006; 296: 2805–2814.
3. Lutz A, Greischar LL, Rawlings NB *et al*. Long-term meditators self-induce high-amplitude gamma synchrony during mental practice. Proc Natl Acad Sci. 2004; 101: 16369–16373.