Pilot Study on Brain Gym® and Cognitive Functions of Seniors in Hong Kong

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Introduction

Mild cognitive impairment (MCI) refers to a stage of mild level of cognitive decline not sufficient to meet the criteria of dementia. MCI is commonly referred to as the transition between normal cognitive aging and dementia. Community studies have shown an annual progression rate from MCI to dementia of up to 15%.[1] Therefore elderly with MCI should be identified and given close monitoring of the disease progression.

Dementia is under-diagnosed age-related disease in Hong Kong.[2] Unfortunately, the efficacy of symptomatic treatments for dementia is limited and there is no disease-modifying treatment available. Persons with MCI are presumed to be in the earlier stage of disease and are more amenable to treatment. Therefore, it is important to raise the public awareness of MCI for early identification of such victims. The common symptoms of MCI include difficulties in memory, language, executive functions, disorientation in time, date and place and reduced mental speed.[3] Patients and caregivers aware of these symptoms should promptly seek medical attention.

Recent evidence has identified a number of pathophysiological factors for dementing illnesses[4] and it is plausible that the prevention of the development of these factors will also have a positive impact of preventing or slowing the development of MCI. Vascular risk factors, especially stroke, can have a dramatic negative impact on cognition, especially among those already with MCI.[5] and therefore tight control of vascular risks should be implemented. In addition, physical exercise and cognitive activities may also confer protection against risk of cognitive decline in elderly persons.[6-10]

Brain Gym®

Brain Gym® is originated from Educational Kinesiology and was found by Dr. Paul E. Dennison and Gail E. Dennison.[11] It consists of a series of 26 simple movements.

The Brain Gym® activities are organized into four categories-the Energy Exercises, Deepening Attitudes, the Lengthening Activities, and the Midline Movements-that correspond with the three primary types of movement that humans learn: stabilization, locomotion, and manipulation. These three types of movement, contributors to the physical skills of learning, work together to provide the spatial orientation that allows for flexibility of attention in three directional fields: up-and-down, forward-and-back, and left-and-right.[11] They also support the physical mechanics involved in the three main areas of function:

1. Organization/up-and-down ~ (Energy Exercises) to center and align; for planning, creating order, and lining things up. (Deepening Attitudes) to relax, calm, and physically or emotionally stabilize; for sharing, playing, cooperating, and sensory memory

2. Focus/forward-and-back ~ (The Lengthening Activities) to release held tension and enable action; for focusing, understanding, expressing oneself, and taking initiative

3. Communication/left-and-right ~ (The Midline Movements) to encourage sensorimotor coordination; information processing necessary for reading, writing, listening, and speaking

Organization/up-and-down	**Focus/forward-and-back**	**Communication/left-and-right**
The Energy Exercises ✧ Sipping Water ✧ The Energy Yawn ✧ The Thinking Cap ✧ Space Buttons ✧ Earth Buttons ✧ Brain Buttons ✧ Balance Buttons Deepening Attitudes ✧ The Positive Points ✧ Hook-ups (Part I & Part II)	The Lengthening Activities ✧ The Owl ✧ Arm Activation ✧ The Footflex ✧ The Gravity Glider ✧ The Calf Pump ✧ The Grounder	Midline Movements ✧ The Elephant ✧ Think of an X ✧ Neck Rolls ✧ The Double Doodle ✧ Alphabet 8s ✧ Belly Breathing ✧ The Cross Crawl ✧ Cross Crawl Sit-ups ✧ Lazy 8s ✧ The Rocker ✧ The Energizer

In this study, we have chosen 5 movement as intervention. They are "Sipping Water", "Brain Buttons", "The Cross Crawl" and "Hook-ups" that normally called the PACE process and "The Thinking Cap".

Objective, Subjects and Methods

Aiming at studying the relationship between Brain Gym® and cognitive functions of seniors, the Hong Kong Sheng Kung Hui Welfare Council conducted a pilot study from December, 2009 to Feburary, 2010. We recruited members in five elderly services units. Subjects aged ≥60 years were invited by social workers, occupational therapists for participation in the study. We assessed the cognitive functions using the Hong Kong Montreal Cognitive Assessment (HK-MoCA).[12] The HK-MoCA evaluates seven cognitive domains including visuospatial/executive functions, naming, verbal memory, attention, abstraction and orientation. It has been studied in local elderly stroke patients and is found to have good validity and reliability.[12] We also assessed depressive symptoms with the validated Chinese version of the 4-item Geriatric Depression Scale.[13]

Participants were assessed at baseline and were then assigned to the control group or the intervention group. Those in the intervention group received the Brain Gym 5-style training in at least 3 times a week for four weeks. Controls subjects did not receive any cognitive intervention during the study period. The HK-MoCA and GDS were repeated the end of study period to assess the effect of the Brain Gym training on cognition and mood. Informed consent was obtained from all subjects for study participation.

Statistical analysis

Data are compared between control and intervention groups using c^2 or independent sample t tests as appropriate. We also compared group difference on the HK-MoCA total score at baseline and follow-up using analysis of covariance adjusting for age, sex and year of education. As scores on the GDS were not normally distributed, the Mann-Whitey U test was used.

We calculated changes in the total and seven domain subscores of the HK-MoCA and on the GDS total score by subtracting the baseline score from the follow-up score. For HK-MoCA, changes were further classified as *declined or no change* for change score ≤0, and as *improved* for change score of >0. For GDS, changes were classified as *declined or no change* for change score of ≥0, and as *improved* for change score <0. To assess efficacy of the Brain Gym intervention upon cognition and depressive symptoms, we used the ^{2} test to compare the proportion of change in total and domain subscores of the HK-MoCA and in GDS between the two subject groups. Furthermore, we used binomial logistic regression model to determine the effect of group upon changes in HK-MoCA total and domain scores while adjusting for age, sex, education and baseline HK-MoCA and GDS scores.

Results

One-hundred and twenty subjects participated in the study. Seventy and 50 subjects were assigned to the control and intervention groups, respectively. There were no differences in age, sex and education between the two groups as shown in table 1. The control group had significantly higher scores on the HK-MoCA at baseline and follow-up. Scores on GDS did not differ between the two groups at both time points (table 2).

Table 1. Comparison of demographic features

	Control	Intervention	*p*
N	70	50	
Age	74.4 (7.0)	75.5 (7.4)	0.417
Female	59 (84.3%)	44 (88.0%)	0.565
Education in year	3.5 (5.0)	3.0 (5.0)	0.094

Age presented as mean (SD) and compared using independent sample t test

Sex presented as n(%) and compared using c2 test

Table 2. Comparison of HK-MoCA and GDS

	Control	Intervention	*p*
HK-MoCA total baseline	19.3 (4.7)	15.3 (5.7)	<0.001
HK-MoCA total follow-up	20.8 (4.4)	17.0 (6.2)	<0.001
GDS baseline	5.0 (7.0)	6.0 (6.0)	0.375
GDS follow-up	5.0 (7.0)	6.0 (5.0)	0.155

HK-MoCA presented as mean (SD) and compared using ANCOVA adjusted for age, sex and years of education

GDS presented as median (interquartile range) and compared using Mann-Whitney U test

There were no significant differences in the proportion of changes in the HK-MoCA total score or the GDS between the two groups. However, there was a significantly higher proportion of subjects in the intervention group having improved relative to the control group in the attention domain in the HK-MoCA (p=0.004). Multivariate logistic regression controlling for age, sex, education and baseline HK-MoCA and GDS scores showed that intervention is significantly associated with improvement in the HK-MoCA attention domain (Odds Ratio=2.46; 95% Confidence Interval 1.04-5.82, p=.04).

Discussion

Our study showed that the Brain Gym 5-style intervention exerts positive effect on cognitive functions in community-dwelling elderly persons. It appears to be particularly beneficial to attention. The attention domain in the HK-MoCA contains items evaluating verbal sustained attention, working memory and vigilance, which are basic abilities for everyday functions and responsible for consolidation of memory for long-term storage.(Baddely, 1986) Although we did not find benefits towards delayed verbal memory performance in the HK-MoCA, we hypothesize that, with a longer training duration improvement in memory secondary to better attention may be observed.

In conclusion, the Brain-Gym 5-style intervention (i.e. Sipping Water, Brain Button, Cross Crawl, Hook-Ups and the Thinking Cap) exerts beneficial effects in attention in community-dwelling elderly persons. It is also well accepted in this population.

Reference

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