

Cognitive effects of calligraphy therapy for older people: a randomized controlled trial in Hong Kong

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Background: This pilot study investigated the effects of calligraphy therapy on cognitive function in older Hong Kong Chinese people with mild cognitive impairment.

Methods: A single-blind, randomized controlled trial was carried out in a sample of 31 adults aged 65 years or older with mild cognitive impairment. They were randomly assigned to receive either intensive calligraphy training led by a trained research assistant for eight weeks (calligraphy group, $n = 14$) or no calligraphy treatment (control group, $n = 17$). Participants' cognitive function was assessed by the Chinese version of the Mini-Mental State Examination (CMMSE) before and after calligraphy treatment. Repeated measures analysis of variance and paired samples t -tests were used to analyze the data.

Results: A significant interaction effect of time and intervention was detected [$F(1, 29) = 9.11$, $P = 0.005$, $\eta^2 = 0.24$]. The calligraphy group was found to have a prominent increase in CMMSE global score, and scores in the cognitive areas of orientation, attention, and calculation after two months ($\Delta M = 2.36$, $P < 0.01$), whereas their counterparts in the control group experienced a decline in CMMSE score ($\Delta M = -0.41$, $P < 0.05$).

Conclusion: Calligraphy therapy was effective for enhancing cognitive function in older people with mild cognitive impairment and should be incorporated as part of routine programs in both community and residential care settings.

Keywords: calligraphy therapy, Chinese elderly, mild cognitive impairment, cognitive function, randomized controlled trial

Introduction

Chinese calligraphic handwriting requires integration of mind, body, and character in an interwoven dynamic process. It involves visual perception of the characters, spatial structuring of the characters, cognitive planning, and maneuvering of the brush to follow specific character configurations.¹

Empirical studies of Chinese calligraphy have focused mainly on how to execute and appreciate this activity artistically by following the instructions of calligraphers.^{2,3} Recently, growing clinical research on calligraphy handwriting has found that calligraphy used as therapy may improve behavioral and psychosomatic disorders,^{4,5} and have a therapeutic effect on hypertension and other diseases, such as type 2 diabetes.^{6,7} It is further argued that the act of calligraphic writing may train people's attention and concentration and result in relaxation and emotional stabilization.⁸ For instance, calligraphy has been found to have successfully enhanced spatial ability, visual attention, and picture memory in people with Alzheimer's disease.⁹⁻¹⁴ Similarly, it has been found that intellectual leisure activities in later life, including calligraphy, may delay cognitive deterioration.¹⁵

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Cognitive deterioration is one of the commonest complaints of normal aging,¹⁶ the prevalence increases with age.¹⁷ Because mild cognitive impairment may lead to a sense of frustration, a lower level of life satisfaction, or even dementia,¹⁸ effective nonpharmacological interventions need to be found to optimize cognitive function in older people with mild cognitive impairment and to delay cognitive deterioration.¹⁹

Based on the fact that the efficacy of drug treatment for dementia, including medication, is usually short-lived, not guaranteed for all users, and may impose a significant financial burden on patients,²⁰ and calligraphy seems to have the potential to prevent cognitive deterioration, we initiated a randomized controlled pilot trial to examine the cognitive effects of calligraphy therapy in older Hong Kong Chinese people with mild cognitive impairment to see whether it should be considered as one of the useful nondrug training modalities to protect against dementia and be incorporated as part of routine programs in both community and residential care settings in Hong Kong.

Materials and methods

Participants

Thirty-one older Chinese people were recruited from the Kwong Yum Home for the Aged, which was established in 1979 and specializes in high-quality care for the frail elderly in Hong Kong. Inclusion criteria were age 70 years or above, a Chinese version of the Mini-Mental State Examination (CMMSE) score 20–25, and absence of blindness, aphasia, or relevant behavioral disturbance. Participants were randomly assigned to a calligraphy group ($n = 14$) or to a control group ($n = 17$). Written informed consent was obtained from all participants. This study was ethically approved by the Chinese University of Hong Kong.

Design

This was a single-blind randomized controlled trial in which the cognitive function of participants was assessed by the CMMSE before and after training in Chinese calligraphic handwriting. The participants in the control group did not receive any training during the study period. The participants in the calligraphy group, in contrast, practised Chinese calligraphy in a quiet room led by a trained research assistant. Each session of calligraphic writing lasted about 30 minutes, with one session per day, five times per week, for eight consecutive weeks. The Chinese calligraphy

character content was chosen randomly from a handbook of calligraphy writing. Calligraphic writing involves “brush handwriting by tracing the strokes and structures of the characters displayed in a mixture of traditional calligraphic styles.”²¹

CMMSE scale

In this study, the general cognitive status of the participants was measured by the CMMSE, an instrument used widely for assessing cognitive performance in both the research and clinical settings.²² The CMMSE can be generally divided into two sections, ie, one section that covers orientation (including time and place), memory (immediate and delayed recall), and attention and calculation (100 minus 7, then minus 7, five times), and a second section that covers language, testing the ability to name objects, follow commands, and copy two interwoven polygons. In addition, the CMMSE scale has good psychometric properties when applied to the Hong Kong Chinese population, with satisfactory internal consistency (Cronbach's alpha 0.86), test-retest reliability (alpha 0.78), and interrater reliability (intraclass correlation 0.99). The clinical cutoff score for diagnosis of dementia is 19/20,²³ and a score ≤ 25 was found to be the optimal cutoff point for detection of mild cognitive impairment.²⁴ Thus, older people with a CMMSE score of 20–25 were recruited as participants with mild cognitive impairment in this study.

Statistical analysis

Data analyses were carried out using the Statistical Package for Social Sciences version 15 (SPSS Inc, Chicago, IL). Independent samples *t*-tests (and Chi-square when appropriate) were used to compare demographic and pharmacological variables between the control and intervention groups at baseline. Two-way repeated measures analysis of variance was used to evaluate the cognitive measure, with time being the within-group factor and control/intervention as the between-groups measure. Paired samples *t*-tests were further conducted to compare before and after scores in six subdimensions of the CMMSE for the control and intervention groups, respectively.

Results

Table 1 summarizes the baseline demographics of the study participants. Results of independent samples *t*-tests and Chi-square tests show that there were no significant differences between the control and calligraphy groups in terms

Table 1 Demographics and baseline measures by group

	Control Group (N = 17)	Calligraphy Group (N = 14)	P*
Age (M, SD)	85.76(6.93)	85.79(4.93)	0.99
Gender			0.77
Male	1(6.3%)	5(35.7%)	
Female	15(93.8%)	9(64.3%)	
Education			0.95
No formal education	8(47.1%)	7(50.0%)	
Below or at primary level	7(41.2%)	5(35.7%)	
Secondary or above	2(11.8%)	2(14.3%)	
CDRS (M, SD)			
Total	104.53(15.18)	108.36(12.89)	0.46
Attention	32.35(3.53)	33.64(3.00)	0.29
Initiation/preservation	24.29(5.80)	26.93(6.64)	0.25
Construction	4.76(1.48)	5.50(1.12)	0.14
Conceptualization	24.82(4.93)	24.57(4.72)	0.89
Memory	18.29(4.62)	17.71(3.27)	0.70
CMMSE (M, SD)			
Total	22.88(3.28)	22.71(1.86)	0.87
Orientation	8.53(1.55)	7.79(1.42)	0.18
Memory	4.94(0.90)	4.86(0.95)	0.80
Attention and calculation	1.71(1.76)	2.21(1.89)	0.45
Language	7.71(0.99)	7.86(1.10)	0.69

Abbreviations: CDRS, Chinese version of Mattis Dementia Rating Scale; CMMSE, Chinese version of the Mini-Mental State Examination; M, mean; SD, standard deviation.

of their age ($P = 0.992$), gender ($P = 0.072$), and education ($P = 0.946$). No significant difference was detected between the two groups in their cognitive performance, as measured either by the Chinese version of Mattis Dementia Rating Scale (CDRS) or the CMMSE.

Results of repeated measures analysis of variance showed a significant main effect of time on improving the CMMSE score [$F(1, 29) = 4.50, P = 0.04, \eta^2 = 0.13$], but no significant main effect of intervention [$F(1, 29) = 1.31, P = 0.26, \eta^2 = 0.04$]. The interaction effect of time and calligraphy training was significant [$F(1, 29) = 9.11, P = 0.005, \eta^2 = 0.24$, see Table 2].

Table 2 Repeated measures analysis of variance

Effect	Mean square	df	F	P	η^2
Time	14.53	1	4.5	0.04	0.13
Error (time)	3.23	29			
Intervention	22.72	1	1.31	0.26	0.04
Error (intervention)	17.3	29			
Time* Intervention	29.43	1	9.11	0.01	0.24

Note: *refers to interaction effect.

In addition, paired samples t -tests revealed that there was a decline in cognitive performance in general for the control group ($\Delta M = -0.41, P < 0.05$), but significant improvement for the calligraphy group ($\Delta M = 2.36, P < 0.01$). With regard to the four specific domains, namely, orientation (including time and place), memory (including immediate and delayed recall), attention and calculation, and language, a significant decline was observed in orientation for the control group ($\Delta M = -0.88, P < 0.01$) while a significant improvement was detected in the same area for the calligraphy group ($\Delta M = 1.21, P < 0.05$). Moreover, there was no change in memory and language and a positive but insignificant change in attention and calculation for the control group; in contrast, in addition to orientation, participants in the calligraphy group also had training gains in the other three cognitive areas, namely memory ($\Delta M = 0.43$), attention and calculation ($\Delta M = 0.43$), and language ($\Delta M = 0.14$), although these positive changes were not statistically significant (see Table 3).

Discussion

This study, designed as a single-blind randomized controlled trial, examined the cognitive effects of calligraphy therapy in a sample of older Hong Kong Chinese people. Our results confirm that calligraphy was effective in improving cognitive abilities in older people who received intensive training in Chinese calligraphic writing, who were found to have a marked increase in the global CMMSE score after two months, whereas their counterparts in the control group experienced a decline in CMMSE score. This finding is encouraging

Table 3 Cognitive enhancement (paired samples t -test) by control/calligraphy group

CMMSE	Control group		Calligraphy group	
	Pretest mean (S.D.)	Post-test mean (S.D.) Δ (S.D.)	Pretest mean (S.D.)	Post-test mean (S.D.) Δ (S.D.)
Total	22.88(3.28)	22.47(3.99)* -0.41(2.50)	22.71(1.86)	25.07(3.10)* 2.36(2.59)
Orientation	8.53(1.55)	7.65(2.00)** -0.88(1.17)	7.79(1.42)	9.00(1.04)* 1.21(1.58)
Memory	4.94(0.90)	4.94(1.03) 0.00(1.06)	4.86(0.95)	5.29(0.91) 0.43(1.22)
Attention and calculation	1.71(1.76)	2.06(1.52) 0.35(1.46)	2.21(1.89)	2.64(1.34)^ 0.43(1.02)
Language	7.71(0.99)	7.71(0.99) 0.00(1.37)	7.86(1.10)	8.00(1.04) 0.14(1.23)

Notes: ** $P < 0.01$; * $P < 0.05$; ^ $P < 0.1$.

for elders who are vulnerable to cognitive decline and have sufficient spare time to practice calligraphic writing.

When the pretest and post-test means of the CMMSE subdimensions were compared, the control group suffered a decline in orientation, showed no change in memory and language, and only a slight and insignificant improvement in attention and calculation. In contrast, the calligraphy group showed a significant improvement in orientation and a significant improvement in attention and calculation. Their scores also slightly increased in the domains of memory and language in the post-test, although the increase was not statistically significant, which was probably because of the small sample size.

The improvement identified for orientation in time and place during this study lends support to the view that calligraphy therapy is able to enhance spatial ability and sense of control.^{9,10} The resulting improvement in reality orientation via calligraphy treatment has been found to help elders by halting confusion, disorientation, social withdrawal, and apathy.¹⁹ This activity may help seniors to become more alert and sensitive to their environment, enabling them to remain cognitively fit for a longer period of time. Thus, as a nonpharmacological approach to protect against cognitive decline in elders with mild cognitive impairment, Chinese calligraphic writing should be incorporated as part of routine programs in both community and residential care settings.

Despite these encouraging findings, there are several limitations that should be addressed. First, this was only a pilot study with a small sample size, so we should be cautious about generalizing the findings to the entire older Hong Kong population. Another limitation is that there was only one outcome measurement, namely CMMSE, which prevents us from being able to investigate the broader effects of Chinese calligraphy handwriting in older people with mild cognitive impairment in a more definitive manner. A large-scale study following this pilot trial with a more detailed design is pending to address these limitations.

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Disclosure

The authors report no conflicts of interest in this work.

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