



Chinese Calligraphy Handwriting (CCH) by Finger Writing for Treatment of Stroke, Coma and Alzheimer's Conditions

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Abstract

The present system relates to treating the health condition of a user. The method includes determining a sensory signal for use to treat the user's health conditions. The core of the system involves using the user's finger as the writing instrument to perform the tasks of writing or graphic drawing for the purpose of enhancing general health of the practitioner, treating specific conditions of diseases as well as rehabilitating the user's specific conditions of psychosomatic, neuropsychiatric and geriatric disorders.

Background

Chinese calligraphy, a traditional Chinese art with a history of several thousand years, is practiced by millions of people in Asia and internationally. Psychological research in the past 40 years has established Chinese calligraphy being capable of achieving, during its execution, emotional stabilization, mental relaxation, and physiological slowdown from the physical perspectives. From the cognitive perspective, research has confirmed that Chinese calligraphy causes positive impacts on heightened attention and concentration, enhanced problem-solving capabilities and spatial abilities, improved spatial and abstract reasoning, shortened response time, and improved short-term memory [1-3]. For the general population, it can also enhance the general health condition of the practitioners.

Biofeedback training refers to clinical training procedures used to modify a user's physiological responses or patterns of such responses that aim to achieve self-regulation of maladaptive responses and disordered states. The procedures enable the user

to control a certain specified physiological process by providing an external or verbal cue or a monitor to indicate the activity and associated physiological processes. Our Chinese Calligraphy Handwriting (CCH) in general or by finger writing is biofeedback-based treatment within behavioral medicine, which has contributed to the therapy and rehabilitation of health-related disorders over the years. When applied to users without health disorders, biofeedback can enhance self-regulation of bodily processes to thereby improve general health, as the generation of specific patterns of brain waves in the practice of meditation. Therefore, biofeedback training with finger writing offers an effective process of treating illnesses as well as enhancing the health of the users under a system of feedback regulation of bodily states.

Following these principles, we have studied CCH training for several psychosomatic, behavioral, cognitive and physical disorders, such as hypertension, diabetes, emotional and mental disorders, attention deficit hyperactivity disorder, autism spectrum disorder,

post-traumatic stress disorder, and linguistic disorders, for health improvement, clinical intervention, and rehabilitative intervention. In fact, we have applied this treatment system successfully in the above areas. We have conducted the first studies in strokes, coma and vegetated patients with the CCH finger writing by our team.

There is growing support for cognitive-linguistic therapies for people with language deficits after stroke, such as visual-spatial rehabilitant for deficits associated with right hemisphere stroke in favor of the alternative conditions with cognitive rehabilitation. [1] We introduce in this application, a unique, innovative and culture-based calligraphy finger writing as an effective system of cognitive neural therapy and rehabilitation for stroke and coma patients. It is gratifying that this successful clinical intervention and technical development for this treatment has been achieved through the efforts of our team.

The Finger Handwriting

This finger writing act involves the visual-spatial relations and the numerous ingredients of Chinese characters that directly connect and promote connections of cranial nerves. Stimulation of the cerebrum should be able to strengthen the patient's cognitive activities of visual-spatial relations, combination, variation, shape differences, and so forth. Early research discovered that Chinese character writing activates brain cognition, which may be related to the functional plasticity of human cerebral cortex. When processing the visual-spatial configurations of Chinese character forms at writer's cortical level, the writing activity constitutes the reproduction, restoration, and the processing of visual perception processing [4].

The CCH Treatment of the Stroke Patients

CCH involves visual perception of the character, spatial structuring of the character, cognitive planning, and maneuvering of the brush to follow specific character configurations. It can improve people's behavioral, psychosomatic as well as clinical conditions. These include attention and concentration, physical relaxation and emotional stabilization. Successful treatments with this intervention have been obtained with patients of strokes, coma and vegetated state. There were reported significant improvements in palm strength of the affected hand and quicker response time in the stroke patient's fine motor coordination tasks, along with heightened attention and alertness [5-8].

The Cognitive-neural Foundations on Finger Writing

We have identified several previous studies that offer the cortical foundations for the practice of visual-tactile feedback in the finger writing treatment for stroke recovery.

a) Studies of some individuals in whom the inter-cortical pathways were sectioned with the objective of controlling convulsions showed that the cortical association neurons

connecting the two sides of the brain have a significant role in determining the patient's responses to visual, auditory, and tactile stimuli, with each channel being similarly affected by the task operations concerned [9-12]. Extensive destruction of most of the neural connections between the two cerebral cortices produces either no diminution or at least an inconsistent diminution - of the patients' ability to transfer motor habits learned on the preferred side to the opposite side of the body. [13] This implies that the use of one hand to perform a writing task would not hinder the reactive and physical learning mechanism of the cortex by the fingering act.

b) Recent neuroimaging research has focused on CCH and the associated brain activation. [14] Valid resting-state functional magnetic resonance imaging (fMRI) data were collected from the CCH and control participants. The CCH individuals showed better neural functions of Updating and Inhibition, but the two groups did not differ in Shifting. The CCH group also showed stronger Resting-State Functional Connectivity (RSFC) than the control group in the brain areas involved in updating and inhibition. These results suggested that long-term CCH training may be associated with improvements in specific aspects of the executive functions and the strengthened neural networks in related brain regions. This means that finger-writing would also facilitate this functional effectiveness of the brain as compared with that observed in the brush CCH training.

c) Some recent research has confirmed the neuroplasticity involved in the handwriting act. Specific findings have shown that white matter and grey matter changes occur accordingly after handwriting acts have been performed. [15-19] Previous studies discovered that the cingulate cortex is involved in the process of visual stimuli, pre-motor planning and memory, which are vital in the CCH training. As the CCH participants all started the exercise at a very young age, this may have promoted the efficiency of neurons in the cingulate gyrus. A smaller cortical gray matter (CGV) in the CCH groups suggested that long-term CCH practice may reshape the brain structure by increasing the efficiency of the neural activity. An application of fingering writing as a writing task would be expected to produce and enrich similar cortical change derived from these studies on neuroplasticity.

These studies reviewed above offer an excellent foundation for designing a unique system of finger writing treatment for patients of coma, vegetated states, and stroke, including a case where the patient awakened from severe brain damage. Central to this system is the involvement of the tactile and motion feedback in addition to usual channels of sensory feedback. A single case of a vegetated stroke patient using finger writing with tactile and motion feedback was successfully completed from our system of treatment system. This effort constitutes the core of our confidence in forecasting calligraphic finger writing training as an effective system of rehabilitation. The findings from this clinical intervention constitute

the basis of the present patent application. The full details of this clinical treatment in awakening a coma patient from a severe stroke are attached for reference. This finding has been published in the *Journal Neuropsychiatric Disease & Treatment* in early 2018.

Highlights of the CCH Finger Treatment System

The present system relates to a method for treating a health or clinical condition of a patient of coma, stroke or vegetated state, and Alzheimer's Disease. It comprises determining a sensory feedback signal for use to treat the health condition. The method also comprises measuring the change to the sensory signal while the user is engaging in a writing task. The change of the sensory signal can be used as a biofeedback to regulate the user's activity

and thereby to treat the user's health condition.

According to one aspect of the system, the sensory signal can be measured when the user is engaging in a graphic production. The graphic production can be made based on a predetermined graphic element such as the Chinese characters or graphic items. The system comprises the writing action by a finger of the user, wherein the movement of the finger is aided by hand by one or more caregivers. The present system can be used with or without the application of a sensory feedback signal in accordance with the health or clinical condition to be treated. The act of the finger writing system comprises using a writing material on a template, a flat surface or in 3D open air gesturing, by the caregiver, through an act of tracing the strokes of the character.



Figure 1: shows samples of finger writing materials, which can be usual Chinese characters, English letter forms, ancient visual forms or special designed forms, etc. It also shows the finger writing practice.



Figure 2: shows an embodiment of the writing system formed according to the principles of finger writing tool. It includes the writing template, the finger writing characters. The depths of the grooved character strokes can be determined according to the health condition of the patient. The act of treatment involves the process of showing the character which is followed by the tracing act of the patient as assisted by the trainer or caregiver.

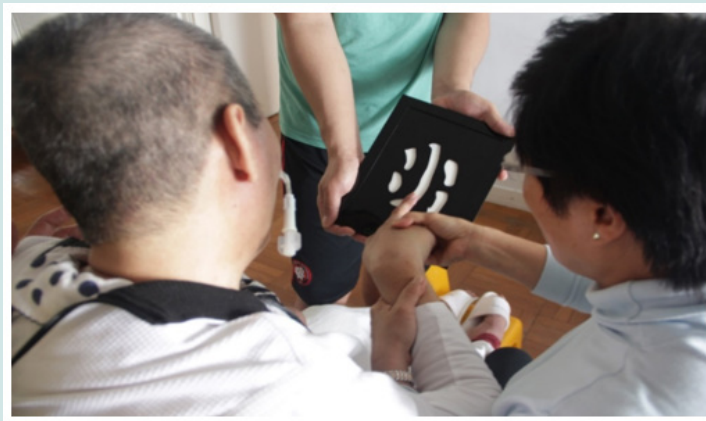


Figure 3: shows another embodiment of the treatment system with the writing character embedded onto a plastic board wherein the stroke of the character contains grooved strokes. The patient is helped by caregivers for positioning his body upright, movement of his finger through the stroke grooves as well as showing him the characters before his eyes for viewing purposes before the task action.



Figure 4: Explaining the CCH finger writing treatment details to an Alzheimer’s patient

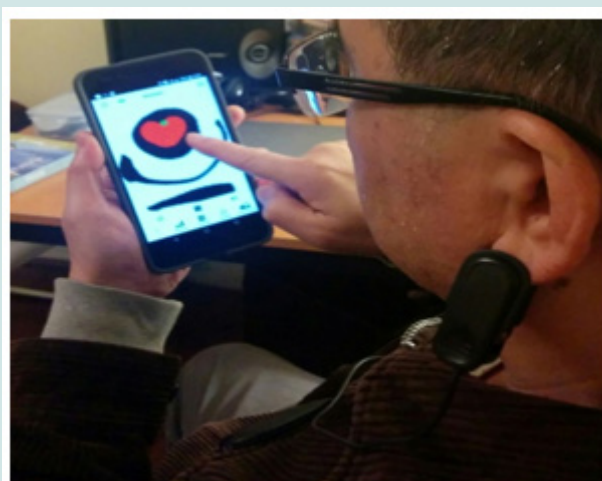


Figure 5: A popular option of HCC finger writing treatment is to use a smart mobile phone such as an iPhone. We have run several studies with this system. This model integrates well with the adoption of biofeedback mechanism embedded into the treatment protocol.

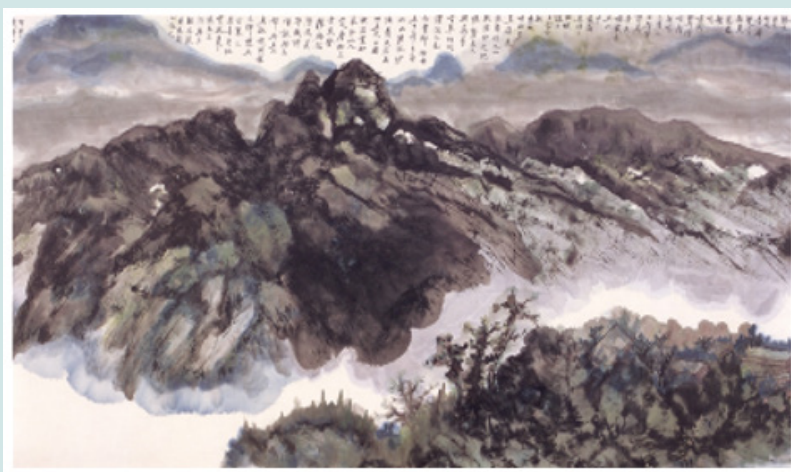


Figure 6: A clinical case reporting the success of self-recovering through continued brush calligraphy training by an elderly calligrapher after stroke. The landscape painting was completed four months after the stroke causing the loss of his right-hand control and perceptual disability. The calligrapher was able to perform fine motor control to write a mini-sized essay describing the mountain scenes drawn. Three months later, the elderly calligrapher, Prof. Jao Tsung-I, a well-known sinologist and esteemed scholar of Chinese classics and history, wrote a Chinese essay with his righthand, which is shown at the top of the above painting.

References

- Saper CB (2013) Waking Up from Coma: New Treatments, New Hope. Report on Progress. The Dana Alliance for Brain Initiatives.
- Kao HSR (2006) Chinese calligraphic handwriting (CCH): a science for health and behavioral therapy. *International Journal of Psychology* 41(4): 282-286.
- Kao HSR (2010) Calligraphy therapy: A complementary approach to psychotherapy, *Asia Pacific Journal of Counselling and Psychotherapy* 1(1): 55-66.
- Kao HSR (1999) Psycho-geometric Principles of Chinese Character Writing. In G Leedham, M Leung, V Sagar, X-H Xiao (Eds.). *Proceedings of the 9th Biennial Conference of the International Graphonomics Society* pp: 107-110.
- Xu M, Kao HSR, Zhang M, Lam SPW, Wang W et al., (2013) Cognitive-Neural Effects of Brush Writing of Chinese Characters: Cortical Excitation of Theta Rhythm. *Evidence-Based Complementary and Alternative Medicine*.
- Chiu ML, Kao HSR, Ho SMY (2002) The efficacy of Chinese calligraphic handwriting on stroke patients: A multiple cases study. *Proceedings of the Second International Congress on Vascular Dementia, Salzburg, Austria* 207-212.
- Smith KU (1947) The functions of the intercortical neurons in sensorimotor coordination and thinking in man. *Science* 105(2722): 234-235.
- Smith KU (1951) Learning and the associative pathways of the human cerebral cortex. *Science* 114(2953): 117-120.
- Chen W, He Y, Gao Y, Zhang C, Chen Cet al., (2017) Long-term experience of Chinese calligraphic handwriting is associated with better executive functions and stronger resting-state functional connectivity in related brain regions. *PLoS ONE* 12(1): e0170660.
- Plantona S, Juclac M, Rouxa FE, Démonetd JF (2013) The "handwriting brain": A meta-analysis of neuroimaging studies of motor versus orthographic processes. *Cortex* 49(10): 277-287.
- Cao F, Vu M, Chan DHL, Lawrence JM, Harris LN et al., (2013) Writing affects the brain network of reading in Chinese: A functional magnetic resonance imaging study. *Human Brain Mapping* 34(7): 1670-1684.
- Gimenez P, Bugescu N, Black JM, Hancock R, Pugh K et al., (2014) Neuroimaging correlates of handwriting quality as children learn to read and write. *Front. Hum. Neurosci* 19(8): 155.
- Richards TL, Grabowski TJ, Boord P, Yagle K, Askren M et al., (2015) Contrasting brain patterns of writing-related DTI parameters, fMRI connectivity, and DTI-fMRI connectivity correlations in children with and without dysgraphia or dyslexia. *Neuroimage Clin* 28(8): 408-421.
- Yuan Y, Brown S (2015) Drawing and writing: an ALE meta-analysis of sensorimotor activations. *Brain Cogn* 98: 15-26.
- Cao F, Perfetti CA (2016) Neural signatures of the reading-writing connection: Greater involvement of writing in Chinese reading than English reading. *PLoS ONE* 11(12): e0168414.
- Planton S, Longcamp M, Péran P, Démonet JF, Jucla M et al., (2017) How specialized are writing-specific brain regions? An fMRI study of writing, drawing and oral spelling. *Cortex* 88: 66-80.
- Kao HSR, Lam SPW, Kao TT, Chan A, KW Chinese et al., (2018) Calligraphy Handwriting (CCH): A Case of Rehabilitative Awakening of a Coma Patient after Stroke. 2018. *Neuropsychiatric Disease and Treatment* 14: 407-417.
- Kao HSR, Goan CH (2002) Brush writing instruments for health & therapy. US Patent.
- Kao HSR, Goan CH (2005) Method on & system for health treatment. US Patent.



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