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Submitting author: Ms Nar Chi, Nerita Chan

Post title: Senior Physiotherapist, Tuen Mun Hospital, NULL

The Application of Upper Limbs Motion Analysis in Chinese Calligraphy for Rehabilitation

Chow YY(1), Chan NC(2), Lao LM(2), Szeto G(3), Poon YH(2)

(1) Department of Orthopaedics and Traumatology, NTWC (2) Department of Physiotherapy, TMH (3) Department of Rehabilitation Sciences, The Hong Kong Polytechnic University

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Introduction

It has long been recognised that practising brush writing in Chinese Calligraphy promotes the sense of wellbeing in both psychological and physical aspects. Based on International Classification of Functioning, Disability and Health (ICF), we emphasise the participation of life in rehabilitation. It is believed that Chinese Calligraphy can be used in rehabilitation to facilitate the recovery of physical conditions and help promoting the spiritual health.

Objectives

To use the 3D upper limb motion analysis to develop a systematic and reproducible measure for the integrated motion in brush writing.

Methodology

An experienced Chinese Calligrapher was invited to perform the tests. The same Chinese character “永” was written in different styles, the 篆書 Seal script (SS), 楷書 Regular script (RS), 隸書 Clerical script (CS), 行書 Running script (RuS) and 草書 Cursive script (CuS). The Vicon Mx40® and Aurion® were used for kinematics and surface electromyography (EMG) analysis. Sixteen electrodes were used to measure the selected muscles on neck, abdominal, shoulder, elbow and wrist regions. Force plate by Advanced Mechanical Technology Inc. was used to measure the shifting of centre of gravity (CoG). The size of word, position of body to table and feet placement position were standardized. Trajectories of markers and EMG signal while writing was measured in a synchronized setting.

Result

The abdominals had the highest percentage of work in all scripts while writing, which illustrated the importance of core and breathing control. Shoulder girdle stabilisers showed higher average activities than the other muscles and this illustrated the

importance of shoulder stability. More wrist motion was recorded while writing RuS and CuS matched with the expert opinion that a flowing motion of the brush is needed for these scripts. Lastly, the CoG of the body had minimal movement which illustrated the importance of base of support and the stability of whole body.

Conclusion: The 3D motion analysis and the EMG system are able to measure and analyse the complex integrated motion in brush writing. Brush writing seems to be a good exercise mode for the core control and girdle stabilization due to the extensive work on abdominals and shoulder muscles. This method can be used in further studies as the outcome measure to document the changes of movement and muscle control in patients after practising Chinese Calligraphy.