Effect of Mirror Therapy on Human Primary Motor Cortex Function in Motor Learning

Ippei NOJIMA, PT, MS
Department of Rehabilitation, Nishieigashima Hospital

Ippei NOJIMA, PT, MS, Toshio KAWAMATA, MD
Kobe University Graduate School of Health Science

Tatsuya MIMA, MD
Human Brain Research Center, Kyoto University Graduate School of Medicine

Purpose: The purpose of this study was to test whether the plasticity changes of the primary motor cortex (M1), which has been proposed as a neural basis of motor learning, was induced by mirror therapy.

Methods: We investigated by using transcranial magnetic stimulation (TMS) in 12 neurologically healthy subjects. Each subject was asked to rotate two cork-balls in a counter-clockwise direction with non-dominant hand as fast and accuracy as possible and the number of ball-rotation was counted for 30 seconds. After measuring the motor behavior and TMS (Pre), subjects practiced Motor-training intervention of the right hand with mirror visual feedback (MVF) superimposed on the left hand using a mirror box (Post1). Furthermore, the beneficial effects of MVF were disrupted by the continuous theta burst stimulation (cTBS), which is a procedure to suppress local cortical function, over M1 and the occipital cortex (OC) (Post2). Subjects were randomly assigned with the M1 (n=8) and OC group (n=8) by the site where cTBS was applied. Finally, both groups performed another set of mirror therapy intervention (Post3).

Results: Mirror therapy significantly improved the motor behavior and increased the excitability in M1. In addition, the motor behavior and cortical excitability were transiently suppressed by cTBS in M1 group but not in OC group. However, subsequent mirror therapy following cTBS could improve the motor behavior and cortical excitability, again.

Conclusion: These results have suggested that the cause-effect link between the M1 activity and behavioral improvement in MVF-induced motor learning.