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学位論文題目

The effect of Bilateral Finger Training (BFT) paired with
Artificial Neural Stimulation (ANS) on motor cortex plasticity

リハビリテーション治療学分野

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【Introduction】

Upper arm paresis is the most common disability in stroke. The quality of life (QOL) of stroke survivors is associated with the level of ability to perform ADL. Bilateral motor training is a useful method to modify the excitability of the primary motor cortex (M1). Severe upper arm paresis limits voluntary bilateral training. Therefore, it is important to investigate rehabilitation protocols which can move severely paralysed arm artificially. The effects of artificial bilateral movement on M1 excitability through functional electrical stimulation or transcranial magnetic stimulation (TMS) have not been compared with voluntary bilateral training. Therefore, we compared motor-evoked potentials (MEPs) following TMS over the M1 of voluntary movements after voluntary bilateral motor training and repetitive artificial bilateral movements generated through peripheral nerve stimulation and TMS.

【Methods】

Surface electromyograms of the abductor pollicis brevis (APB) muscles were recorded bilaterally in 12 healthy participants. Three sessions with different interventions were conducted: (1) bilateral finger training (BFT) involving bilateral thumb abduction, (2) right APB-triggered TMS of the ipsilateral M1 (i-TMS), and (3) right APB-triggered contralateral median nerve stimulation (c-MNS). Each protocol consisted of 360 trials for ~30 min. Resting motor threshold (RMT), MEPs induced by single-pulse TMS, short-interval intracortical inhibition (SICI), and intracortical facilitation (ICF) induced by paired-pulse TMS were assessed as outcome measures at baseline and at 0, 20, 40, and 60 min after intervention.

【Results】

RMT showed no significant change with time course when compared to the baseline. The MEP amplitude significantly increased at the post-intervention periods in comparison to the baseline in all three protocols. The MEP amplitude was significantly increased in BFT and in APB-triggered i-TMS protocols, at post 0, 20 and 40 minutes and in APB triggered c-MNS at post 20, 40 minutes. No significant effect of intervention on baseline MEP. SICI was significantly decreased at 0 min post-intervention in the BFT and APB-triggered i-TMS. ICF was significantly increased at 0 min post-intervention in the BFT and at 20 min post-intervention in the APB-triggered c-MNS.

【Discussion】

The main finding of the present study was the long-lasting increase in MEP amplitude in all three bilateral movement protocols.

【Conclusion】

Thus, whether voluntarily or artificially caused, repetitive bilateral movements enhance corticospinal excitability.

Keywords

bilateral training, transcranial magnetic stimulation, functional electrical stimulation, neuroplasticity