The electrophysiological underpinnings of tactile improvement transferring from one hand to another

Malika Azaroual-Sentucq*[1], Dollyane Muret[2,3], Eric Koun[1,4], Roméo Salemme[1,4], Luke Miller[1,5], and Alessandro Farnè[1,4,6]

[1]Equipe IMPACT – Centre de Recherche en Neurosciences de Lyon (CRNL), CNRS UMR 5292, INSERM UMRS 1028, Université Claude Bernard Lyon 1, Lyon – France

[2]Université de Paris, NeuroDiderot, Inserm – NeuroDiderot – France

[3]Université Paris-Saclay, NeuroSpin-UNIACT, CEA – CEA - NeuroSpin - Université Paris Saclay – France

[4]Hospices Civils de Lyon, Neuro-immersion Mouvement et Handicap – Hospices Civils de Lyon – France

[5]Donders Centre for Cognition of Radboud University – Netherlands

[6]Center for Mind/Brain Sciences (CIMeC), University of Trento – Italy

Abstract

Hand somatosensory deficits affect the patient's dexterity and quality of life. Yet, research on touch rehabilitation remains scarce. One notable approach in this regard is Repetitive Somatosensory Stimulation (RSS), improving tactile acuity of the stimulated finger by inducing transient plasticity in the corresponding primary somatosensory (S1) representation after passive mechanical stimulation. Recent work from our group showed remote tactile improvement (TI) on the unstimulated hand: RSS on the right index finger (rD2) induced TI at this finger and at the left thumb (lD1) and middle finger (lD3), while tactile acuity at rD1 and rD3 remained stable. But the physiological mechanisms underlying these remote effects remain unknown. Given this specific pattern of improvement, we hypothesize that RSS produces remote TIs by modulating inhibitory processes between S1 fingers' representations within and between hemispheres.We conducted a double-blind sham-controlled study in 40 volunteers undergoing, before and after RSS on rD2, electroencephalography (EEG) recordings of somatosensory evoked potentials to indirectly measure the level of inhibition between digits within (rD2-rD3 and lD2-lD3) and between (rD2-lD2 and rD3-lD3) hands. Tactile acuity was assessed on these fingers using the 2-point discrimination task. Preliminary results from 21 participants tend to replicate the transfer of improvement to the other hand following RSS on rD2 (TI on rD2 and lD3, unchanged acuity on lD2 and rD3). EEG data showed a trend for an increased inhibition between rD2-rD3 as well as rD2-lD2. These preliminary results suggest that RSS remote effects may be mediated by increased interhemispheric inhibition between homologous S1 regions.

Keywords: Repetitive Somatosensory Stimulation, Tactile acuity, Primary somatosensory cortex, Cortical inhibition, EEG

*Speaker