Somatosensory cortex participates in the consolidation of motor memory

David Ostry

Behavioral studies have shown that newly learned motor skills are initially labile but are rapidly consolidated into a more stable state. The circuits which enable the consolidation of motor memories remain uncertain with most work to date focusing on primary motor cortex (M1). Here, by using transcranial magnetic stimulation (TMS) to block consolidation, we report the first direct evidence that plasticity in somatosensory cortex is involved in the consolidation of motor memory. The task involved force-field adaptation in which participants made movements to targets while a robot applied forces to the hand to alter somatosensory feedback. Immediately following adaptation, continuous theta-burst transcranial magnetic stimulation (cTBS) was delivered to block consolidation, then, following a 24-hour delay which would normally permit consolidation, we assessed whether there was an impairment in retention. It was found that when mechanical loads were introduced gradually to engage implicit learning processes, suppression of somatosensory cortex following training eliminated retention entirely. In contrast, cTBS to primary motor cortex following learning had no effect on retention at all; retention following cTBS to motor cortex was not different than following sham TMS stimulation. We confirmed that cTBS to somatosensory cortex blocked motor memory consolidation and that the observed loss of retention was not due to an inability to retrieve a consolidated motor memory. Specifically, retention was unaffected, which rules out a memory retrieval failure, when cTBS was delivered to somatosensory cortex after memory consolidation (24 hours after learning). In conclusion, somatosensory cortex rather than motor cortex is involved in the consolidation of motor memory.