Electrical microstimulation in the primate dorsomedial frontal cortex alters the timing of self-initiated saccades

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Although it has been widely accepted that the dorsomedial frontal cortex (DMFC) is involved in the self-triggering of movements, the underlying neural mechanism remains largely unknown. The previous studies have shown that the gradual buildup of neuronal activity in the motor thalamus plays a causal role in the internal triggering of saccadic eye movements. We postulated that these signals in the thalamus are sent to DMFC, and regulate the timing of self-initiated saccades. Indeed, the local field potential recorded from DMFC gradually increased before the initiation of saccades. To examine the causal role in saccade generation, we applied electrical microstimulation to DMFC when monkeys prepared for saccades to the location of previously flashed visual stimuli. The effects of stimulation on saccade latency were greater when monkeys attempted to make a saccade 1,200 ± 300 ms following the cue ('self-timed task', changes in median latency = 56 ± 14 ms) than when monkeys made a saccade in response to the fixation point offset ('externally-triggered task', 6 ± 3 ms, $n = 73$, paired t test, $p < 0.01$). Our results suggest that the timing of self-initiated saccades might be regulated by the preparatory signals in DMFC.