

Role of Primate Superior Colliculus in Preparation and Execution of Anti-Saccades and Pro-Saccades

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We investigated how the brain switches between the preparation of a movement where a stimulus is the target of the movement, and a movement where a stimulus serves as a landmark for an instructed movement elsewhere. Monkeys were trained on a pro-/anti-saccade paradigm in which they either had to generate a pro-saccade toward a visual stimulus or an anti-saccade away from the stimulus to its mirror position, depending on the color of an initial fixation point. Neural activity was recorded in the superior colliculus (SC), a structure that is known to be involved in the generation of fast saccades, to determine whether it was also involved in the generation of anti-saccades. On anti-saccade trials, fixation during the instruction period was associated with an increased activity of collicular fixation-related neurons and a decreased activity of saccade-related neurons. Stimulus-related and saccade-related activity was reduced on anti-saccade trials. Our results demonstrate that the anti-saccade task involves (and may require) the attenuation of preparatory and stimulus-related activity in the SC to avoid unwanted pro-saccades. Because the attenuated pre-saccade activity that we found in the SC may be insufficient by itself to elicit correct anti-saccades, additional movement signals from other brain areas are presumably required.

Key words: superior colliculus; eye movement; anti-saccade; stimulus-response mapping; sensorimotor transformation; oculomotor; motor preparation; saccade; visual fixation