Abstract

Purpose: Strabismus surgery is well documented in both the literature and in practice with varying levels of success and permanence. Our goal is to characterize longitudinal changes in eye alignment and movements in monkey models for strabismus following strabismus correction surgery.

Methods: The study included 1 rhesus monkey (M1) with exotropia. Strabismus had previously been induced using an optical prism-viewing paradigm from birth until 4 months to disrupt binocular vision during their critical period for visual development. A recession/resection surgery was performed at 6 years of age to weaken the lateral rectus and strengthen the medial rectus of the left eye only. Strabismus angle, saccade performance, smooth pursuit performance, fixation stability and nystagmus were analyzed before surgery, immediately (1-3 days) after surgery and 6 months after surgery. Similar analysis of a second strabismic monkey is planned.

Results: Strabismus angle with the right (untreated) eye viewing was ~31°XT (pre), ~11°XT (immediate post), ~18°XT (1wk post), and ~20°XT (6 months post), and with the left eye viewing was ~20°XT, ~10°XT, ~9°XT, and ~18°XT, respectively. Saccade gain showed significant changes in both eyes when viewing immediately after surgery, but attained pre-surgical values by 6 months post-surgery. Saccade peak velocity with the left eye viewing increased immediately after surgery and remained increased after 6 months in both eyes in both horizontal directions. There were small, idiosyncratic changes in saccade latency. Smooth pursuit velocity gain showed significant post-surgical changes in the covered eye, regardless of which eye was viewing. Naso-temporal asymmetry during monocular smooth-pursuit increased only with the right eye viewing immediately after surgery, but attained pre-surgical values by 6 months.

Conclusions: Similar to outcomes in human surgical treatment for strabismus, strabismus angle in M1 showed a decrease immediately after surgery, followed by a steady progression back towards the monkey's pre-surgery angle. The most notable post-surgical dynamic change in eye movements was a change in smooth-pursuit and saccade eye velocity in both the treated and untreated eye. We hypothesize that these static and dynamic changes are due to a combination of central neural adaptation and extraocular muscle remodeling that occurs as a consequence of the surgical procedure.