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Comparison of Naso-Temporal Asymmetries in Optokinetic, Smooth-Pursuit and Ocular Following Eye Movements in Monkeys with Strabismus

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Abstract

Purpose: When tested under monocular viewing conditions, humans and monkeys with infantile strabismus often show strong eye movement responses to nasally directed visual motion stimuli and weak responses to temporally directed stimuli. The goal of this study was to compare and contrast these naso-temporal asymmetries during three visually mediated eye movement responses - optokinetic nystagmus (OKN), smooth-pursuit (SP) and ocular following (OFR).

Methods: Two strabismic monkeys (1 esotrope (ET) and 1 exotrope (XT)) were tested under monocular viewing conditions during nasal or temporal OKN, SP or OFR stimulation. OKN stimulus was unidirectional motion of a 70°X50° random dot pattern at 20, 40 or 80 °/s for 1 minute. SP stimulus was foveal step-ramp target motion at 10, 20 or 40 °/s. OFR stimulus was brief (200ms) unidirectional motion of a 38°X29° random dot pattern at 20, 40 or 80 °/s. Data from both left and right eye viewing conditions were combined for statistical analysis of eye movement parameters.

Results: Naso-temporal asymmetry in monocular OKN is identified as a difference in steady-state gain of the OKN response (mean ratio of Nasal to Temporal gain for ET was 1.20±0.14 and for XT was 1.50±0.14). Naso-temporal asymmetry in monocular OFR is manifested as a difference in OFR velocity gain (mean ratio of Nasal to Temporal gain for ET was 1.29±0.36 and for XT was 2.19±1.02). No asymmetry in OFR latencies and amplitudes were identified. Asymmetry in monocular SP is manifested as a difference in steady-state velocity gain (mean ratio of Nasal to Temporal gain for ET was 1.66±0.39 and for XT was 1.42±0.56) and

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average acceleration during pursuit initiation (mean ratio of Nasal to Temporal acceleration for ET was 1.30 ± 0.81 and for XT was 2.17 ± 0.92) but not latency. Catch-up saccades were significantly more frequent during tracking of temporalward stimuli.

Conclusions: Naso-temporal asymmetries are identified in all three visual tracking paradigms in both monkeys with either eye viewing. The most striking asymmetries are found in SP tasks - differences in steady-state gain, initial acceleration and frequency of catch-up saccades. Our data are consistent with the current hypothesis for the mechanism for naso-temporal asymmetry that invokes an imbalance in cortical drive to brainstem circuits.

Keywords: 722 strabismus • 525 eye movements: saccades and pursuits • 753 vision and action



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