# Abducens Neuron Responses in Monkeys with Strabismus

**M. N. Agaoglu, A. C. Joshi, S. Agaoglu, V. E. Das**

**College of Optometry, University of Houston**

Disrupting binocular vision during the first few months of life in a monkey results in strabismus. The objective of this study was to investigate response properties of abducens motoneurons (ABN) in relation to horizontal misalignment in monkeys with strabismus.

Burst-tonic (BT) activity of 49 neurons in the abducens nucleus (17-Left Abducens LTBT; 32-Right Abducens RTBT) was recorded from one strabismic monkey (OD: ~30° XT; OS: ~15° XT) during horizontal smooth pursuit (0.2 Hz, ±15°) under each monocular viewing condition. Neuronal firing rates (FR) and horizontal component of eye position and velocity ($E_{pos}$, $E_{vel}$) were used to identify regression coefficients (K-position, R-velocity, C-constant) in a first-order model ($FR = K*E_{pos} + R*E_{vel} + C$) for each tracking condition.

Both RTBT and LTBT activity was well fit with the first order model equation. For RTBT motoneurons, the mean coefficients were K=5.4±3.8, R=1.4±0.6, C=41±62. Fit coefficients (K and R) were not significantly different whether the animal viewed with his right eye (left eye deviated) or left eye (right eye deviated) (paired t-tests; $p>0.65$). Further, K and R coefficients were not significantly different from those in normal monkeys as derived from the literature (K=5.6±3.5, R=1.3±0.9, C=108±76; t-tests $p>0.57$). Mean coefficients for LTBT motoneurons as estimated during OS viewing were K=5.0±2.4, R=1.5±0.7, C=58±44. Again the K and R coefficients were not significantly different from the normal (t-tests, $p>0.42$); However, mean LTBT coefficients estimated during OD viewing (left eye deviated; K=8.8±3.2, R=2.2±0.8, C=-67±65) were indeed significantly different than those estimated during OS viewing and were significantly different from the normal ($p<0.001$). The constant term (C) was significantly different from the normal during either OD or OS viewing for both RTBT and LTBT motoneurons.

The difference in the constant term between normal monkeys and the strabismic monkey is suggestive of muscle length adaptation. Based on the mean position coefficient, muscle length adaptation can account for approximately 12° of the strabismus. LTBT cells display an additional nonlinearity, (coefficients are different during OD or OS viewing) which indicates nonlinear muscle contractility in different gaze positions.