**Saccadogram Evaluation and Report**

**Date:**

**Subject: Initials##**

**Chief Complaint:** Slow Saccades

**Eyes Tested:** Monocular testing for RE(OD) and LE(OS).

**Tracker System:** SMI High-Speed/PEECS.

**Testing Completed:** Main sequence (center out saccades), anti-saccades, centripetal (out to center) saccades and smooth pursuit.

**Findings:**

Raw data for both eyes (OD & OS) was sufficient in quantity for evaluation of oculomotor function. The mean velocity (degrees/sec) for the subject’s 10 degree vertical and horizontal saccades were (OD velocity / OS velocity):

10-degree saccadic velocities

Direction OD OS

Rightwards 105.8 deg/sec 100.0 deg/sec

Leftwards 100.0 deg/sec 147.2 deg/sec

Upwards 69.7 deg/sec 87.1 deg/sec

Downwards 36.5 deg/sec 74.1 deg/sec

1. Saccades were slow in all directions however significantly slower in the vertical directions. Horizontal center-out saccades were slow, hypometric and multi-stepped. Notably the subject never made a single saccade greater than 5 degrees. To complete a saccade plan to targets in the periphery, the subject used multiple small saccades < 5 degrees to do so. However vertical saccades were significantly slower and hypometric than horizontal, often never landing on target and occasionally compensated by a smooth pursuit movement.
2. Smooth pursuit was saccadic, however the oculomotor system was able to acquire relatively preserved function horizontally **and** vertically, however gains were reduced. This indicated a relatively overall preserved pursuit function in comparison to the saccadic system. We were unable to measure VOR in our study.
3. On the anti-saccade task: 29 out of 34 trials were errors representing an 85.3% error rate which is significantly higher than normal (< 5% expected for normal subjects) suggesting the inability to suppress reflexive saccades by the frontal cortical circuitry.
4. Saccadic intrusions were noted, specifically square waves jerks (SWJ) during fixation and smooth pursuit. The SWJs were very small amplitude (<1 degree) but did occur in bursts. Direction changing, pendular nystagmus were NOT noted. While a few down beats of nystagmus were seen they were not sustained on eccentric gaze downwards.

**Interpretation**: With a history of parkinsonism now presenting with slow and hypometric saccades worse in vertical than horizontal direction, frequent square wave jerks (SWJ), and high number of errors in the anti-saccade task is consistent with a diagnosis of Progressive Supranuclear Palsy. The differential diagnosis includes lipid storage diseases (Niemann-Pick Type C, Gaucher’s), the dementias (CBD, MSA, FTD, DLB), Stiff-Person’s Syndrome, and Whipple’s Disease. Notably, the medical etiologies of slow saccades wide ranging and the following table is provided for reference and clinical correlation.

**Report Prepared by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Technical Note: Sufficient downward saccades were tracked in the both eyes. Tracking artifacts were seen primarily in the left eye (OS) due in part to ptosis and eye color. Due to the size, timing and quality of the recording and technical limitations prevented making an estimate of square wave frequency. *(\*)Model estimate of mean velocities and standard deviations for CONTROL subjects provided for reference. However currently they are not age matched, and control database is being developed here at Columbia (Rascal-IRB: AAAR0433).*

**Appendix 1**

**Medical Etiologies of Slow Saccades**

*Adapted from Neurology of Eye Movements Leigh and Zee 5th Ed.*

Spinocerebellar ataxias: especially type 2, also with SCA1, 3, 4, 5, 7, 8, 17, 23, 28

Huntington’s disease

Progressive supranuclear palsy

Parkinson’s disease (in advanced cases)

Related diseases: Lytico-Bodig, Guadeloupean parkinsonism, dystonia

Whipple’s disease

Lipid storage diseases (Gaucher’s, Niemann-Pick type C)

Pantothenate-kinase-associated degeneration (PKAN)

Wilson’s disease

Drug intoxications: anticonvulsants, sedatives, benzodiazepines

Tetanus

Gluten sensitivity

Dementias

Alzheimer’s disease (stimulus-dependent)

FTD (Frontotemporal dementia)

CJD (Creutzfeldt-Jakob disease)

DLB (Dementia with Lewy bodies)

CBD (Corticalbasal Degeneration)

AIDS: Dementia in association with AIDS

PPRF (paramedian pontine reticular formation lesions)

INO (Internuclear ophthalmoplegia) (adduction)

Paraneoplastic syndromes

ALS (Amyotrophic lateral sclerosis)

Mitochondrial disorders (MNGIE, MELAS, MERFF, NARP, SANDOS, Kearns-Sayre syndrome)

CADASIL

Acanthocytosis

Cranial nerve (peripheral) palsies (CN3, 4, 6)

Graves (Thyroid eye disease) restrictive ophthalmopathy