DIFFERENCES IN PERFORMANCE ON THE ANTISACCADE TASK IN FOOTBALL ATHLETES DURING CHILDHOOD AND LATE ADOLESCENCE


Introduction
- To date, few studies on saccadic eye movements in children and adolescents exist, especially those with mild traumatic brain injury (mTBI) suffered in a sports related environment.
- Antisaccade (AS) task in particular may be able to objectively assess for mTBI or the effects of subconcussive loading by comparing baseline to follow-up performance.
- AS task engages areas including the prefrontal cortex (PFC).
- Quantifying performance with oculomotor assessments may help to understand which brain regions may be injured during a mTBI or affected due to subconcussive loading.
- Age-based differences in oculomotor system response resulting from differences in brain development are also of importance when considering the use of an assessment modality across ages.

The Antisaccade and the Brain

The Antisaccade Task
- AS depends on cognitive control to inhibit the reflexive prosaccade to the target and then initiate a saccade in the opposite direction (goal directed behavior)
- Intentional voluntary movements & inhibitory control processes engage the PFC [5]
- MRI studies have also shown activation of the supramarginal gyrus, frontal eye fields, intraparietal sulcus, and prefrontal cortices during the AS test [1]
- Discrepancies on antisaccade task performance have been found between children and adults with differences between the 6-8, 9-11, 12-15, and 20-35yrs age groups [3]
- Changes in the PFC during normal childhood development include linearly increasing white matter volume [8], and the maturation of higher-order cortices only after lower-order somatosensory and visual cortices [2]

Methods
- Participants: high school football team males (n=92; age 13-18 YRS) and Pop Warner football team males (n=34; age 5-13 YRS)
- Saccadic eye movement data collected using EyeLink 1000 system (SR Research, Canada) with binocular eye tracking at 1000 Hz (monocular: 2000 Hz)
- AS data taken at baseline (before the beginning of the football season)
- AS metrics: number of wrong-way trials
- This is one element of a larger study that includes other oculomotor modalities, biomechanics, athletic exposure, Standardized Assessments of Concussion, etc.

Preliminary Results
- Preliminary results for Pop Warner participants based on small sample size of 1.5 years
  - Trend of increasing number of correct trials with age matches previous studies [3,5]
  - This is the first time working with this population for this study, which is scheduled to continue into a second year where additional baseline data will be acquired to increase sample size

Preliminary Outcomes
- Trend in the preliminary data shows the younger age group (Pop Warner participants) made a greater number of wrong way trials. A greater sample size is needed to assess for statistical difference
- This trend may suggest that the younger group was less likely to inhibit the reflexive prosaccade in accordance with development of the higher-order cortices in the PFC. Alternatively, the trend could be due to a misunderstanding of the antisaccade task by the younger cohort
- Trend of increasing number of correct trials with age matches previous studies [3,5]
- This is the first time working with this population for this study, which is scheduled to continue into a second year where additional baseline data will be acquired to increase sample size

References
7. SRResearch (Figure 3) http://www.sr-research.com/headsupp_sr.html

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- Duke Institute for Brain Sciences
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- Durham Eagles Athletic Association

Figure 1: Cortical Activation during the AS Task (Ettinger, et al. 2008)

Figure 2: Sample AS Task

Figure 3: Full Setup Side View

Figure 4: A representative binocular AS trial detailing the metrics associated with this eye movement task. This sample trial represents a participant that exhibited an initial wrong-way saccade with undershoot, followed after a latent period by a corrective saccade with some level of overshoot

Table 1: Preliminary Results of Pop Warner participants based on small sample size of valid data (n = 20)
- Baseline data shows high school participants (age 13-18yrs) understood the antisaccade task. While many wrong-way saccades were initiated, participants performed corrective saccades in opposition to the target in nearly all cases.
- Ages 5-13yrs (Pop Warner participants) completed more wrong-way trials without correction