Oculomotor performance and information processing in young and older adult populations.

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Introduction

Individuals with a history of Concussion/TBI manifest disruption of information processing in sub-cortical pathways resulting in long-term neurological impairments.

Hence, It is critical to establish and validate **Physiological biomarkers** which can predict vulnerability. This might help to identify the appropriate patients for rehabilitation to mitigate the risks.

Almost 50% of Traumatic Brain Injury (TBI) patients manifest vestibular symptoms including dizziness resulting in postural instability and fall risk. However, we still bore confounding evidence on oculomotor performance and vestibular information processing in the healthy **young (18-35 years of age) and older adults (above 55 years of age)** population.

1st order information processing from inner ear.

a) Vestibulocollic reflex (VCR)
b) Cervico-ocular reflex (COR)
c) Cervicospinal reflex (CSR)
d) Cervico-colic reflex (CCR)
e) Vestibulospinal reflex (VSR)
f) Vestibulo-ocular reflex (VOR)

Among these reflexes, we explored the rotational compensatory movement of eye (VOR) as an avenue to establish a potential physiological biomarkers of TBI.

Objective

In this regard, in current pilot study, we obtained age stratified normative data to classify young and adults. Here, we established a normative data of oculomotor performance in healthy young and senior population which can be compared reliably with age and sex specific TBI counterparts.

Methods

In this pilot study, healthy normal ten subjects were recruited from young and adult age populations.

Subjects underwent oculomotor eye-tracking measures including saccade, smooth pursuit, sinusoidal harmonic accel eration,

visual suppression, optokinetic te sting, and trapezoidal step testing, subjective visual horizontal and vertical testing.

Rotational chair tests were performed in the Neuro Kinetics rotary chair (Pittsburgh, PA).

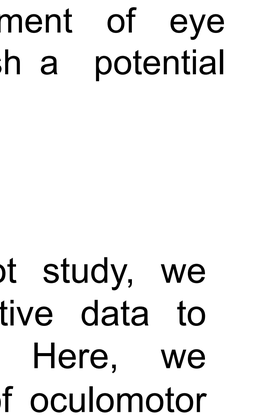
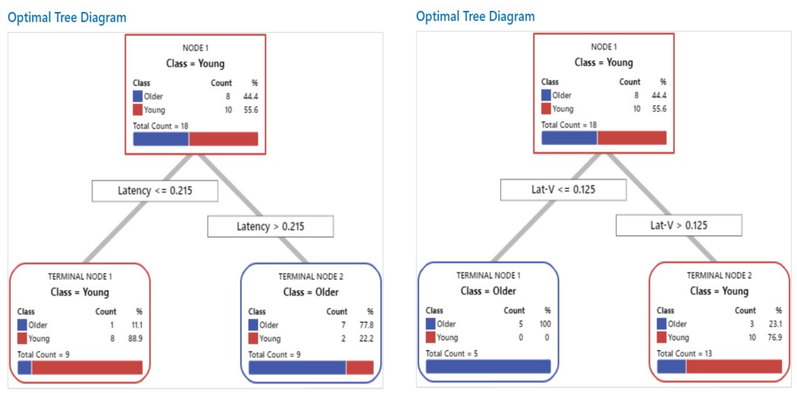


Fig 1. Rotary Chair

Results

Fig 2. Classification and Regression Tree of Saccade latency



A. Horizontal **B.** Vertical

Fig 3. Gain of smooth pursuit as a function of frequency of rotation

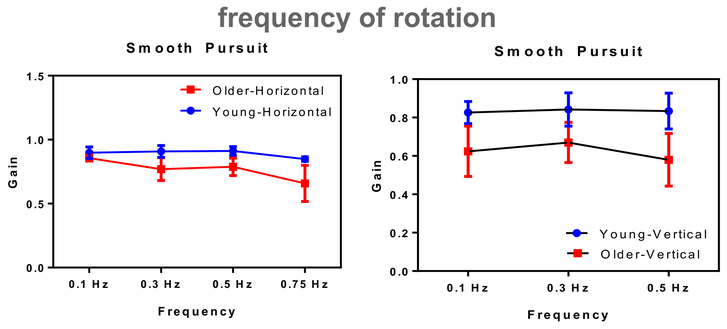


Fig 4. Gain to Optokinetic Stimulus

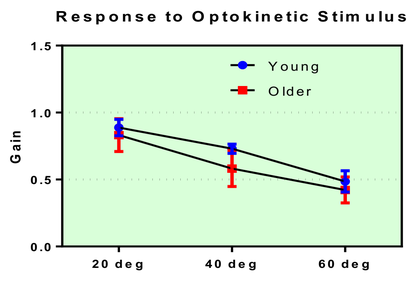


Fig 5. Subjective Visual Vertical/Horizontal

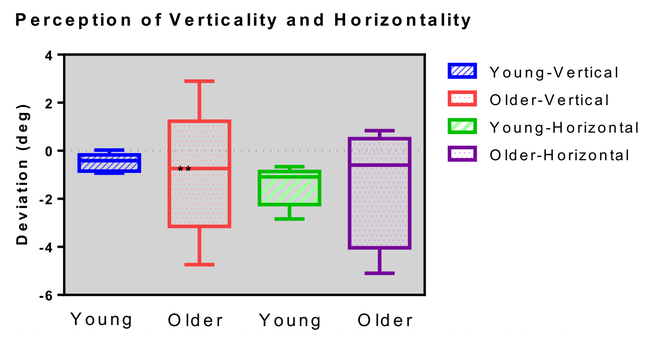


Fig 6. Gain (A) and Asymmetry (B) of SHA responses

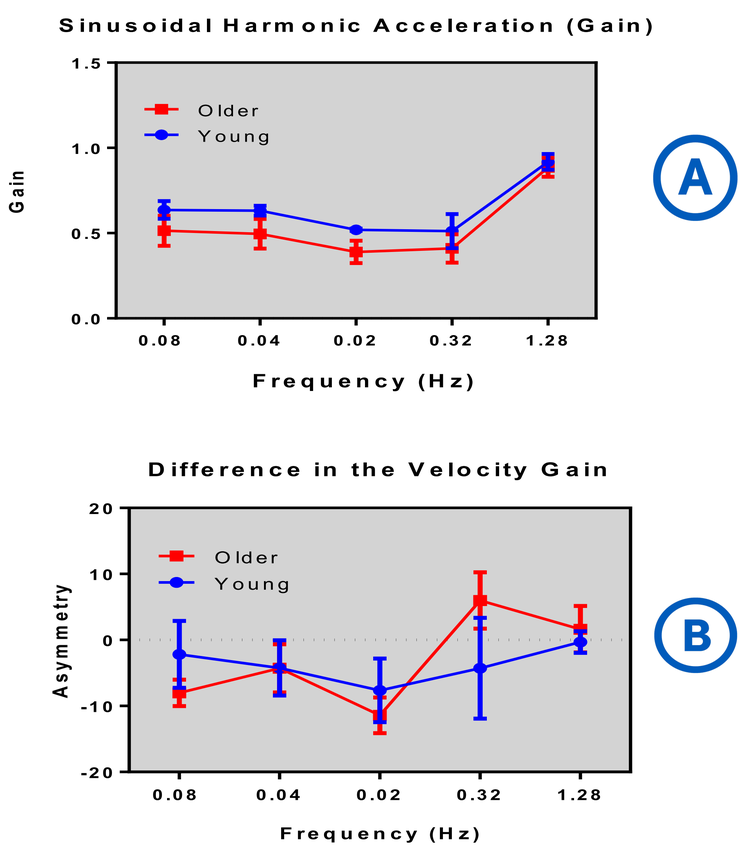


Fig 7A. Directional Preponderance in Trapezoidal Test

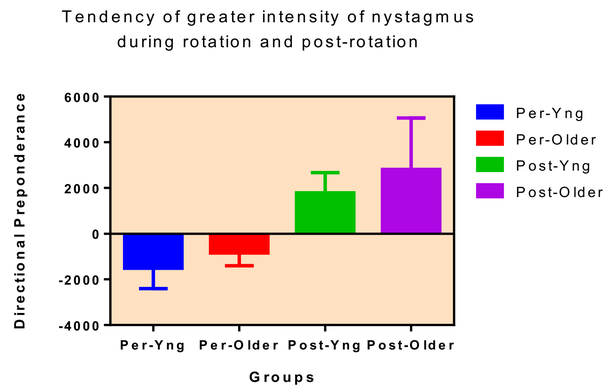


Fig 7B. Potential of Per-rotational nystagmus to discriminate young and adults (Receiver Operating Characteristic Curve)

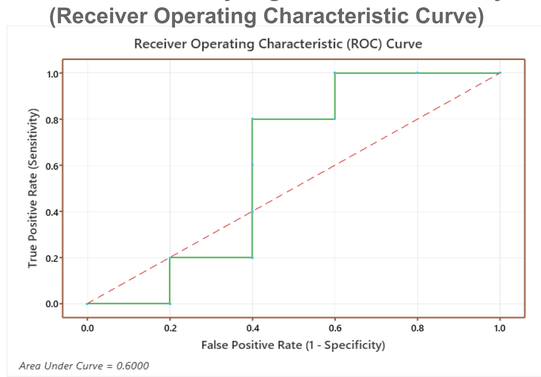
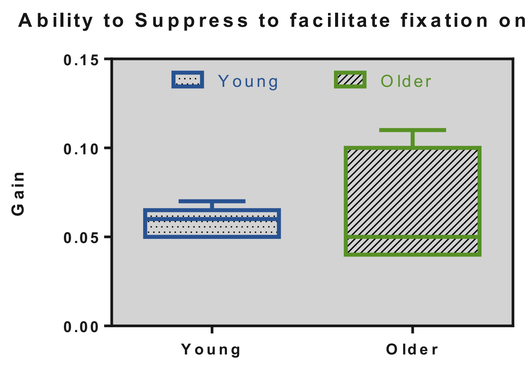


Fig 8. Visual Suppression



Interim Findings.

1. Horizontal saccade latency of 0.215 secs and vertical saccade latency of 0.125 secs classifies young and older adults (Fig 2).
2. Gain of higher frequency SP in horizontal direction and response in optokinetic stimulus were low in in older adults (Fig 3 & 4).
3. Perception of Verticality is found to be compromised in older adults indicating otoliths integrity (Fig 5).
4. Asymmetry of velocity gain in SHA indicates involvement of vestibular periphery pathology in older adults (Fig 6B).
5. Directional preponderance evident in young population was found to be offset in older adults (Fig 7a & B).
6. Though not significant, the ability to suppress visual fixation was found to be reduced in older adults (Warrants more sampling) (Fig 8).

Overall, we obtained normative data for the stratified age groups (young vs adult population) to enable the quantification of vestibular information processing. The obtained data indicated that this provides an ideal platform to determine a physiological biomarkers to reflect the TBI induced neurological deficits.

References

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