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Dynamic visual function and its aging effect

Purpose

Many real-world tasks consist of relative movement between observers and targets, evaluation of visual functions while targets and/or observers are in locomotion might better reflect individuals’ functional performances. In this study, we examined the impact of body motions on static and dynamic visual functions and their age-related changes.

Methods

Forty-three subjects with normal vision were recruited and divided into three age groups, 17 in young (18-30 years), 12 in middle-age (31-55 years) and 14 in elderly (≧56 years). Visual acuity (VA) and contrast sensitivity (CS) were measured when stimuli moved at 4 speeds (0, 30, 60 and 90°/second) and observers posed sitting, stepping and walking on treadmill. Subjects were required to identify isolated letter (H, O, T or V) or grating orientations (vertical, horizontal, right or left) in VA and CS task respectively. Targets were shown by Psykinematix on a 50-in LCD monitor.

Results

Mixed between-within subjects ANOVA was used to study the impact of speeds, body postures and age on VA and CS. Increased stimuli’s speed significantly impeded VA and CS (p<0.001), which significantly reduced when stimuli’s speed increased from 0 to 60°/second and plateau state was then reached. Interestingly, VA and CS were not significantly different among three body postures (p>0.10), reflecting little impact brought by locomotion. There was an aging effect on VA and CS (p<0.001). VA among three age groups was significantly different (p<0.001), but insignificant difference occurred between young and middle-age group in CS. Slope change in VA (-0.08 to -0.10) and CS (-0.14 to -0.20) among different speeds showed stronger age-related decline in CS. Interaction effect by body posture and age was insignificant in VA and CS; same result was also obtained when speed was considered. Significant interaction effect by speed and age was found in CS (p<0.001) but not in VA, indicating that moving speed affected older subjects’ CS more.

Conclusion

Visual functions were significantly influenced by moving stimuli but not by observers’ locomotion. Both VA and CS deteriorated when targets moved till 60°/second. Stronger age-related decline with the effect of speed suggested further study on the correlation of dynamic vision with functional performance in daily activity (e.g. balancing), which involves more low-contrast stimuli.