THE EFFECT OF AGE ON FUNCTIONAL VISUAL FIELD AND ON VISUAL EXPLORATION DURING DRIVING

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Objectives: The functional visual field is the area where targets on a complex background can be recognized and distinguished from distractors. It is hypothesised that the functional visual field is influenced by age and that it is relevant for safe driving.
During driving, it has been shown that older drivers allocate a larger percentage of their visual scan time to a small subset of areas in the driving scene than younger drivers. Therefore, it is hypothesised that older drivers focus on central areas with neglecting peripheral areas for daylight and night driving compared with younger drivers.

Methods: We projected 30 pictures of everyday life into a hemisphere (diameter 60 cm) realizing a ± 90^o visual field. In addition to the projected pictures, targets and distractors appeared in a randomised order within the ± 50^o visual field area. Furthermore, subjects had to conduct neuropsychological examinations (TMT A+B, MoCA, Clock Drawing) and take a simulated drive on a motorway route under day and night conditions. 110 healthy subjects (48.17 ± 16.73 years; range: 20-78 years) volunteered for the study.

Results: Target detection rate decreased with increasing eccentricity of the target ($p<0.01$). Whereas young subjects showed a very small decrease in target detection rate with increasing eccentricity ($10^o \rightarrow 50^o$: 8.83%), older subjects showed a large drop in target detection rate with increasing eccentricity ($10^o \rightarrow 50^o$: 37.54%). On the other hand, reaction time increased with increasing eccentricity of the target ($p<0.01$). Older subjects showed a higher reaction time compared to younger subjects independent of target position ($p<0.01$).
During driving, older subjects allocated their gaze more to the central area compared to younger subjects, but the difference was only significant during night driving (day: $p=0.10$; night: $p=0.01$). Furthermore, older drivers persist longer on central areas (day: $p=0.03$; night: $p<0.01$) whereas younger drivers do more eye movements to scan the scene, but these differences were not significant (day: $p=0.20$; night: $p=0.08$). At night, both young and older drivers do less eye movements (younger: $p=0.01$; older: $p=0.01$) and persist longer on central areas than during day driving, but the difference reached only significance for older subjects (younger: $p=0.10$; older: $p=0.01$).

Conclusion: The results of the functional visual field test show an age-dependent effect on target detection and reaction time. Older subjects have more problems detecting targets in the periphery. Similar results have been found during simulated driving. Older drivers change their gaze less than younger drivers and persist longer on central areas. A possible impact of these age-dependent effects could be a delayed detection of peripheral hazards during driving for elderly drivers and thus less time for an adequate reaction.