

Comparing the eye movements during driving turns in older adults with and without elevated amyloid burden

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BACKGROUND

- Subtle changes in instrumental activities of daily living, especially cognitively intensive tasks like driving, may signal the earliest stages of Alzheimer's disease (AD).
- Eye-movement patterns reflect the coordination of visual attention and cognitive control, offering an ecologically valid indicator of early cognitive risk.
- Elevated brain amyloid burden ($A\beta$) is an early biomarker of AD, even in cognitively normal older adults [1].
- This study evaluates eye-movement patterns during driving turning maneuvers in cognitively normal older adults with and without elevated $A\beta$ burden.

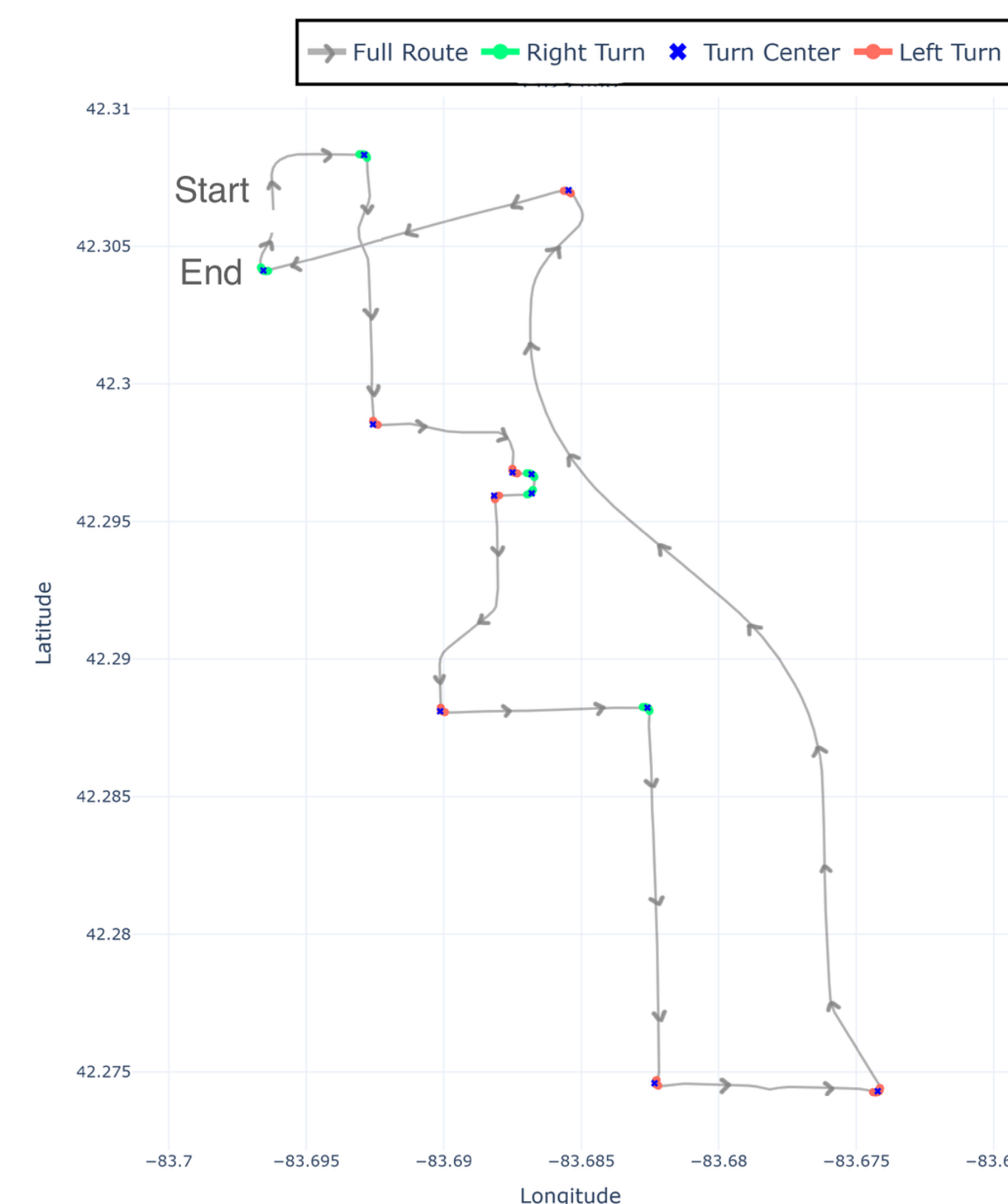
DATASET

- We analyzed data from 40 older volunteers, aged 65+, who were determined to be cognitively normal via Michigan ADRC consensus conference diagnosis.
- All participants completed the following:
 1. Amyloid PET scan
 2. Fixed course drive (all participants followed the same route)
 3. Additional neuropsychological testing
- Amyloid positivity was determined via PiB PET scan [2]:
 - Amyloid positive ($A\beta+$) (n=20): centiloid value ≥ 20
 - Amyloid negative ($A\beta-$) (n=20): centiloid value ≤ 10
- During the fixed course drive of each participant, eye-movement data and vehicular data were collected using the Tobii Pro Glasses and the DL1 CLUB Data Logger respectively

METHODS

- Right and left turn maneuvers made during the fixed course driving trip were automatically detected using a predefined heading-change threshold
 - Figure 1 shows the right and left turns automatically detected by our algorithm for one study participant
- Eye-movement measures (fixation duration, saccade duration, number of fixations/saccades) were computed per turn type.
- Independent sample t-tests compared eye-movement measures during right and left turns between $A\beta+$ and $A\beta-$ groups.

Figure 1. Detected Turning Maneuvers for a Participant

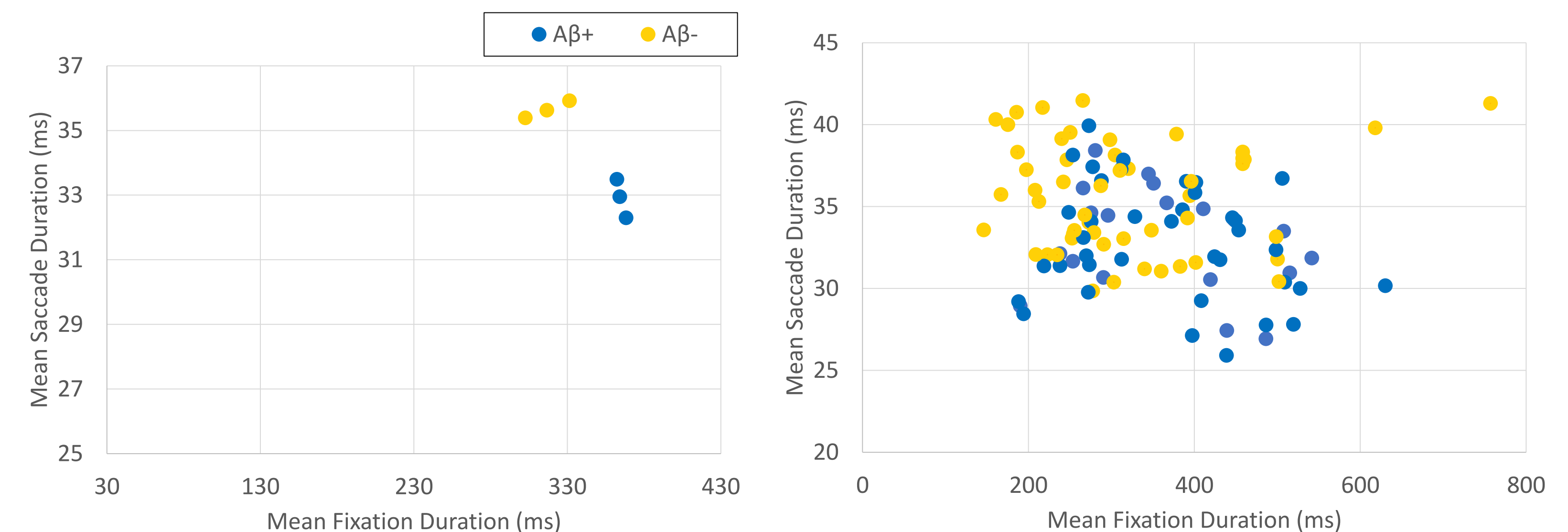


RESULTS

- In this study, $A\beta+$ drivers showed a pattern in longer average fixation durations paired with shorter saccade durations, while $A\beta-$ had shorter fixation durations with slightly longer saccade durations (shown in Figure 2).
- Mean and median fixation durations were significantly longer in $A\beta+$ drivers than $A\beta-$ drivers specifically during right turns (p 's < 0.05).
- Mean saccade duration during right turns was significantly shorter in $A\beta+$ drivers compared with $A\beta-$ drivers ($p < 0.05$).
- No significant group differences were found during left turns.

Figure 2. Group Differences in Fixation and Saccade Durations During Driving Right and Left Turns

Group-level (left) and participant-level (right) scatter plots comparing mean fixation and saccade durations during turns between $A\beta+$ and $A\beta-$ drivers.



CONCLUSION

- During turning events, cognitively normal $A\beta+$ drivers show distinct eye movement patterns compared with $A\beta-$ peers
- Findings suggest $A\beta+$ drivers spend longer times fixating on points of interest (perhaps needing more time to process visual information) and make shorter saccades, potentially indicating narrower, less exploratory eye movements, aligning with early AD oculomotor research.
- Further research will explore eye movements in larger samples during additional driving maneuvers using machine learning to gain deeper insights into oculomotor gaze behavior changes across broader driving demands in $A\beta+$ seniors.

REFERENCES

[1] Chetelat et al. (2013) NeuroImage: Clinical, vol. 2, pp.356–365; [2] Amadoru et al. (2020) Alzheimer's Res Ther. 12(1):22

ACKNOWLEDGEMENTS



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