

Involuntary Saccade Initiation is Related to Voluntary Saccade Timing in Infantile Nystagmus

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Background

The largely horizontal, oscillatory eye movements that are characteristic of infantile nystagmus (IN) comprise slow phase drifts away from fixation followed by a resetting saccadic quick phase. The typical frequency of these cycles is about 2-4 Hz. In subjects with early-onset nystagmus, we investigated whether the timing of the nystagmus quick phase was influenced by the initiation of a normal saccadic gaze shift provoked by a vertical target jump.

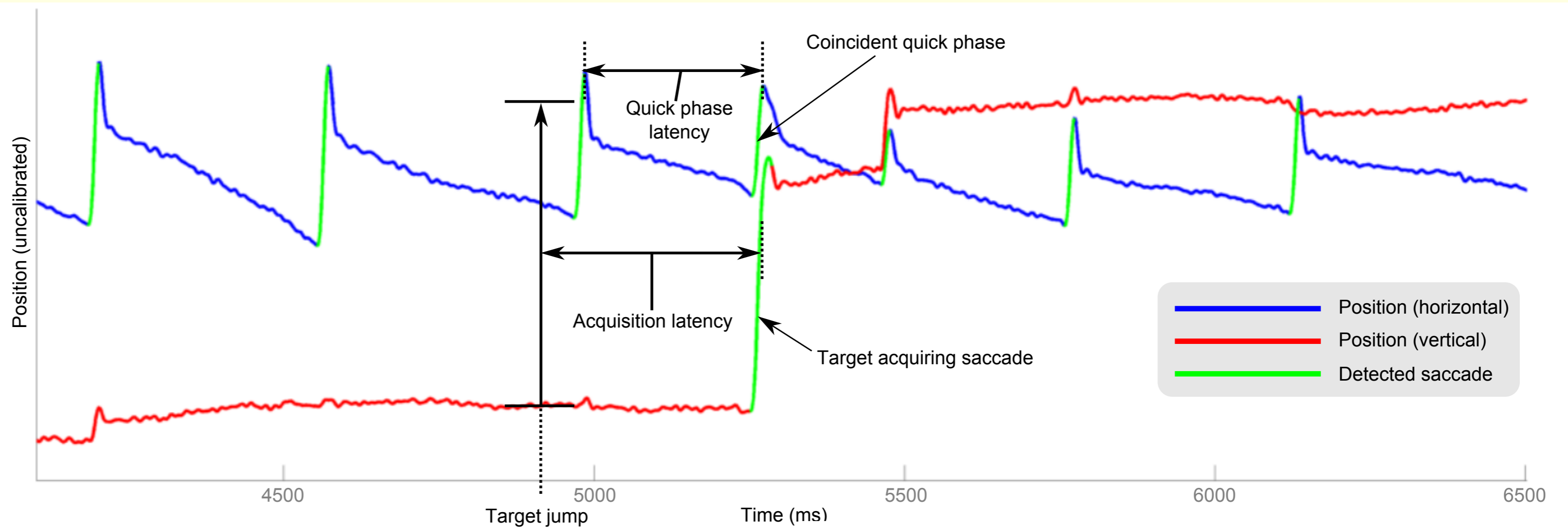


Fig. 1: Example eye trace showing the features identified for analysis

Methods

Fourteen subjects with horizontal early-onset nystagmus (12 with IN, one with fusion maldevelopment nystagmus, one with gaze-paretic nystagmus) were seated 2 m from a display screen, viewing a target cross which was displaced either 3 or 5° up or down at random delays of 1-2 s, with a return to centre between each presentation. Each participant performed a total of 80 target jumps. Saccades were automatically detected in both the nystagmus plane and the orthogonal plane using a combination of established and custom-made saccade detection algorithms.

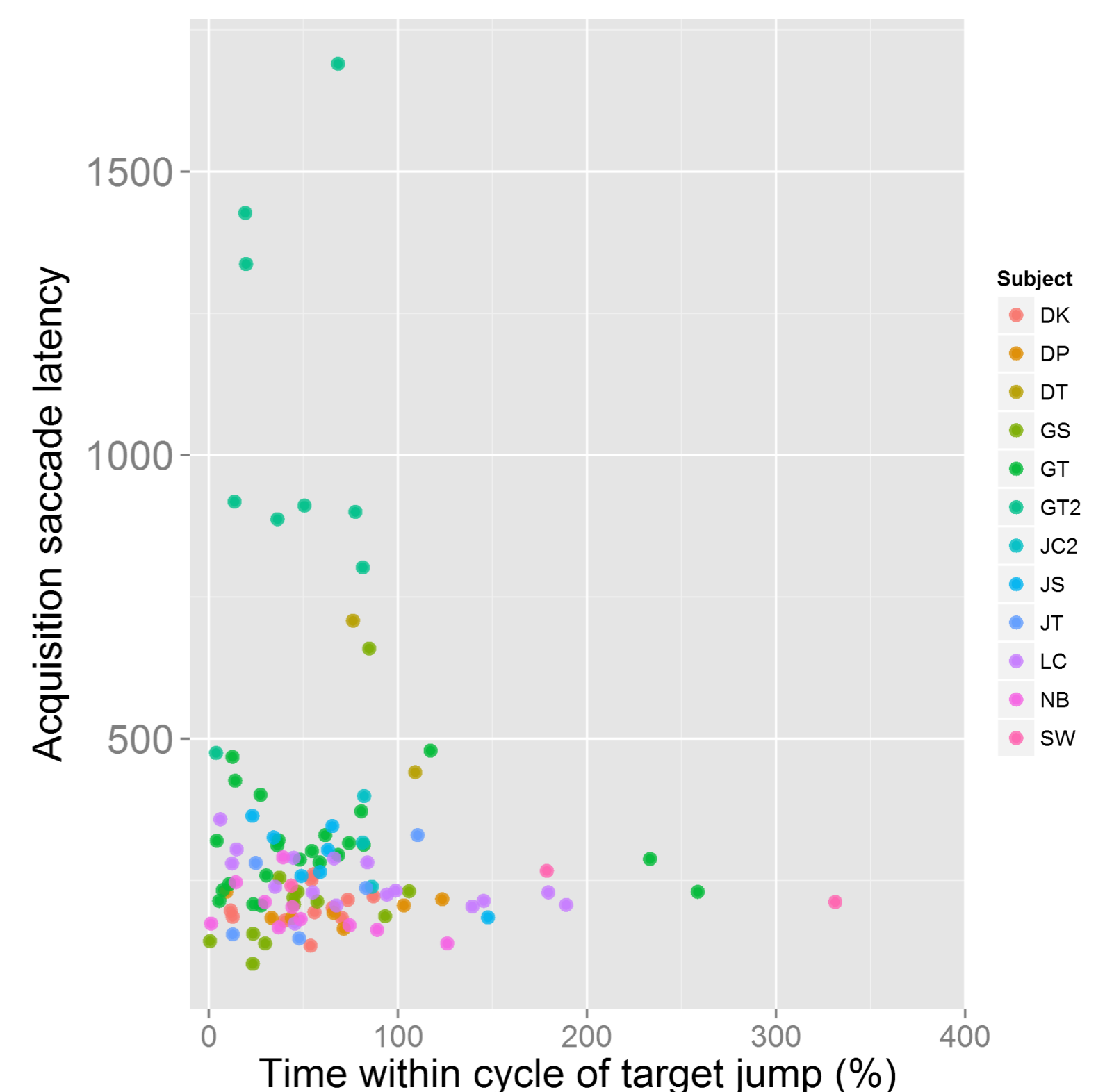


Fig. 2: The time of the target jump within the nystagmus cycle does not significantly affect acquisition latency (only subjects with IN shown; correlation = -0.09)

Results

Out of 194 identified vertical target-acquiring saccades, 186 (96%) coincided with a nystagmus quick phase. Giving equal weighting to all participants, the rate of saccade coincidence was 94%.

Quick phases coinciding with voluntary saccades show significantly more variance in cycle length ($p < 0.001$).

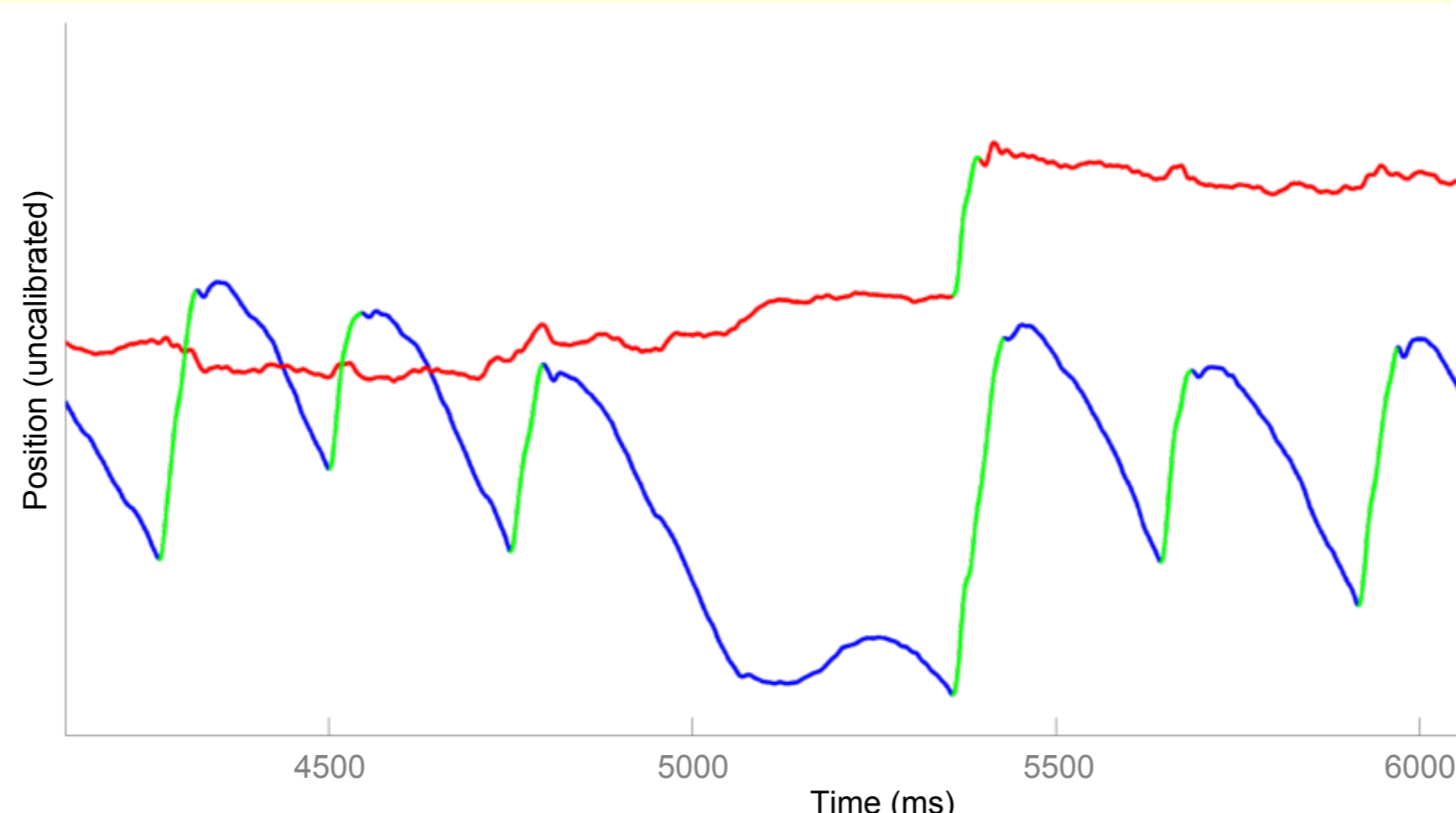


Fig. 3: Example of waveform changes prior to target acquisition

Conclusions

- The coincidence of quick phases with vertical saccades suggests that the nystagmus waveform is modified in order to accommodate the timing of voluntary saccades.
- Although the target appeared randomly with respect to the nystagmus cycle, saccade timing was not significantly affected, suggesting that the target was perceived throughout the slow phase and not just during the so-called 'foveation period' of IN.

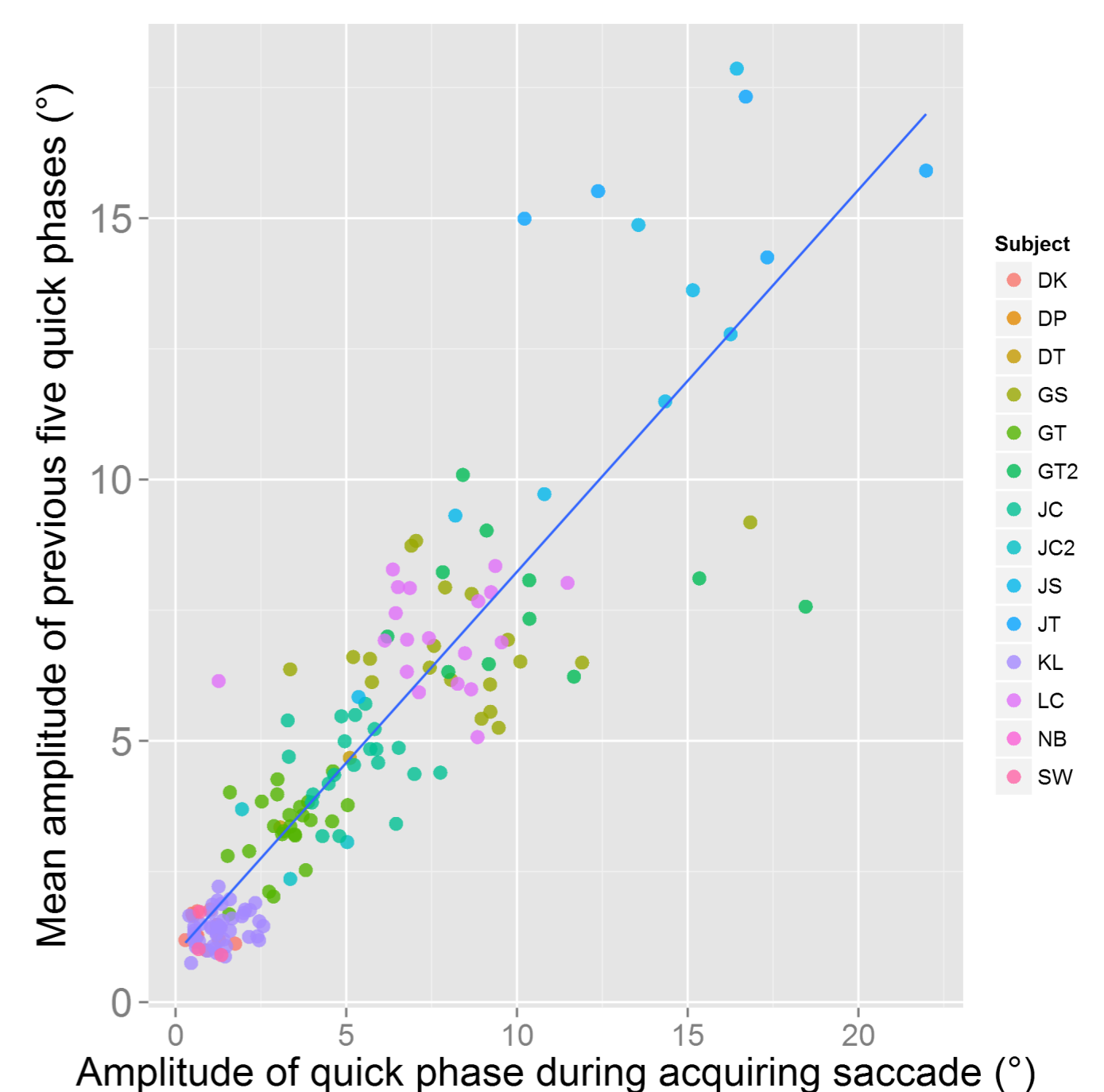


Fig. 4: Quick phase amplitude is unaffected by coincident target acquiring saccades