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Effects of diabetic peripheral neuropathy on the use of vision during walking

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Background and aims

Due to a decrease in sensory feedback, patients with diabetic peripheral neuropathy (DPN) are expected to use vision as a way of detecting foot position during walking, restricting their ability to visually identify upcoming obstacles. By examining how people visually acquire (first look at) targets during walking, we can elucidate to what extent diabetes patients use their eyes to identify foot position, and plan subsequent stepping during walking.

Materials and methods

Twelve participants (4 with diabetic peripheral neuropathy DPN, 4 with non-neuropathic diabetes [D], and 4 healthy controls [C]) negotiated a stepping walkway, stepping on irregularly placed targets as accurately as possible whilst walking at a natural gait velocity. The timing of horizontal eye movements during stepping were measured using an eye-tracking device, with respect to foot-target contact.

Results

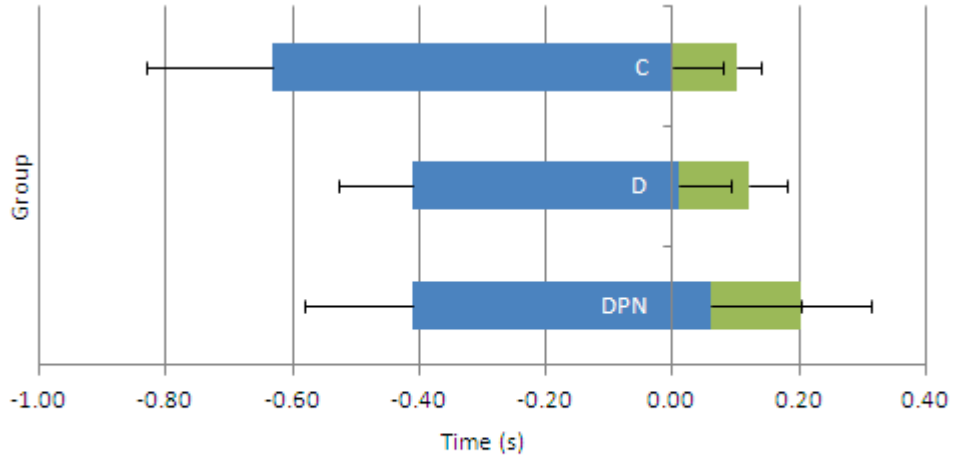

Figure 1. Mean group differences in timing, of when the target was visually acquired (blue bar), and when the eyes were looking from one target to another (green bar), with reference to foot-target contact occuring at 0s.

Patients with DPN visually acquired the targets significantly later (start of the blue bar), and remained looking at them for significantly longer after the foot had contacted the ground (end of the blue bar). Patients with DPN spent significantly less time in total looking at targets than the control group, but took significantly longer to look between targets (length of green bar)(Fig 1.).

Conclusion

Patients with neuropathy appear to use vision as a method of detecting when foot placement occurs during stepping. Unlike healthy controls, who look to the next target prior to foot-ground contact, patients with neuropathy remain looking at the target until after foot-ground contact, in an attempt to increase stepping accuracy. Patients with neuropathy also take longer to look from one target to another, which may indicate the presence of motor neuropathy in the extra-occular muscles. The increased time to look between targets may therefore be an explanation for the later acquisition of the subsequent target. This visual gaze strategy may restrict the ability of patients with neuropathy to identify upcoming obstacles, increasing the chances of tripping and falling.

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