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Accelerator pedal control in diabetes: influence of ankle proprioception and muscle strength

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Aims

Diabetic peripheral neuropathy (DPN) influences neural sensitivity, nerve conduction velocity, proprioception and muscle strength. The aim of this work was to investigate whether plantarflexor muscle speed of strength generation (SSG) and/or ankle proprioception in people with diabetes both with and without peripheral neuropathy would affect accelerator pedal control on a driving simulator.

Methods

Fifty-four active drivers, 15 with DPN (DPN, aged 66±6.0yrs), 25 with diabetes but no neuropathy (DM, aged 62±8.7yrs) and 14 controls without diabetes (C, aged 58±10yrs), undertook a maximum isometric test of the plantarflexor muscles and a proprioception test of the right ankle joint using a dynamometer, in addition to a driving task using a driving simulator. We measured SSG (Nm/s), proprioception error values (degrees) and accelerator pedal position (degrees) from these tests, respectively.

Results

The DM and DPN groups showed significantly lower values for SSG with respect to C (DPN: 80.9±58.4; DM: 134.2±89.3; C: 233±135.4 Nm/s; $p<0.05$). The DPN group showed the highest proprioception error (DPN: 4.7±0.7; DM: 3.2±0.5; C: 3.2±0.68 deg; $p>0.05$), and the lowest value of accelerator pedal displacement during the driving test (DPN: 1.8±0.8; DM 3.1±0.6; C: 2.9±0.7 deg; $p>0.05$) compared to DM and C groups.

Conclusions

Whilst not affecting people with diabetes without neuropathy, reduced ankle joint proprioception together with a slower production of plantarflexor muscle strength seems to influence accelerator pedal control during a driving simulation task in people with DPN.