The Temple Diabetic Driving Study: Parts II and III

Kerianne E. Spiess, DPM, Laura E. Sansosti, DPM, and Andrew J. Meyr, DPM FACFAS*  
*Resident, Temple University Hospital Podiatric Residency Program  
Associate Professor and Residency Program Director, Department of Podiatric Surgery, Temple University School of Podiatric Medicine and Temple University Hospital, Philadelphia, Pennsylvania (Alldoey@gmail.com)

Statement of Purpose and Literature Review

The effect of lower extremity pathology and surgical intervention on automobile driving function has been a topic of contemporary interest in the orthopedic literature. Several authors have published general guidelines and produced original data on the return to safe driving following lower extremity surgery [1-3]. Others have specifically studied the effect of chronic musculoskeletal lower extremity pathology, the use of immobilation devices, the effect of major limb amputation, and the general effects of diabetes and hypoglycemia on driving outcomes [4-6].

The Temple Diabetic Driving Study: Parts II and III


Part II: A comparison of mean brake response time in diabetic drivers with and without foot pathology.

Methodology

Part II Table: Outcome measure results

<table>
<thead>
<tr>
<th></th>
<th>Controls Without Neuropathy</th>
<th>Controls With Neuropathy</th>
<th>Diabetics Without Neuropathy</th>
<th>Diabetics With Neuropathy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Brake Response Time (seconds)</td>
<td>0.72±0.15</td>
<td>0.73±0.17</td>
<td>0.75±0.14</td>
<td>0.77±0.15</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.16±0.16</td>
<td>0.14±0.14</td>
<td>0.10±0.10</td>
<td>0.12±0.10</td>
</tr>
<tr>
<td>Number</td>
<td>160</td>
<td>160</td>
<td>200</td>
<td>200</td>
</tr>
</tbody>
</table>

Part III Table: Outcome measure results

For Part III of the investigation we further expanded data collection in the group of diabetic drivers to include all active diabetic drivers, with and without neuropathy or lower extremity surgery, who defined themselves as active drivers. Neuropathy was defined utilizing the Michigan Neuropathy Screening Instrument (MNSI) which is a validated measure of diabetic neuropathy encompassing sensory, motor and autonomic components. The instruments are available in 5 forms for each leg and both forms are used for both limbs, with scores of 2.5 defining neuropathy [11].

A priori power analysis was calculated to ensure appropriate sample size within groups. Comparative statistical analyses performed on the primary outcome measure (mean brake response time) employed the independent Student's t test.

Part II: Table: Outcome measure results

For Part II of this investigation we compared a control group of 25 active diabetic drivers with lower extremity neuropathy but no history of specific diabetic foot pathology (n=160 trials) to an experimental group of 25 active diabetic drivers with and without neuropathy (n=200 trials). We think that the results of this investigation demonstrate both clinically and statistically significant findings, and further add to the body of knowledge with respect to potentially impaired driving function in diabetic patients. We also think that these subsequent studies demonstrate an interesting progression of a scientific hypothesis. We had initially (Part I) compared a group of neuropathic diabetic drivers to a control group of drivers with neither diabetes nor neuropathy. But either diabetes, diabetic neuropathy, a combination of the two, or another confounding variable could have been responsible for the observed differences.

The third part subsequently hypothesized that diabetics with neuropathy complicated by the specific onset of foot pathology (amputation and Charcot neuropathy) would perform worse than diabetics with neuropathy but without foot pathology. However, the observed mean in both groups was slower than the suggested safety threshold of 0.700 seconds.

Discussion

The results of this investigation demonstrate that diabetic neuropathy may have a negative effect on driving performance. Although this provided original and unique data on potentially impaired diabetic driving function, two acknowledged limitations of our original investigation were 1) demographic differences between the control and experimental groups and 2) heterogeneity within the experimental group. This provided a clear opportunity to expand upon our original hypothesis and further elucidate the effects of diabetes on driving.

The objectives of these case-control investigations were 1) to compare mean brake response time between two groups of diabetic drivers with diabetes but with and without lower extremity sensorimotor neuropathy and 2) to compare mean brake response time between neuropathic diabetic drivers with and without specific diabetic foot pathology.

In conclusion, the results of this investigation provide further data with respect to slow brake response times and potentially impaired driving function in diabetics with lower extremity neuropathy.