Functional outcome in people with diabetic neuropathy at different stages of complications

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INTRODUCTION

Diabetic neuropathy (DN) frequently leads to ulceration and these patients have an increased risk of lower limb amputation [1,2]. Limited knowledge exists on the functional outcome at various stages of this process. The aim of this study is to investigate multiple aspects of functional outcome/mobility of patients with DN at different stages of complications with trans-tibial amputations (TTA) as the last stage.

METHODS

To date in this ongoing study, 24 subjects with DN and no history of ulceration (control group), 13 with DN and a current plantar ulcer, 9 with DN and partial foot amputation and 21 with DN and unilateral trans-tibial amputation were studied. Informed consent was obtained and functional status was assessed based on the fundamental activities of mobility, largely focused on walking. Physical activity was recorded using Stepwatch Activity Monitors. Patient's perception of mobility was assessed with a self-administered Rivermead Mobility Index (RMI). Plantar pressure was measured with the Pedar in-shoe system while participants walked at their self-selected pace. Gait parameters were measured using digital video. Total Heart Beat Index (THBI), as an indicator of functional capacity/energy expenditure, was measured with a Polar Heart Rate Monitor. Statistical differences between the TTA group and the control group, matched on marginal distributions (age, gender, height, weight), were tested by means of independent t-tests ($\alpha = 0.05$). The other two groups were not sufficient in number and not sufficiently matched to be included in the inferential statistical analysis.

RESULTS AND DISCUSSION

Average daily strides were significantly reduced in the TTA group compared to controls (Table 1). The other two groups showed intermediate activity levels in comparison (Figure 1). Subject's own perception of level of mobility (RMI), gait velocity and functional capacity (THBI) were all significantly different between the TTA group and the controls. Daily plantar cumulative stress [3] was significantly reduced for the TTA group. However, peak pressure over the MT1-2 region was not significantly different between these two groups (Table 1). This also applied to other foot regions but these results are not reported here.

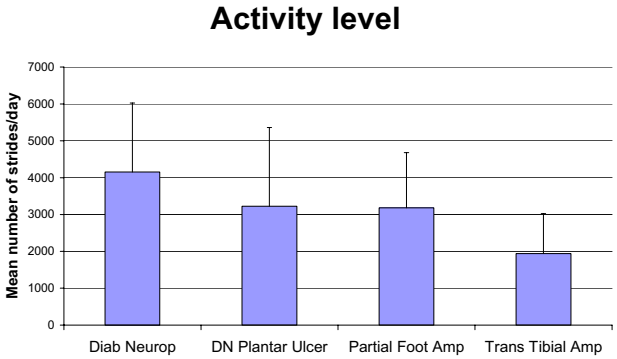

Figure 1: Activity levels measured as a one week average of number of strides per day. Mean and standard deviations are shown for four groups of subjects with DN.

CONCLUSIONS

All groups in this study demonstrated relatively low to very low levels of activity compared to normative values from healthy subjects [3]. Reduced physical activity levels and reduced walking speed seem to limit plantar loading in the TTA group. However, the surviving foot may be at risk of plantar ulceration if functional performance is improved during rehabilitation. This may also apply to the groups at other stages of complications. Therefore, efforts to increase fitness and activity levels should not occur at the expense of foot injury prevention.

REFERENCES

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ACKNOWLEDGEMENTS

Thanks to Michelle Evans, Tim Rebeiro, Jo Burton, Vanessa Davies, Jane Lewis and Scott Cawley for their assistance.

Table 1: Summary of results comparing the control group with DN and no complications and the trans-tibial amputation group.

	Control group Mean (SD)	**TTA group** Mean (SD)	**p**
Activity level (Average strides/day)	4155 (1869)	1941 (1084)	0.001*
RMI (score out of 15) - median	15 (9-15)	11.5 (8-14)	0.001*
Gait velocity (m/s)	1.11 (0.22)	0.76 (0.14)	0.001*
Peak pressure 1-2 MT (kPa)	301.6 (72.3)	316.3 (91.8)	0.574
Daily Plantar Cumulative Stress (MPa /day)	505.7 (235.7)	355.6 (211.1)	0.038*
THBI (beats/m)	1.27 (0.48)	1.71 (0.49)	0.005*

* Significant ($p \leq 0.05$)