

Diabetic Polyneuropathy affects the Braking Forces during Walking

Hans H.C.M. Savelberg¹, Nicolaas C. Schaper², Paul J.B. Willems¹, Ton L.H. Dd Lange³, Kenneth Meijer¹

¹ Nutrition and Toxicology Research Institute Maastricht, Dept. Health Sciences, Universiteit Maastricht ²Cardiovascular Research Institute Maastricht, Academic Hospital Maastricht and ³Fontys School of Higher Education, Eindhoven, The Netherlands.

Diabetic polyneuropathy is associated with reduced muscle function. Moreover, an increased incidence of foot ulceration is found in patients with diabetic polyneuropathy. Increased plantar pressure is recognized as one of the determinants of foot ulceration. Gait studies on elderly have provided evidence that a reduced muscle function affects the distribution of joint moments. Such a redistribution will influence the loading of the foot sole. The aim of this study was to test the hypothesis that reduced muscle strength in patients with diabetic polyneuropathy causes a redistribution of joint moments that is associated with increased plantar pressure patterns. In this study 10 healthy elderly (HE), 10 diabetic people without polyneuropathy (DB) and 8 persons with diabetic polyneuropathy (DPN) were included. To assess muscle function maximal plantar and dorsal flexor strength was assessed. Moreover plantar pressure and joint moment patterns were analyzed, while subjects walked at 1.4 m/s.

Strength of plantar and dorsal flexors was significantly reduced in DB and DPN subjects compared to HE. DPN was associated with significantly increased plantar flexion moments and reduced knee extension moments during the first half of the stance phase. Moreover it was found that in DPN patients pressure under the forefoot increased while that under the heel was reduced.

The redistribution of joint moments that is found in DPN is to be interpreted as a reduction of the braking impulse during the initial part of the stance phase. As a consequence of this, the centre of pressure will travel faster to the forefoot and remain there for a longer period, resulting in the increased load of this part of the foot.

This study shows that there is an association between muscle strength, gait performance and plantar pressure patterns.