A New Classification of Diabetic Gait Pattern Based on Cluster Analysis of Biomechanical Data

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Abstract

Background:

The diabetic foot, one of the most serious complications of diabetes mellitus and a major risk factor for plantar ulceration, is determined mainly by peripheral neuropathy. Neuropathic patients exhibit decreased stability while standing as well as during dynamic conditions. A new methodology for diabetic gait pattern classification based on cluster analysis has been proposed that aims to identify groups of subjects with similar patterns of gait and verify if three-dimensional gait data are able to distinguish diabetic gait patterns from one of the control subjects.

Method:

The gait of 20 nondiabetic individuals and 46 diabetes patients with and without peripheral neuropathy was analyzed [mean age 59.0 (2.9) and 61.1(4.4) years, mean body mass index (BMI) 24.0 (2.8), and 26.3 (2.0)]. *K*-means cluster analysis was applied to classify the subjects' gait patterns through the analysis of their ground reaction forces, joints and segments (trunk, hip, knee, ankle) angles, and moments.

Results:

Cluster analysis classification led to definition of four well-separated clusters: one aggregating just neuropathic subjects, one aggregating both neuropathics and non-neuropathics, one including only diabetes patients, and one including either controls or diabetic and neuropathic subjects.

Conclusions:

Cluster analysis was useful in grouping subjects with similar gait patterns and provided evidence that there were subgroups that might otherwise not be observed if a group ensemble was presented for any specific variable. In particular, we observed the presence of neuropathic subjects with a gait similar to the controls and diabetes patients with a long disease duration with a gait as altered as the neuropathic one.

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