Foot deformities classification through kinematics-kinetics-plantar pressure data: cluster analysis.

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Summary: Understanding diabetic neuropathics (DN) gait disorders is important in order to prevent foot ulceration formation. Until now DN foot biomechanics alteration have been highlighted comparing them with generic control groups. The present study promote a patient classification based on the type of foot in order to highlight gait alteration derived from neuropathy rather than those related to foot morphology.

Conclusions: The comparison between DN and normal subjects organized in homogeneous groups allowed better understanding of biomechanics alteration related to diabetic foot. An automatic homogeneous groups classification was obtain through cluster analysis for most of the biomechanics variables.

Introduction: DN leads to nerve degeneration and reduced muscle innervations. Together with vasculopathy develops into a foot disease which may lead to callosity and ulcers.

Patients/Materials and Methods: Kinematics, kinetics and plantar pressure data of 35 subjects (14 normal (C), 9 diabetics (D), 12 DN) have been collected by means of 6 cameras BTS Srl. motion capture system (60–120 Hz) synchronized with 2 Bertec force plates (FP4060−10) and 2 plantar pressure plates (Imago). A 3D fullbody and foot marker set was used and gait and posture analysis performed [1]. Five homogeneous groups were created: cavus foot (CF), CF and valgus (V) heel, CF and normal heel, CF and normal hallux, CF and V hallux. 3D subsegments forces, plantar pressure, contact surface and joint rotation angles ranging from 30 ms-1 to 70 ms-1. One of the pre-determined instantaneous distance curves from the carpet to the balloon in the coronal plane were plotted together with instantaneous distance curves from the carpet to the balloon in the transverse plane rotation and sagittal plane tilt of the pelvis was determined by tracking the movement of 3 reflective markers attached to the PSIs and the sacrum using 8 Vicon 612 cameras. Transverse plane rotation and sagittal plane tilt of the pelvis drove the carpet sideways and vertically towards balloons appearing at random positions. The subjects undertook a number of trials over a pre-determined set of trajectories with difficulty ranging from 30 ms-1 to 70 ms-1. One of the pre-determined trajectories was selected for analysis, which ensured the subject was tilting and rotating the pelvis simultaneously. Averages of all instantaneous distance curves from the carpet to the balloon in the perpendicular plane were plotted together with standard deviation (SD) indicating variability of performance which was quantified to excessive ML forces mostly on forefoot (FF). The 2nd showed a delay in the peak FF forces, excessive peak vertical forces, a supinated FF with excessive abduction and plantarflexion on push off phase.

Discussion: Comparison with heterogeneous nb revealed that ML forces and peak plantar pressure were the variables subjected to major misleading interpretation. Therefore type of foot related alterations may be taken into account in foot orthosis prescription.

References

The effect of game speed on performance during core control training

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Summary: Children with cerebral palsy (CP) have reduced selectivity of muscle control including core muscles around the pelvis and spine. The aim of this study was to determine how game difficulty affects performance in a virtual reality (VR) game, which was shown to have a good potential to improve core control. Findings of this study will inform how the game can be adapted for patients with CP.

Conclusions: Performance deteriorates as game difficulty increases but there is some inter-subject variability. Adjustment of game velocity appears to be a simple and effective means of customising task difficulty as a function of patients’ motor ability during rehabilitation.

Introduction: Virtual rehabilitation provides participants with repetitive practice, feedback about performance, and motivation to endure practice (Holden, 2005). Motivation comes in way of finding a level of difficulty which is not too hard to make someone give-up, but not too easy to lose interest. Barton et al. (2006) developed a VR game in which a magic carpet is flown through a virtual world being driven by movement of the pelvis towards balloons appearing at random positions to quantify core control. The set level of difficulty used for this task was probably too low for the healthy control and too high for a patient with CP. The aim of this study was to discover the relationship between performance and difficulty set by increasing game velocity in VR.

Patients/Materials and Methods: Four healthy male volunteers (19–23 years) were trained to play the magic carpet game at a default level of difficulty. Visual feedback for subjects about their movement was generated by the CAREN system (MOTEK, Amsterdam, The Netherlands). Three dimensional orientation of the pelvis was determined by tracking the movement of 3 reflective markers attached to the PSIs and the sacrum using 8 Vicon 612 cameras. Transverse plane rotation and sagittal plane tilt of the pelvis drove the carpet sideways and vertically towards balloons appearing at random positions. The subjects undertook a number of trials over a pre-determined set of trajectories with difficulty ranging from 30 ms-1 to 70 ms-1. One of the pre-determined trajectories was selected for analysis, which ensured the subject was tilting and rotating the pelvis simultaneously. Averages of all instantaneous distance curves from the carpet to the balloon in the coronal plane were plotted together with standard deviation (SD) indicating variability of performance which was quantified