Abstract

Introdution and aim of study

The objective of the research was to estimate the component value (of potential and kinetic energy) as well as the total external work needed for lifting and accelerating centre of mass COG, the level of mechanical energy recovery in the model of inverted length-adjustable pendulum, in the gait of patients suffering from HD before and after applying therapy, and compare them to the results of healthy people moving with natural speed. The research also helped to ascertain if the values of kinetic variables found with those suffering from degenerative CSN make it possible to identify the characteristic malfunctions and common features of gait of those suffering from HD, as well as to find if these values can be utilized to establish remedial procedures that will reduce gait disorders.

Methods, background and settings

The research was carried out as part of the registry project, with a group of HD patients registered in European Huntington's Disease Network. The research into the gait of the control group and the gait of HD patients was carried out in Pracownia Biokinetyki Zakładu Biomechaniki in Akademia Wychowania Fizycznego in Cracov.

Thirty patients aged 43.4±13.5, with average body weight and height of respectively 61,6±13,9 kg and 1,62±0,11 m were qualified for the research. The control group comprised 30 healthy people of similar age (45,7±9,5), with average body weight and height of respectively 67,7±12,7 kg and 1,64±0,34 m, displaying similar temporal and spatial parameters to those of the HD patients.
The natural velocity gait of the two groups was examined twice (before and after a three-week hospital based mobility enhancement treatment) by means of Vicon 250 3D movement analysis.

The data collected within the HD group before and after mobility enhancement were compared with the kinematic and kinetic variables collected within the control group

The gait of both groups was registered in Pracownia Biokinetyki, AWF in Cracov, on a twenty-metre gait examination track, after an adaptation exercise consisting in a free walk with markers stuck on the anthropometric points.

Results and Conclusions

It was observed that the HD patients' pattern of spatial movement of centre of mass was different from the healthy people's stereotypical centre of mass movement. The main difference consisted in a statistically significant restriction of ΔOSCZ_std and ΔOSCX_std gait cycle oscillation, as compared to the results of the control group. The graphs showing the vertical and lateral changes of centre of mass in the cycle in HD1 and HD2 groups did not meet the similarity criteria for the graphs of the control group.

The values of the components of potential (ΔEp_std) and kinetic (ΔEky_std) energy (in comparison of HD1 and control group), the total external work (ΔEc_std) as well as the level of mechanical energy recovery in the model of inverted length-adjustable pendulum during walking, were different between the HD group and the healthy control group. The average values of the control group

were remarkably higher than those of the HD group. As regards the resultant kinetic energy (ΔEk_std) no significant differences between the groups were noticed.

Analysis of gait cycle curves, allowed to indentify important periods and events for neural coordination of gait cycle, diffrent from physiological pattern. Changes of gait pattern included relativ previous time of foot contact, highest level of COM in MST phase and the end of single suport TST phase, and both dubble suport phases.

The findings of the research will allow the establishment of remedial procedures that will improve the pattern of movement of HD patients and ensure a more physiological movement stereotype.