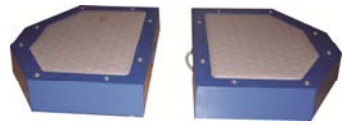
Concurrent measurement of lower limbs stability in balance examinations

Mariusz Strzecha, Henryk Knapik**, Paweł Baranowski***, Jan Pasiak****,*

** Katedra Wychowania Fizycznego i Zdrowotnego, Wydział Nauczycielski, Politechnika Radomska, Polska*
*** Katedra Ergonomii, Protetyki i Ortotyki, Akademia Wychowania Fizycznego, Katowice, Polska*
**** Centrum Rehabilitacji im. prof. M. Weissa "STOCER", Konstancin – Jeziorna, Polska*
***** Katedra Badań Operacyjnych i Ekonometrii, Politechnika Radomska, Polska*

Introduction

A man moves his body weight from one limb to the other one. This is visible through permanent change of value with which left and right lower limb force on supporting plane. This phenomenon is called balancing. Balancing can be measured by frequency and amplitude of changes of pressure forces during moving the body weight from one limb to another.



Picture 1. Two platform stabilographical scale

A man also changes distribution of pressure forces acting on the supporting plane. It is visible through the change of location of points of application of resultant force of base, coming from lower limbs: right (center of pressure leg right - COPLR) and left (center of pressure leg left - COPLL). It is confirmed by measurement of pressure force as well as assigned points of statokinezjograms.

Results & Discussion

This article indicates the necessity of performing concurrent measurement of separate actions of lower limbs during examination of balance. Such a method of measurements ensures two platform stabilographic scale

The owner of the company constructed this device and software, which performs tasks worked out with the coauthor of this publication Mr. Strzecha.

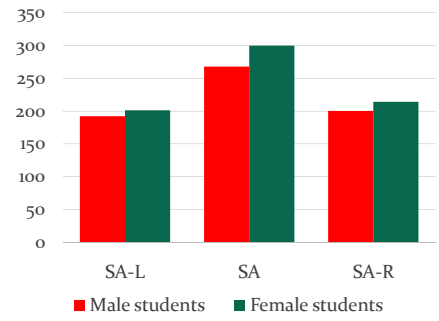
One platform posturograph registers signal describing relocation COP. Two platform stabilographic scale offers widen possibilities. It registers the same parameters as one platform posturograph, moreover it registers signals describing relocation of points of application of plane force coming from right (COPLR) and left lower limb (COPLL).

Posturograph	Right platform	One platform	Left paltform
Examined person	COP_{LL}	COP	COP_{LR}
A			
B			

Table 1. The results obtained in examinations preformed on one and two platform stabilograph

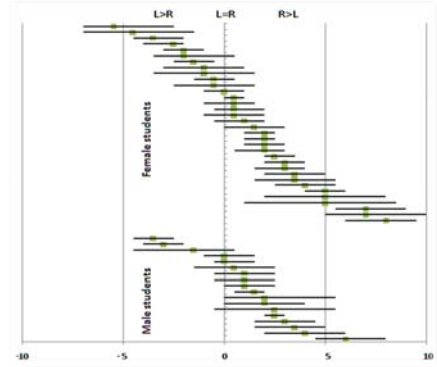
	eyes	COP_{LL}	COP	COP_{LR}
opened				
closed				
RQ		1,25	1,56	0,68

Table 2. Romberg coefficient's value of examined person (an example)



The average value of the sway area (SA) measured in standard way (graph over) is much bigger than the values measured separately for left (SA-L) and right (SA-R) lower limb. The difference between female and male group of students is also visible. In both groups the average value of the sway area measured by relocating COPLL are smaller than the one for COPLR indicating higher stability of left lower limb.

Meaningful differences between sway area (SA) measured in the standard way and sway area measured separately for left lower limb (SA-L) and right lower limb (SA-R) reach 30% and are arising from continuous shifting body weight from one to other lower limb by persons.



The balancing phenomenon of continuous shifting the body weight from one to another lower limb shows graph over. On the per cent scale there are placed the results of persons, represented by an interval and a point (square). The interval represents the range of the balancing for each person indicating range between minimal and maximal percentage load of lower limbs determined during the examination. The square on the interval indicates the average value of balance measurement determined during the entire examination from each sampling period (frequency 200Hz).

Conclusions

Essential innovation is also the change in the mechanical construction of the platform scale enabling reciprocal shifting of the platform's location. Such a solution created the possibility of performing examinations in positions characteristic for sport's discipline.

Presented new method of measurement of balance enables measurement of weighting symmetry of lower limbs. Presented set of tests used for measurement of weighting symmetry of lower limbs and influence of visual perception on their results.

In pilot study preformed with the set of these tests following observations were made: meaningful differences between sway area value of statokinezjograms measured by COP and sway areas value of statokinezjograms measured concurrently and separately for both left and right lower limbs, much higher load placed on the right than on the left lower limb, meaningful disproportions in stability between left and right lower limb.

Artykuł opublikowany:
Strzecha M., Knapik H., Baranowski P., Pasiak J. (2008) Concurrent measurement of lower limbs stability in balance examinations. Current research in motor control - from theory to clinical aplication. Katowice. AWF.

More information
about posturograph can be found at
www.koordynacja.com.pl

The authors can be contacted at: e-mail: **strzecha@konto.pl** tel.: **606-592-153**