

BAROPODOMETRY MEANS OF QUANTITATIVE EVALUATION IN POSTURAL BALANCE RECOVERY OF PERSONS WHICH SUFFERED A STROKE

Danelciuc Francisc Tadeus¹

¹The Chronicle of Neuropsychiatric Hospital from Siret, Romania

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Summary

Coordinative capacities are manifesting under different forms, one of them being the ability of balance, with a decisive role in static, walk, in daily activities of persons after stroke. The study conducted aims to highlight the benefits that can be provided with appropriate equipment and judiciously used in people after stroke, to assess postural balance using baropodometry and also training it using the MBT physiotherapy device

Introduction

Cerebrovascular diseases are a major public health problem, ranked second in Europe after cardiovascular disease. The rehabilitation of patients diagnosed with CVA require long-term programs and care, with increased costs for society.

Even though the methods of recovery after stroke are customized depending on the patient, the goal is the same, namely: the acquisition of a functional status which allows: independence, accommodation with the mental and physical changes caused by stroke, integration into family and society.

Of the most common disabilities after stroke can be mentioned: motor and sensitivity disorders, perception disorders, thinking and communication problems, emotional problems. The most important are the motor disorders represented by muscle weakness, impossible / difficult mobilization of a member, muscle fasciculation, accompanied

by the disappearance of sensitivity for painful stimuli, mechanical, thermal.

In stroke recovery it is very important to assess what percentage of the brain is affected and its ability to take over the deficit neurological functions of normal brain.

Disability and ability to recover after stroke depend on the affected area of the brain (in the sphere of dominant / nondominant), area / areas of the brain affected, surface and depth of brain lesions, and associated diseases.

Balance plays an essential role in recovery (static, walking, etc) which is recognized by most experts in the field of rehabilitation. Balance is a component of the coordination abilities, which after Blume (1981) cited by R. Mano (1992) are arranged in a system. Due to disturbance factors balance can be changed or even lost, its recovery is possible through a complicated exertion of postural control due to selection and adjustment of muscle control schemes (Sbenghe, 2002, p. 337).

By the same author, postural control is achieved by using three primary sources of information: sensitive somatosensory receptors (extero or proprioceptors), visual receptors and vestibular receptors.

The stability of a body depends on factors such as: position of the center of gravity projected to the bearing surface, weight and height of the center of gravity to the supporting surface (Hay, 1980 pg.154-157).

Maintaining balance a certain period of time depends on several factors some of which are genetically conditioned, reflexes have an important role in this aspect (Bota, 2002 pg.391-393). So stability can be developed through exercises designed for this purpose and also transfer through the use of exercises, used for other purposes than improving balance.

Purpose

The present study aims to determine whether the MBT physiotherapy device can be used successfully in balance recovery on post stroke patients using baropodometric evaluation.

Material and method

The research was conducted on a sample of 86 patients (group representing experimental group) with post stroke hemiparesis hospitalized consecutive in BFKT section of Suceava County Hospital, in the period October 2013 - September 2014. The patients included in the study had an average age of 57.6 ± 7.8 years. Among them were 50 men and 36 women. The control group consisted of 20 people

MBT technology composition:

- *baropodometric plate* (Fig. 1) represents a postural assessment platform from which information is transferred on the computer monitor regarding the exercised pressures, the plant surface and the oscillations of the center of balance of the person that is on the platform. Access to this information has as effect management/control on the development of postural control stability and also and quality of carrying out steps;

- *MBT physiotherapy device* (Fig. 2) - the recovery MBT device is represented by the fact that is raised in the heel and has a curved rim. Behind it, on the heel area, MBT device offers a rolling ramp, so-called Heel Sensor (or Masai Sensor). Unlike the tip of a stable heel of a typical shoe, this one is very flexible/soft, so that the patient can be guided by the device. Having information (desktop screen) on the state of balance while performing exercises - without moving, leads to the realization of a self-control creating a biofeedback which contributes to correcting movements, increased capacity to maintain balance during static and dynamic action.



Fig. 1



Fig. 2

Result interpretation

The parameters of the evaluation baropodometric platform were analyzed separately in the group of patients with right and left hemiparesis, and compared to the values obtained in the control group. Our study showed statistically significant differences between the experimental group and the control group on most baropodometric reviewed parameters. (Table 1.)

Table nr. 1 – Baropodometric parameters at patients with right hemiparesis - women

Baropodometric parameters	WITHOUT MBT		P1	WITH MBT		P2
	Control group N=20	Experimental group N=36		Control group N=20	Experimental group N=36	
SPD(cm ²)	97,25	106,125	> 0,05	101	98,75	<0,05
SPS (cm ²)	91	100,125	> 0,05	91	95,8	<0,05
PBD (kPa)	53,925	43,7625	< 0,05	65,1	54,685	<0,05
PBS (kPa)	46,7	57,7	> 0,05	67,3	66,835	<0,05
PBA (%)	53,4	51,85	<0,05	57	56,17	<0,05
PBP (%)	46,933	48,15	>0,05	43	43,83	<0,05
PBLS (%)	55,86667	55,225	<0,05	51,9	54,83	<0,05
PBLD (%)	44,13333	44,775	<0,05	48,1	45,37	<0,05
PBSA (%)	20,075	29,425	>0,05	33,45	30,82	<0,05
PBSP (%)	24,75	25,8	<0,05	18,45	24,065	<0,05
PBDA (%)	24,275	22,4375	>0,05	23,5	20,065	<0,05

PBDS (%)	30,9	22,3375	<0,05	24,55	24,51	<0,05
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From the assessment of baropodometric pressure it has showed that the control group (patients in trials without MBT) showed statistically significant elevated values compared to the experimental group (with MBT), of the center of pressure deviation, towards the left unaffected lower limb. This deviation was observed in 29 patients, representing 76.32% of the cases. In 6 patients, representing 15.8% of patients, the deviation center of pressure was normal, and in 3 patients (7.9%) the deviation was towards the paretic side. As represented in Tables 1 and 2 there were also statistically significant parameter changes of oscillations values. Other baropodometric parameters showed no statistically conclusive negative growth as compared with the control group. But in tryout without MBT in both groups there were no statistically significant differences between the experimental group and the control group after most of the parameters studied.

Table nr. 2 Baropodometric parameters at patients with right hemiparesis – men

Baropodometric parameters	WITHOUT MBT		P1	WITH MBT		P2
	Control group N= 20	Exp. group N=50		Control group N= 20	Exp. group N = 50	
SPD(mm)	90,25	97,25	> 0,05	100,3	98,125	<0,05
SPS (mm)	88	91	> 0,05	99,3	93	<0,05
PBD (kPa)	60,85	53,925	< 0,05	58,98	55,75	<0,05
PBS (kPa)	55,7	46,7	> 0,05	55,08	53,375	<0,05
PBA (%)	52,65	42,38	<0,05	54,04	51,1125	<0,05
PBP (%)	47,35	57,62	>0,05	45,96	48,8875	<0,05
PBLS (%)	47,075	45,16	<0,05	49,42	47,25	<0,05
PBLD (%)	52,925	54,96	<0,05	51,12	52,75	<0,05
PBSA (%)	25,675	20,075	>0,05	25,82	75,0625	<0,05
PBSP (%)	21,4	24,75	<0,05	21,44	20,3125	<0,05
PBDA (%)	26,95	24,275	>0,05	27,35	24,175	<0,05
PBDP (%)	25,95	30,9	<0,05	25,4	28,575	<0,05

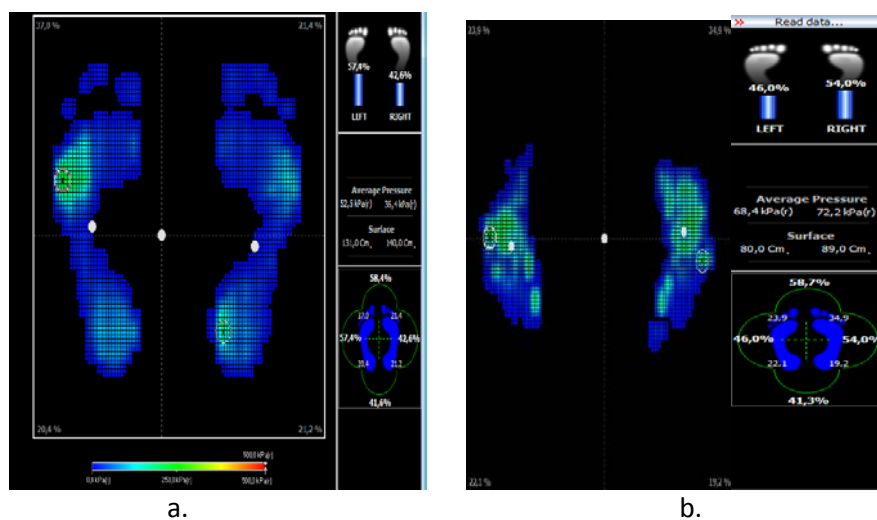


Fig. 1 Baropodometry with (b.) and without (a.) MBT

Table nr. 3 **Baropodometric parameters evolution with CP oscillations in right hemiparesis**

Oscillations	WITHOUT MBT		P1	WITH MBT		P2
	Medium group	Light Group		Medium group	Light group	
OLS	-2,09667	-1,2775		-1,675	-2,355	
OLD	3,343333	0,64125		1,435	2,471	
OA	9,67	4,0125		7,86	9,4595	
OP	-7,42	-5,24875		-10,18	-6,4905	

Table nr. 4 **Baropodometric parameters evolution with CP oscillations in left hemiparesis**

Oscillations	WITHOUT MBT		P1	WITH MBT		P2
	Medium group	Light Group		Medium group	Light group	
OLS	-2,35333	-1,82625		-0,885	-2,4315	
OLD	1,613333	1,34625		1,685	2,5015	
OA	8,14	4,0575		6,355	11,6075	
OP	-6,89667	-5,6		-5,2	-	

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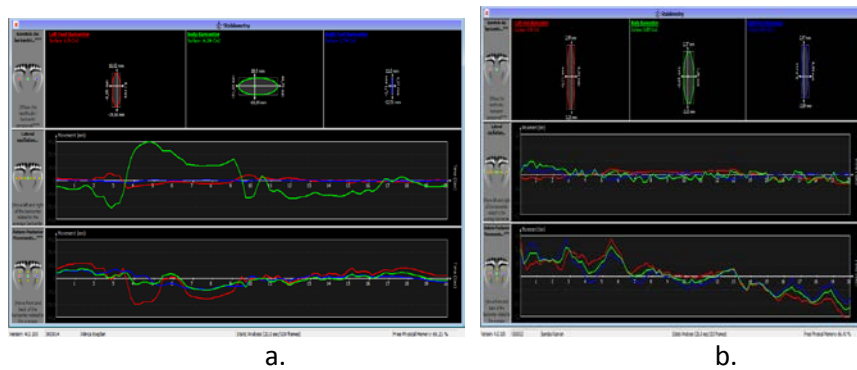


Fig. 2, Center of gravity oscillations on each inferior limb

The analysis of the results allows to conclude that most examined patients formed normostable type of static postural balance. Above are presented images with baric pressures of plantograms (Fig. 1 a and b) and the degree of pressure oscillations of the center of each inferior limb in a patient with right hemiparesis and one with left hemiparesis. (Fig. 2 a and b).

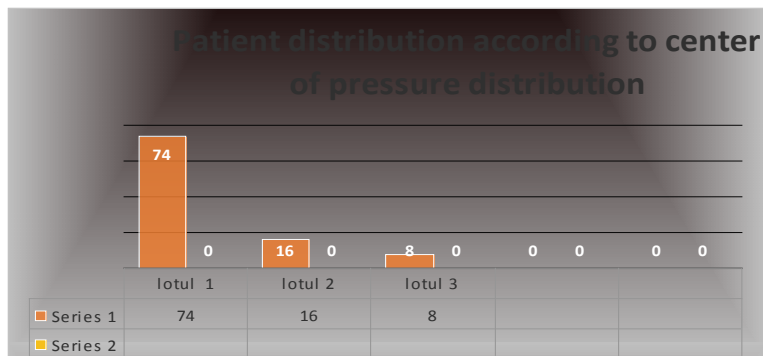


Fig. 3. Patient distribution according to center of pressure

group 1 - deviation to the affected side, group 2 - normal, group 3 - deviation to the affected side

Baropodometric research conducted in this study demonstrated that most patients with post stroke hemiparesis ensure static stability of the body in upright position by moving the center of pressure toward the unaffected

limb. But the results of this study showed that there is a group of patients who developed another strategy for ensuring stability in maintaining upright body posture. The data represents a high importance for recovery planning for this type of disease.

Conclusions and motions/suggestions

Like other devices, balance methods of assessment, the baropodometric testing platform can provide important data regarding the postural balance evaluation. These data allow us to perform analyzes on the state of training, parameters of balance manifestation.

As particularly important in the treatment after stroke, balance can be restored. Classic treatment are a solution also new technology gives us other opportunities. Finding new methods and helpful equipment in balance recovering, post stroke statics, must be a constant concern of specialists. Baropodometric platform and MBT physiotherapy device are a device that can evaluate and train retrain a patient.

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**BAROPODOMETRIA MIJLOC DE APRECIERE
CANTITATIVA ÎN RECUPERAREA ECHILIBRULUI
POSTURAL LA PERSOANELE CE AU SUFERIT UN
ACCIDENT VASCULAR CEREBRAL**

Cuvinte cheie: baropodometrie, evaluare, recuperare, echilibru, dispozitiv de fizioterapie.

Rezumat

Capacitățile coordinative se manifestă sub forme diferite, una dintre ele fiind capacitatea de a se echilibra, cu rol hotărâtor în statică, mers, în desfășurarea activităților cotidiene a persoanelor post AVC. Studiul efectuat și-a propus să evidențieze avantajele pe care poate să le ofere un echipament adecvat și judicios utilizat în cazul persoanelor post AVC, pentru evaluarea echilibrului postural cu ajutorul baropodometriei cât și antrenarea lui prin utilizarea dispozitivului de fizioterapie MBT.