Case Studies

The Role of Posturography in Assessing the Process of Rehabilitation in Poststroke Patients—A Case Study

Witold Rongies, MD, PhD,*,† Bartosz Słomka, MSc,*,‡ Angelika Duczek, MSc,‡ and Włodzimierz Dolecki, MSc†

Stroke is one of the most common causes of death and disability both in Poland and around the world. Each year, 250 out of 100,000 people in Europe are diagnosed with a disruption of cerebral perfusion in the form of stroke. In Poland, approximately 65,000-70,000 people are affected each year, with the incidence steadily increasing. Stroke survivors suffer from impaired cognitive and motor functions. Moreover, they exhibit severe gait pattern abnormalities, which together with balance disorders, constitute the main factors increasing the risk of falls in this patient group. Therefore, postural stability and gait assessments in these patients should be an important part of every examination instead of being conducted only for the purposes of physical rehabilitation. Currently, the most common method of postural stability assessment both in the healthy and those affected with a disorder is posturography. The aim of the study was to evaluate selected posturographic parameters in poststroke patients before and after rehabilitation treatment. **Key Words:** Stroke—rehabilitation—postural balance—posturograph—Barthel index—center of gravity.

Introduction

There have been a number of studies demonstrating that patients with damage to the nervous system, and especially to the central nervous system (CNS), exhibit poorer postural stability and an increased sway of the center of gravity (COG).[1-6]

The aim of this study was to evaluate selected posturographic parameters in poststroke patients before and after rehabilitation treatment.

Methods

A 59-year-old male with left hemiparesis due to 4 prior incidents of ischemic stroke in the right cerebral hemisphere (1994, 1998, 1999, 2009), with concomitant type 2 diabetes and hypertension, underwent 3 cycles of rehabilitation treatment at the Rehabilitation Center of Independent Public Central Clinical Hospital in Warsaw in the years 2010-2011 (Table 1). On the patient's qualification for rehabilitation sessions, he was diagnosed with left side pyramidal syndrome manifesting as left hemiparesis (of moderate severity), speech disorder in the form of dysarthria, central paresis of the left facial nerve, and left hemianopsia. Computed tomography scans of the brain showed metasynchronous vascular focal lesions. Doppler imaging of afferent cerebral vessels showed an

From the *Department of Physiotherapy, Rehabilitation Division, II Faculty of Medicine, Medical University of Warsaw, Warsaw, Poland; †Department of Rehabilitation, Independent Public Central Clinical Hospital in Warsaw, Warsaw, Poland; and ‡Department of Neurology, II Faculty of Medicine, Medical University of Warsaw, Warsaw, Poland.

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Address correspondence to Bartosz Słomka, MSc, PhD Programme, Department of Physiotherapy, Rehabilitation Division, II Faculty of Medicine, Warsaw, Poland. E-mail: slomka.bartosz@interia.pl.

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Table 1. *Treatment period characteristics*

Treatment period duration	No. of treatment sessions	Interval between treatment periods
January 6, 2010-January 26, 2010	30	2 months between first and second sessions
March 29, 2010-May 25, 2010	30	4 months between second and third sessions
October 7, 2010-December 22, 2010	15	1 month between third and fourth sessions

atherosclerotic plaque with a possible ulceration in the right internal carotid artery.

Each rehabilitation session was conducted by the same physical therapist and included proprioceptive neuromuscular facilitation exercises, balance exercises, and gait re-education techniques. During intervals between his therapeutic sessions, the patient performed only basic everyday activities and, contrary to recommendations, maintained a sedentary lifestyle. The proprioceptive neuromuscular facilitation (proprioceptive neuromuscular facilitation) was his first outpatient rehabilitation treatment and it was conducted 3 months after the most recent stroke. The purpose of therapy was to improve the patient's performance status. The Barthel index was used for the patient's functional evaluation before and immediately after each rehabilitation period.

The Barthel scale is useful in evaluating a patient's state of independence before treatment, his progress as he undergoes treatment, and his status when he reaches maximum benefit.

The Barthel scale is an ordinal scale used to measure performance in activities of daily living. The scale assesses 10 activities of daily living. Eight items are related to self-care activities: feeding, transfer from chair to bed and back, grooming, toileting, bathing, dressing, bowel and bladder continence. Two items pertain to mobility: walking or propelling a wheelchair, and ascending/descending stairs. It is scored on a 3-point weighted scale ranging from total dependence to total independence in an activity, with the weighted scores summed to give a total score from 0 (total dependence) to 100 (total independence): 0 to 20 points mean total dependence, 20 to 80 points mean that to some extent the patient needs the help of others, and the evaluation of the limit from 80 to 100 points means that with a little help the patient can function independently. Obtaining 40 points or less means that a patient requires constant care.[7]

Static posturography with the WIN POD PEL 38 (Medicapteurs, France) posturography platform, with WIN-POD version 3.81 software, was used to evaluate the extent of postural instability on the first and last days of each rehabilitation period. The evaluated parameters were sampled at a frequency (f) of 100 Hz over 30 seconds, in 4 consecutive measurements, with 60-second intervals of rest in a sitting position. Posturographic assessment was conducted in a comfortable bipedal stance, with the feet bare and the arms motionless and loosely hanging along the body. The first 2 assessments were conducted with the eyes open, whereas the subsequent 2 were conducted with the eyes closed. All pedobarographic assessments were conducted by the same person, in the same lighting, humidity and temperature conditions, and at the same time of day. The following postural stability parameters were evaluated: the amplitude (mm), area (mm^2), and mean velocity (mm/s) of center of gravity sway. All posturographic assessments were conducted according to the established methods. To increase the accuracy and quality of these assessments, we had adopted additional inclusion/exclusion criteria based on our own long experience. Thus, each posturographic assessment was accompanied by patient evaluation in terms of general well-being, medication compliance, the number of hours of sleep, alcohol consumption, physical exertion, experienced pain, any of which could adversely affect postural stability. The assessment exclusion criteria were other musculoskeletal pains (>3 in a visual analog scale), severe foot deformities, taking psychoactive medications on the day of assessment, functional shortening of a lower limb by over 15 mm, general malaise, a lack of declaration of abstinence, and <6 hours of night rest (sleep) in the 24-hour period immediately preceding the assessment. The patient agreed to participate and signed an informed consent form approved by the Bioethics Committee of the Medical University of Warsaw.

Results

In the case presented here, the first posturographic assessment revealed significant postural instability, which was especially prominent without visual control. The analyzed parameters were significantly improved following a 30-day comprehensive rehabilitation period. This improvement in posturographic parameters corresponded to a slight but significant improvement in the patient's functional status assessed in the Barthel scale (before/after 60/75, 70/80, 65/85 points). The next 30-day rehabilitation period, analogous in terms of quality, began after an interval of 63 days. The values of the assessed posturographic parameters prior to the second treatment period were comparable to the baseline ones. After the treatment was completed, we once again observed a considerable improvement in static postural stability. Similar changes accompanied the subsequent treatment periods (Figs 1-3).