Balance Rehabilitation Unit (BRU™) posturography in relapsing-remitting multiple sclerosis

Commented by: Bianca Simone Zeigelboim[1]

Kessler N, Ganança MM, Ganança CF, Ganança FF, Lopes SC, Serra AP, Caovilla HH. Balance Rehabilitation Unit (BRU™) posturography in relapsing-remitting multiple sclerosis. Arq Neuropsiquiatr. 2011;69(3):485-90.

For a long time it was believed that, after its development, the central nervous system (CNS) would become a rigid structure that could no longer be modified, and that lesions to it would be permanent, since its cells could not be regenerated or reorganized. Today it is known that the CNS has great adaptability and there is evidence of plasticity in the attempt to regenerate even the adult brain[1]. Neuronal plasticity is the CNS's ability to modify some of its morphological and functional properties in response to alterations in the environment[1], and it does not occur only due to pathological processes (after neural lesion), which is an extremely important fact in the individual's functional development[2].

There is general consensus in literature about which motor tasks induce plastic and dynamic modifications in the CNS. Practicing motor activities and learning abilities may alter synapses or reduce molecular alterations in perilesional areas[3].

When there is vestibular lesion, the CNS naturally performs functional recovery of the balance disorder through neuroplasticity. Vestibular rehabilitation is considered a therapeutic resource due to its approach, which is based on the central neuroplastic mechanisms: adaptation, habituation and substitution.

Within the variety of protocols existing in the therapeutic procedure of the patient with vestibulopathy, the Virtual Reality Method stands out. Over the past years, some virtual reality systems and force platform used for balance assessment and rehabilitation have been improved. Among them, we highlight the *Balance Rehabilitation Unit* (BRU™), which provides visual stimulus that elicits oculomotor responses of pursuit, of optokinetic and saccadic movements, vestibulo-ocular reflex and vestibulo-visual interaction. This method has the aim to change the postural control system through the experience of several visual environments with congruent and conflicting stimuli. The virtual reality platform enables an illusory world, in which the perception of the environment is altered by an artificial sensory stimulus[4].

The purpose of the study presented by the authors was to assess body balance through posturography using the BRU™ in individuals with relapsing-remitting multiple sclerosis (RRMS). Thirty-nine individuals with RRMS took part of the research and were denominated study-group, while 65 healthy individuals composed the control-group. The posturography module was used in both groups, providing information about the position of the center of pressure through quantitative indicators, the limit of stability area, and the ellipse area through ten different conditions of sensory conflict on the platform, as it follows: 1) standing, with eyes opened; 2) standing, with eyes closed; 3) standing on foam, with eyes closed; 4) standing, with eyes opened, with saccadic stimulation; 5) standing, with eyes opened, with rightward optokinetic stimulation; 6) standing, with eyes opened, with leftward optokinetic stimulation; 7) standing, with eyes opened, with downward optokinetic stimulation; 8) standing, with eyes opened, with upward optokinetic stimulation; 9) standing, with visuo-vestibular interaction – horizontal stimulation; and 10) standing, with visuo-vestibular interaction – vertical stimulation[5].

The authors mentioned that there was no significant difference between the groups regarding gender. As for the assessment of the vestibular system, 76.9% reported dizziness – the exam showed abnormalities in 38.5% of the cases and 5.1% presented central signs. Some authors[6] assessed 30 individuals with RRMS and observed vestibular alterations in 86.7% of the patients: 3.3% of them with central origin and most of them, 96.7%, with peripherical origin. The most prominent alterations in the labyrinthic test occurred in the caloric test.

As for the posturography assessment, the authors of the study mentioned that the result of the limit of stability for the control-group was similar to the one found for the study-group, which indicates that there were no abnormalities in motor coordination while the patients performed the maximum sway of their center of pressure on the platform.

The results of the sway speed and the confidence ellipse of the pressure distribution area of the body center in the ten conditions assessed in the study-group showed significant difference when compared with the control-group. The authors mention that the individuals with RRMS showed worse performance when they were on both the firm and the foam surfaces with eyes closed and in the visuo-vestibular interaction condition. These data indicate that static balance is involved when there is visual deprivation and somatosensory conflict. In addition, disorders in the orthostatic position with eyes opened and closed were detected in the rehabilitation unit.

The authors mention the existence of different posturographic assessment parameters and different classification criteria, and emphasize the importance of considering the difference

(1) Graduate Program in Communication Disorders, Universidade Tuiuti do Paraná – UTP – Curitiba (PR), Brazil.
Correspondence address: Bianca Simone Zeigelboim. R. Gutemberg, 99, 9º andar, Curitiba (PR), Brasil, CEP: 80420-030. E-mail: bianca.zeigelboim@utp.br

among studies regarding the duration of the disease, the neurological capacity and the physical and sensory conditions at the time of the assessment.

Abnormal findings in posturography regarding the sway speed and the confidence ellipse may be useful not only for diagnosis and characterization of the balance disorders, but also to monitor the progress of the disease.

Some researches[7] have applied the Dizziness Handicap Inventory questionnaire before and after vestibular rehabilitation using the Cawthorne and Cooksey protocol in individuals with RRMS, and showed that there have been improvements in the physical, functional and emotional aspects.

The RRMS lesions are diffusely spread through the white matter with preference to some areas in the brain (periventricular and corpus callosum). Vertigo, loss of balance and nystagmus occur frequently due to the involvement of brainstem tracts, spinal cord and optic nerves[8].

In order for patients to gain independence, it is essential to carry out a therapeutic program that incorporates mainly the practice of functional activities for all neurological diseases. It is believed that practicing these activities is one of the elements that allow the clinical evolution of neurological patients, since it interferes in a beneficial way, stimulating neuroplasticity[2].

The authors of this study mention that dizziness is the first sign of the disease in 5% of the RRMS cases, and that posturography may be useful not only to assess damages to the vestibular system, but also to monitor the progress of the disease.

In Brazil, there are few studies about the BRU™ equipment, both regarding its strategy for the posturographic assessment and for the labyrinthic rehabilitation using virtual reality in patients with neurological diseases. It is a more physiological therapeutic method used in patients with balance disorders in the last decade. The virtual reality method has been demonstrated in several international journals as an extremely important tool to potentialize the vestibular neuroplasticity. An exercise program that stimulates the cerebellar neurons from distinct afferent inputs is extremely important, and it can promote an induction of mechanisms related to neural plasticity, which will enable a faster and more effective functional recovery.

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