Journal of Physical Education and Sport ®(JPES),Vol 21 (Suppl. issue 2), Art 157 pp 1234 – 1241, Apr. 2021
online ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 - 8051 © JPES

Original Article

Effect of the goal-oriented physical therapy and ergotherapy tasks and dual task activities on the Berg balance scale and balance indicators in patients with the unilateral neglect

YURII DIDO[1], OLENA DULO[2], RAFAŁ GOTOWSKI[3], IGOR GRYGUS[4]
[1,2]Uzhhorod National University, UKRAINE
[3]WSB University in Toruń, POLAND
[4]Institute of Health, National University of Water and Environmental Engineering, Rivne, UKRAINE

Published online: April 30, 2021
(Accepted for publication April 15, 2021)
DOI:10.7752/jpes.2021.s2157

Abstract
Purpose: to assess the effect of the goal-oriented physical therapy and ergotherapy tasks and dual task activities on balance indicators of the Berg Balance Scale (BBS) in patients with the unilateral neglect. *Materials and methods:* The study involved 58 patients. Stroke patients were randomly divided into main group (MG) (29 individuals) and control group (CG) (29 individuals). The exclusion criteria were scores above 3 on the Scale for Contraversive Pushing and above 14 on the NIH Stroke Scale. Physical therapy of CG patients included proprioceptive neuromuscular facilitation (PNF) (shoulder blade and upper limb patterns), balance sitting and standing training, constraint-induced motor therapy (SIMT) ergotherapeutic intervention, and exercises improving fine motor skills. MG patients used the same balance sitting and standing training, the goal-oriented physical therapy and ergotherapy tasks and dual task activities.The therapy was performed 5 days a week for 14±4.2 days in the rehabilitation room. After that, therapy continued at home 3 times a week with the weekly supervision by the physical therapist for up to three months in both groups. The first assessment was performed on the BBS during the third verticalization of patients. The intermediate assessment done on the 14th day to obtain statistical intermediate results. Three months later, patients had a repeated, final assessment in all domains. *Results* The total score of the BBS comprised 20.0 (13.0; 25.0) pointsin all 58 patients. Thus, the mean value in the sample comprised 33.9% out of the maximum. Therefore, all the patients had a high rate of falls, since there was no higher score than 45.Total balance score in MG patients significantly increased from 19(12.5;24.7)points to 35(22.5;43.5) points ($p<0.05$), whereas CG patients showed positive balance dynamic on the BBS from 21(13;25) points to 40(32.5;46.5) points, however these changes were insignificant, $p>0.05$.At the time of intermediate assessment in both groups, 10.3% of patients scored 45 points and more. At final assessment, the share of such patients increased and comprised 17.2% in CG and 31.0% in MG ($p>0.05$).
Conclusions: Thus, the study confirmed better efficiency of the the goal-oriented physical therapy and ergotherapy tasks and dual task activities, received by MG patients, its impact on balance and coordination restoration, if the balance training programs were the same.
Keywords: physical therapy, ergotherapy, balance training, stroke, rate of falls.

Introduction

One of the main reasons for long-term and profound disability of stroke patients is movement disorders. Movement disorders in the acute period present in 65% of patients, and six months later movement defects persist in 53% of stroke patients. Every third (28.3%) patient needs outside help a year after a stroke. (Ullberg, Zia, Petersson, &Norrving, 2015; Teasell, Foley, Hussein, Salter, Cotoi, & Richardson, 2016; Wist, Clivaz, &Sattelmayer, 2016; Tomanek & Lis, 2020; Gyryavets, &Pulyk, 2019).

Movement disorders lead to gait abnormalities and loss of balance, which, in turn, can cause falls, limbs and head injuries. Depending on the location and the extent of brain morphological changes following a stroke, clinical picture and movement disorders can vary significantly (Arieshyna, Karpenko, &Isakina, 2017;Bondar, 2018; Volkova, &Blazhko, 2017;Dmytruk,&Rokoshevska,2017; Zakaliak, & Sprynska, 2017; Piotrowska, 2019; Żołądkiewicz 2019; Gotowski 2015ab; Yukhymchuk, 2018; Gyryavets, & Pulyk, 2019; Metelski, 2019). It is not explained by only one of a number of factors (Nudo,&Milliken, 1996; Nudo, 2003; Park, Min, Lee, Choi, & Kim, 2016; Park,J.Lee,Chang,A.Lee,Hummel,& Kim,2020; Muhammad, & Hassan 2021), such as the degree of hemiparesis, spasticity, sensory disorders and other types of disorders.

Most patients who have survived a stroke become disabled (70-80%), 20-25% of them requiring assistance from others in daily routines for the rest of their lives (Volkova, & Blazhko,2017;Ullberg, Zia,

Corresponding Author: RAFAŁ GOTOWSKI, E-mail: rgotowski@wp.pl

Petersson, &Norrving, 2015;Mytskan, Edynak, Ostapyak, Grytsulyak, &Mytskan, 2016; Grygus, 2018; Zamergrad, &Khatkova, 2018).

Spatial neglect after stroke is one of the main causes of disability. It also leads to restrictions on independence in daily-life activities, (Lazarieva, 2015; Spaccavento, Cellamare, Falcone, Loverre, & Nardulli, 2017). Hemispatialneglect is a severe cognitive condition frequently observed after a stroke. The symptoms include patient's unawareness of one side of space and disability in long-term perspective (Grygus, 2019; Rossit et al., 2019).

Strokes often lead to loss of patients' balance while sitting and standing, therefore balance is one of the primary things to deal with in stroke rehabilitation. If a person cannot sit, he/she cannot perform activities of daily living, such as dressing, bathing, eating, and maintaining personal hygiene. One cannot learn to stand safely before he/she learns to maintain balance.

Purpose: to assess the effect of the goal-oriented physical therapy and ergotherapy tasks and dual task activities on balance indicators on the Berg Balance Scale in patients with the unilateral neglect.

Material &methods

The study involved 58 patients (29 females and 29 males) diagnosed with the right hemisphere ischemic stroke with the unilateral neglect. All subjects who participated in the study signed an informed consent form. The research was carried out in compliance with the international principles of the Helsinki Declaration of the World Medical Association (World medical association Declaration of Helsinki, 2013), and in accordance with the Law of Ukraine "Fundamentals of Ukrainian Legislation on Healthcare" (Law of Ukraine, 1992) on ethical norms and rules for conducting medical research involving human.

The patients were randomly divided into main group (MG) and control group (CG) according to the ratio of 1:1. The exclusion criteria were scores above 3 on the Scale for Contraversive Pushing and above 14 on the NIH Stroke Scale. Physical therapy of CG patients included proprioceptive neuromuscular facilitation (PNF) (shoulder blade and upper limb patterns), balance sitting and standing training, constraint-induced motor therapy (SIMT) ergotherapeutic intervention, and exercises improving fine motor skills. MG patients used balance sitting and standing training, the goal-oriented physical therapy and ergotherapy tasks and dual task activities.

The following balance exercises,we were used while sitting and standing, were the same in both groups: a) oculomotor exercises; b) exercises aimed to restore dynamic system of balance and coordination; c) gradual transfer from a horizontal position in bed to sitting and standing; d) special exercises to maintain balance sitting on a bed, couch, then on a moving surface (a fitball). Goal-oriented physical therapy and ergotherapy taskswere implemented in sitting and standing positions with a focus on training of daily life activities. As part of dual task activities, they used simultaneous speaking aloud or reading while moving, counting to 10 and back, reproducing associative hints from memory.MG patientstrained the skill of performing ADL on unstable platforms while sitting and standing. Theyalsousedredvisualcues.

The therapy was performed 5 days a week for 14±4.2 days in the rehabilitation room. After that, therapy continued at home 3 times a week with the weekly supervision by the physical therapist for up to three months in both groups.

The first assessment was performed on the BBSduring the third verticalization of patients. The intermediate assessment done on the 14th day to obtain statistical intermediate results. Three months later, patients had a repeated, final assessment in all domains.

Comparison of the efficiency of the combined program of physical therapy and ergotherapy in CG and MG was carried out using the indicators of balance restoration on the BBS.

The materials of the research were processed inStatistica 7.0 (StatSoft, USA) of statistical analysis.Mathematical processing of numerical data was fulfilled with the help of variation statistics. The analysis of correspondence of quantitative indicators distribution to the law of normal distribution was checked by Shapiro-Wilk test (W). Median value (Me), upper and lower quartiles (25%; 75%) were calculated for the indicators with a non-normal distribution. Mann-Whitney U test (for independent groups) and the Wilcoxon signed-rank test (for dependent groups) were used provided the indicators had a distribution other than normal.

Results

CG included 13 males and 16 females, whereas MG included 16 males and 13 females ($p>0.05$). The mean age of CG patients was 69.3±9.77 years, and the mean age of MG patients was 67.9±10.46 years ($p>0.05$). At the initial assessment of CG, 5 patients had satisfactory health condition, 12 patients had health condition close to satisfactory, 6 patients had moderately severe condition, and 6 patients had severe health condition. Among MG patients, 6 patients had satisfactory health condition, 15 patients had health condition close to satisfactory, 5 patients had moderately severe condition, and 3 patients had severe health condition. Statistical analysis did not reveal any significant difference in this distribution of patients ($p>0.05$).

According to the obtained results of statistical analysis, none of the BBS items had normal distribution of results, therefore Me (25%; 75%) indicators were calculated.

The total score of the BBS comprised 20.0 (13.0; 25.0) pointsin all 58 patients. Thus, the mean value in the sample comprised 33.9% out of the maximum. Among the scores obtained in the groups of patients, the

minimum score was 5 points, whereas the maximum one was 32 points. Therefore, all the patients had a high rate of falls, since there was no higher score than 45. It should be noted that the results of items of the BBS in CG and MG did not differ statistically at the initial assessment (Table 1).

After conducting the combined course of physical therapy and ergotherapy, it can be stated that the difference in total group scores was influenced not only by significant advantages revealed only in four items of the BBS, but by the general trand towards the statistical advantages of MG patients as well. Specificities of the studied dynamic should also include the fact that CG patients had no significant dynamic only in item No. 12. Besides, the assessment of the dynamic between intermediate and final assessments on the BBS revealed that not all items of MG patients improved significantly: items No. 2, 5-10, 12, 13 and the total score improved significantly at $p<0.01$; items No. 1, 4, 11, 14 improved significantly at $p<0.05$; item No. 3 did not change statistically between intermediate and final assessments ($p>0.05$). The analysis of CG had the following results: items No. 5, 6, 9-11, 14 and the total score improved significantly at $p<0.01$; items No. 1, 2, 4, 7, 8, 12 improved significantly at $p<0.05$; items No. 3 and 13 did not change statistically between intermediate and final assessments ($p>0.05$) (Table 1).

Table 1. Dynamic of balance restoration on the Berg Balance Scale, points, Me(25%;75%)

Items of the BBS	Main group (n=29)			Control group (n=29)		
	Before rehabilitation	Intermidiate results	After rehabilitation	Before rehabilitation	Intermidiate results	After rehabilitation
1.Sitting to standing	3(3;3)	4 (3,5;4)**	4(4;4)**	3(3;3)	3 (3;3)	3(3;4)
2.Standing unsupported	3(3;3)	4 (3;4)**	4(4;4)**	3(3;3)	3 (3;3)	3(3;4)
3.Sitting unsupported	2(2;3)	4 (4;4)	4(4;4)	2(2;3)	4 (4;4)	4(4;4)
4. Standing to sitting	2(2;2,5)	4 (3;4)**	4(4;4)**	2(1;2,5)	3 (2;4)	3(3;4)
5.Transfers (from bedto chair)	2(1;2)	3 (2;4)	4(3;4)	2(1;2)	2 (2;4)	4(3;4)
6.Standing with eyes closed	2(1;2)	3 (2;4)	3(3;4)**	1(1;2)	2 (1;4)	3(2;4)
7.Standing with feet together	1(1;2)	3 (2;3,5)	3(2;4)	1(0;2)	3 (2;4)	3(2;4)
8.Reaching forward with outstreched arm	1(0;2)	3 (2;3)	3(2;3,5)	1(0;2)	2 (1;3)	3(1;4)
9.Retrieving object from the floor	1(0;1)	2 (1;3)	2(1,5;3)	1(0;1)	2 (0,5;3)	2(1;3,5)
10.Turning to look behind	1(0;1)	2 (2;3)	3(2;3)	1(0;1)	2 (1,5;3)	2(1,5;3)
11. Turning 360 degrees	1(0;2)	2 (2;2)	2(2;3)	1(0,5;1)	2 (0;2)	2(1;3)
12. Placing alternate footon stool	0(0;1)	2 (0;2)	2(0;3)	1(0;1)	1 (0;2)	1(0;2)
13. Standing with one foot in front	0(0;0)	1 (0;2)	1(0;2)	0(0;0)	1 (0;1)	1(0;1,5)
14. Standing on one foor	0(0;0)	1 (0;1)	1(0;1)	0(0;0)	0 (0;1)	0(0;1)
Total score	21(13;25)	37 (27,5;41)	40(32.5;46.5)	19(12.5;24.7)	33 (20;39)	35(22.5;43.5)

Note. * – the difference between the indicators in the process of recovery is statistically significant as compared to control group$p<0.05$; ** – $p<0.01$.

The results of the «Sittingtostanding» item of the BBS at the time of intermediate assessment improved significantly only in MG ($p<0.01$), and a significant difference was found between MG and CG in favor of MG being 4 (3.5; 4) points and 3 (3; 3) points respectively ($p<0.01$).

The final results on this item increased statistically in both groups compared to the initial values, the difference between the groups was significant: in CG was 3 (3; 4) points, and in MG 4 (4; 4) points ($p<0.01$).

The results of the «Standing unsupported» item of the BBS at the time of intermediate assessment was 3 (3; 3) points in CG and 4 (3; 4) points in MG (Table 1).The difference between the groups was significant ($p<0.01$), and the statistical difference between the initial and intermediate results was observed only in MG ($p<0.01$).

The difference between the final results of the groups was significant ($p<0.01$), despite significant positive changes in both groups compared to the initial values ($p<0.01$).

At the time of the intermediate and final assessments, the results of «Sitting unsupported» in CG and MG did not differ significantly ($p>0.05$). In both groups assessments were 4 (4; 4) points.Analysis of the intermediate results of the item "Standing to sitting" found that the indicator significantly improved in both groups ($p<0.01$), but a significant difference between MG and CG in favor of the first group was found at the level of 4 (3; 4) and 3 (2;

4) points, respectively (p<0.01).The final results on this point increased statistically in both groups compared to the initial values, but the difference between the groups remained significant: in CG was 3 (3; 4) points, and in MG was 4 (4; 4) points (p<0.01).At the time of the intermediate assessment according to the BBS the results of "Transfers (from bed to chair)" significantly improved in both groups (p<0.01), but the statistical difference between the results of groups 2 (2; 4) and 3 (2; 4) accordingly not obtained (p>0.05).

The final results on this point remained significantly better than the initial ones in both groups, and no statistical difference was found between the results of the groups: in CG and MGO were similar to 4 (3; 4) points.In the analysis of intermediate results of "Standing with eyes closed" the difference between the groups was not significant (p> 0.05). Me (25%; 75%) indicator was 2 (1; 4) points in CG, and 3 (2; 4) points in MG. At the same time, a statistical difference between the initial and intermediate results was observed in both groups (p<0.01). The difference between the final results of the groups was already significant (p<0.01), despite significant positive changes in both groups compared to the initial values (p<0.01).

At the time of the intermediate and final assessments, the results of the item "Standing with feet together" in CG and MG did not differ significantly (p>0.05). In the intermediate assessment were 3 (2; 4) points in CG and 3 (2; 3.5) points in MG, and the final were similar in both groups of 3 (2; 4) points.

Analysis of the intermediate and final results of “Reaching forward with outstretched arm” and “Retrieving object from floor” found that the indicator significantly improved in both groups (p<0.01), and no significant difference between MG and CG was found.

The intermediate assessment according to the BBS found that the results of "Turning 360 degrees", "Placing alternate foot on stool", "Standing with one foot in front" significantly improved only in MG (p<0.01). The final results on this item were significantly better than the initial ones in both groups (p<0.01), at the same time no statistical difference was found between the results of the groups.

The final results on the item "Standing with one foot in front" remained statistically better compared to the initial values only in MG (p<0.01), and reliable dynamics was not established in CG. However, no statistical difference was found between the groups.The difference between the final results of the groups in the item "Standing on one foot" was not confirmed statistically, and the final indicators remained significantly better compared to the initial values in both groups (p<0.01).

The general assessment of the BBS had the following features of dynamics. The intermediate assessment found that the overall scale score improved significantly in MG (p<0.01) and CG (p<0.05), and statistical difference was not obtained between the results of the groups (p>0.05) (Table 1).

The intermediate assessment according to the BBS total score comprised 33(20;39) in CG and 37(27.5;41) points in MG (p>0.05). The final results on this point were significantly better than the initial ones in both groups (p<0.01), at the same time the statistical difference between the results of the groups was established: the score in CG and MG were 35(22.5;43.5) and 40 (32.5;46.5) points, respectively (p<0.05).

Among the obtained points of the BBS total score at intermediate and final assessments there were patients whose scores were 45 points and higher. At the time of intermediate assessment in both groups, 10.3% of patients scored 45 points and more.

At final assessment, the share of such patients increased and comprised 17.2% in CG and 31.0% in MG (p>0.05). Specificities of patients’ distribution at final assessment, according to the risk of falls, are displayed in Fig. 1.

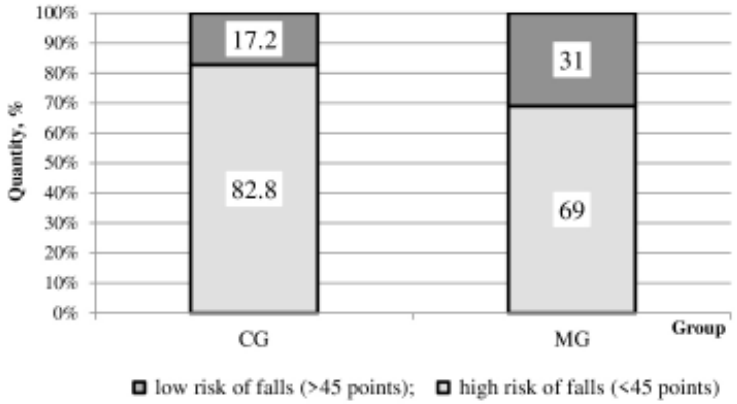

Fig. 1. Distribution of main group (MG) and control group (CG) patients according to the risk of falls on the BBS at the moment of final assessment

Discussion

The initial assessment of patients revealed a high rate of falls in patients who suffered a stroke followed by neglect, as none of the patients scored more than 45 points. Movement disorders reflect patients' inability to stand up independently after sitting, to stand or sit unsupported, as well as loss of balance while stepping or standing. During the course of physical therapy and ergotherapy programs both CG and MG patients showed improvements of all indicators, total balance scores, balance and coordination restoration. At the same time, the comparison of final results of the samples revealed a number of statistical differences in favor of MG patients, as only four items of the BBS had a significant improvement of balance indicators, all of them showed by MG patients, which confirmed benefits of the combined program of physical therapy and ergotherapy they received.
According to the obtained results of the total score of the BBS at the intermediate and final assessments some patients scored 45 points and higher. At the time of intermediate evaluation in both groups, 10.3% of patients scored 45 points or higher. At the final assessment, the share of such patients increased and comprised 17.2% in CG and 31.0% in MG ($p>0.05$).

Thus, the study confirmed statistical advantage in the positive effect of the combined program of physical therapy and ergotherapy (balance sitting and standing training, the goal-oriented physical therapy and ergotherapy tasks and dual task activities.), received by MG patients, on balance and coordination restoration.
Scientific literature presents studies that confirm efficiency of certain interventions to restore patients' balance, as well as high sensitivity, specificity and rating reliability of the BBS to identify patients prone to falls and having disorders of static and dynamic balance and coordination functions.

According toArieshyna, Karpenko, andIsakina (2017), Volkova, andBlazhko (2017), combined use of ergotherapy and physical therapy is one of the best ways for patients to recover after a stroke. Ergotherapy has a positive impact on the degree of recovery of certain functions in post-stroke patients, as well as on the level of their independence while performing major activities of daily living. Rational use of ergotherapy accelerates the recovery of muscle strength, normal joint range of motion, coordinated movements.
According to the studies of Novikova, Akopyan, and Sharapova (2019) the process of rehabilitation treatment implied the development of an individual rehabilitation program for each patient, which included kinesiotherapy, mechanotherapy, physiotherapy, ergotherapy. Thus, the rehabilitation treatment resulted in significant improvement of indicators in the motor function domain, balance and walking functions, and in-hand manipulation.

The studies of Zamergrad, and Khatkova(2018) focused on the treatment of patients with balance disorders caused by a stroke. Effective methods of physical rehabilitation include both regular exercises and exercises aimed to train balance, stability and stamina.
The studies of Park, Min, Lee, Choi, andKim (2016) confirmed benefits of combining proprioceptive neuromuscular facilitation and oculo-motor exercise for balance restoration in patients with neglect as compared to interventions based on oculo-motor exercise alone or a combination of oculo-motor exercise with functional electrical stimulation.

Rossit et al. (2019) hold the 12 weeks randomized controlled study where they compared specialized physiotherapy program outcomes in stroke patients diagnosed with unilateral visual neglect (UVN). The supervised exersice group (SEG, n=10) had three regular standardized sessions per week in the rehabilitation room. The home exercise group (HEG, n=10) patients were given written exercise program and physical therapist encouraged them to exercise on weekly basis throughout the whole intervention. There was no significant differemce in group interaction on the BBS scores ($p<0.05$) after 12 weeks after 12 weeks and throughout the year. Severity of neglect weas highly correlated with the BBS scores ($p<0.05$). The authors stress that patients with UVN may benefit from structured, intensive and progressive physiotherapy programs, with a focuse on balance and mobility, rather than supervised home rehabilitation. These benefits may have retention when regular controls are not omitted.

We have confirmed the effectiveness of using reading during the exercise with hints from a physical therapist. This is in line with the research results of Turgutet al. (2018) who combineda daily reading task with endogenous and exogenous cues provided by a therapist, which were continuously reduced after a patient had reached a defined level of performance. This study shows that adaptive cueing in a reading task can improve neglect symptoms by using an intensive intervention lasting 3 weeks.

The studies of Berg, Wood-Dauphinee, Williams, and Maki (1992); Liston, andBrouwer (1996) revealed an excellent inter-rater reliability of the BBS and test-retest reliability for patients with hemiparesis. The BBS confirmed sensitivity to change in patients between 14 and 90 days after a stroke.

The studies of Chiu, Au-Yeung, and Lo (2003) determined correlation of the BBS with the Barthel Index, Timed "Up and Go" test, Tinetti Mobility Score and the Dynamic Gait Index; walking speed and measurements of foot pressure center. The age of the examined patients did not correlate with scale indicators. The studied older patients, who were able to stand straight 60 seconds, scored from 18 to 53 points on the BBS. The BBS revealed sensitivity to change in patients with central vestibular disorders. Indicators that were equal to 45 points and below or above 45 points, respectively, discriminate fallers from non-fallers in older people. Depending on the value of this threshold, sensitivity and specificity of identifying fallers vary considerably: the threshold of 40 points provides 45% sensitivity and 96% specificity, whereas the threshold of 50 points provides

85% sensitivity and 73% specificity making them almost equal. Compared to the Tinetti Mobility Score and Timed "Up and Go" test, the BBS proved to be the most convincing functional test that allows to separate older people prone to falls.

The study Park, and Lee(2017)aimed to evaluate the predictive validity of the BBS as a screening tool for fall risks among patiets with balance problems.

With regard to the overall predictive validity of the BBS, the pooled sensitivity and specificity were 0.72 and 0.73, respectively; the accuracy curve area was 0.84. The research results showed statistical heterogeneity of indicators. Among the subgroups, the group of persons under 65 years of age, the group of persons with neuromuscular diseases, those with 2+ falls, and those with a cutoff point of 45 to 49 showed better sensitivity with statistically less heterogeneity. Empirical evidence shows that the BBS is an effective tool for detecting the risk of falls and has shown good predictability when used with appropriate criteria and applied to people with neuromuscular disease.

Currently, promising is a personalized approach in the treatment of patients, which involves using a mathematical model developed to predict the impact of treatment and rehabilitation, when methods and means of rehabilitation are prescribed according to models of predicting therapeutic effects rather than indications and contraindications. The models themselves are developed on the basis of research and mathematical analysis of treatment and rehabilitation determinants, which influence therapeutic effects in a particular category of patients. For instance, to reduce spasticity of lower and upper limbs, improve dynamic and static balance, help patient move more confidently while using high-tech rehabilitation methods ("Armeo", "Lokomat-pro", "Brain-port"), Deineko,and Krysiuk (2017)developed a mathematical model for predicting rehabilitation effect, which included the BBS and the GMFCS as determinants. Constructive changes of the physical therapy system, enhancing the role of a physical therapist, and taking into account patient's characteristics in managing physical therapy process have a positive effect on the result (Fedorenko S, at all (2020)

Thus, the study confirmed that stroke patients suffer from balance disorders and require special additional interventions in the program of physical therapy and ergotherapy, as well as better efficiency from combining therapies, such as balance sitting and standing training, the goal-oriented physical therapy and ergotherapy tasks and dual task activities, oculo-motor exercise and visual tracking. The scientific literature proves that the BBS is a sensitive diagnostic test that can be used as a determinant in the mathematical model for predicting the effect of treatment and rehabilitation of post-stroke patients. These results are generally consistent with ours.

Conclusions

Among the obtained points of the BBS total score at intermediate and final assessments there were patients whose scores were 45 points and higher. At the time of intermediate evaluation in both groups, 10.3% of patients scored 45 points and higher. At final assessment, the share of such patients increased and comprised 17.2% in CG and 31.0% in MG ($p>0.05$). Total balance score in MG patients significantly increased from 19(12.5;24.7)points to 35(22.5;43.5) points ($p<0.05$), whereas CG patients showed positive balance dynamic on the BBS from 21(13;25) points to 40(32.5;46.5) points, however these changes were insignificant, $p>0.05$.
Thus, the study confirmed better efficiency of the the goal-oriented physical therapy and ergotherapy tasks and dual task activities, received by MG patients, its impact on balance and coordination restoration, if the balance training programs were the same.

Conflicts of interest - If the authors have any conflicts of interest to declare.

References:

Arieshyna, Yu. B., Karpenko, Yu. M., &Isakina, A. Yu. (2017). Erhoterapiia u systemi fizychnoi terapii postinsultnykh khvorykh [Occupational therapy in the system of physical therapy of post-stroke patients], *Problemyzdorovia, fizychnoiterapii, reabilitatsii ta erhoterapii*, materialy III Vseukrainskoizaochnoinaukovo-praktychnoi internet-konferentsii [Health problems, physical therapy, rehabilitation and occupational therapy, Proceeding of the 3nd All-Ukrainian Correspondence Scientific and Practical Internet Conference]. Sumy.

Berg, K. O., Wood-Dauphinee, S. L., Williams, J. I., & Maki, B. (1992). Measuring balance in the elderly: validation of an instrument. *Canadian journal of public health = Revue canadienne de sante publique*, *83 Suppl 2*, S7–S11.

Bondar, A., Tomanek, M. Menedžment pozaškil'nih navčal'nih zakladìv fizkul'turno-sportivnogo naprâmu (eng. Management of extracurricular educational institutions of physical culture and sports direction), Bydgoszcz 2018.

Chiu, A. Y., Au-Yeung, S. S., & Lo, S. K. (2003). A comparison of four functional tests in discriminating fallers from non-fallers in older people. *Disability and rehabilitation*, *25*(1), 45–50.

Deineko, V. V., &Krysiuk, O. B. (2017). Vyisokotehnologichnaya fizicheskaya reabilitatsiya detey s tserebralnyim paralichom [Hi-tech physical rehabilitation of children with cerebral palsy.*Adaptive physical education, 1*(69), 18–19.

Dmytruk, M., &Rokoshevska, V. (2017). Typoviporushennyafunktsiyikhodby v osibpislyaperenesenohomozkovohoinsultu [Typical disorders of walking function in persons after a stroke]. *Young sports science of Ukraine,* (3), 87.

Fedorenko, S., Vitomskyi, V., Lazarieva, O., Kashuba, V., Andrieieva, O., Vitomska, M., … &Lytvynenko, Yu. (2020). Influence Specificities of the Type of Attitude towards a Disease on Physical Therapy Satisfaction Among the Orthopedic Profile Patients and the Possibilities of Attitude Improvement. *Journal of Physical Education and Sport*, *20*(2),Art 128,896 – 904.https://doi.org/10.7752/jpes.2020.02128

Gotowski, R. (2015).The participation in the Polish nordic walking cup (PPNW) 2011- 2014, [in:] Pohyb a kvalita života. *Zborník príspevkov z medzinárodnej vedeckej konferencie*, Katedra telesnej výchovy a športu, Pedagogická fakulta, Univerzita Konštantína Filozofa, Nitra, 68-75

Gotowski, R., Barwinska-Szczutkowska, G. (2015).Participation of children and adolescents in polish nordic walking cup (PPNW) 2011-2014, [in:] Aktuálne problémy telesnej výchovy a športu IV : *zbornik vedeckých prác* / ed. P. Krška., Ružomberok, Verbum, 70-77

Grygus, I. M., Nohas, A. O., Bereziuk, V. V. (2019). Teoretychne obgruntuvannia zastosuvannia zasobiv fizychnoi reabilitatsii khvorykh na ishemichnyi insult. *Reabilitatsiini ta fizkulturno-rekreatsiini aspekty rozvytku liudyny=Rehabilitation & recreation.* Rivne. 4,7-12.

Grygus, I. M., Ralska, Kh. O., Sondak. V. V. (2018). Zastosuvannia prohramy fizychnoi reabilitatsii khvorykh pislia perenesenoho hemorahichnoho insultu. *Reabilitatsiini ta fizkulturno-rekreatsiini aspekty rozvytku liudyny=Rehabilitation & recreation.* Rivne. 3,18-20.

Gyryavets, M. V., & Pulyk, O.R. (2019). Psykhoemotsiini ta rukhovi rozlady pislia pivkulnoho ishemichnoho insultu [Psycho-emotional and motor dysfunction after hemispheric ischemic stroke]. *Ukraine. Nation's Health,* (3(56)), 102–106. https://doi.org/10.24144/2077-6594.3.2019.191644

Hrushevska, A. O., Grygus, I. M. (2018). Fizychna reabilitatsiia pry ishemichnomu insulti. *Reabilitatsiini ta fizkulturno-rekreatsiini aspekty rozvytku liudyny=Rehabilitation & recreation*. Rivne. 3,34-39.

Kordonska, A., &Hurnyak, I. (2018). Efficient use of common resources in conditions of sustainable development. *Torun International Studies,* *1*(11), 75-87. doi: http://dx.doi.org/10.12775/TIS.2018.007

Law of Ukraine Fundamentals of the Ukrainian Legislation on Health Care. No 2802-XII (1992). Retriever from https://zakon.rada.gov.ua/laws/show/2801-12#Text

Lazarieva, O. (2015). [Modern approaches to the use of physical rehabilitation in patients with neurosurgical profile]. *Theory and Methods of Physical education and sport,* (2), 81–88.https://doi.org/10.32652/tmfvs.2015.2.81-88.

Liston, R. A., & Brouwer, B. J. (1996). Reliability and validity of measures obtained from stroke patients using the Balance Master. *Archives of physical medicine and rehabilitation*, *77*(5), 425–430. https://doi.org/10.1016/s0003-9993(96)90028-3

Metelski, A. (2019). Physical activity in Poland and the European Union. *Quality In Sport, 5*(3), 7-21. doi:http://dx.doi.org/10.12775/QS.2019.013

Muhammad, M., &Hassan, T. M. (2021). Cerebral damage after stroke: the role of neuroplasticity as key for recovery [Online First], *IntechOpen,* doi: 10.5772/intechopen.95512. Retrieved from: https://www.intechopen.com/online-first/cerebral-damage-after-stroke-the-role-of-neuroplasticity-as-key-for-recovery

Mytskan, B., Edynak, G., Ostapyak, Z., Grytsulyak, B., &Mytskan, T. (2016). Insult: riznovydy, faktory ryzyku, fizychna reabilitatsiia [Stroke: causes, factorsof risk, physical rehabilitation]. *Physical Education, Sport and Health Culture in Modern Society*, (3(19)), 295-302. Retrieved from https://sport.vnu.edu.ua/index.php/sport/article/view/783

Novikova, L. B., Akopyan, A. P., &Sharapova, K. M.(2019). [Rehabilitation of post-stroke patients].*LechaschiVrach Journal,* (5), 16–18.

Nudo, R. J. (2003). Functional and structural plasticity in motor cortex: implications for stroke recovery. *Physical medicine and rehabilitation clinics of North America*, *14*(1 Suppl), S57–S76. https://doi.org/10.1016/s1047-9651(02)00054-2

Nudo, R. J., & Milliken, G. W. (1996). Reorganization of movement representations in primary motor cortex following focal ischemic infarcts in adult squirrel monkeys. *Journal of neurophysiology*, *75*(5), 2144–2149. https://doi.org/10.1152/jn.1996.75.5.2144

Park, E., Lee, J., Chang, W. H., Lee, A., Hummel, F. C., & Kim, Y. H. (2020). Differential relationship between microstructural integrity in white matter tracts and motor recovery following stroke based on brain-derived neurotrophic factor genotype. *Neural plasticity*, *2020*, 5742421. https://doi.org/10.1155/2020/5742421

Park, S. E., Min, K. O., Lee, S. B., Choi, W. S., & Kim, S. H. (2016). Effect of eye movements and proprioceptive neuromuscular facilitation on balance and head alignment in stroke patients with neglect syndrome. *Journal of Physical Therapy Science, 28*(2), 596-601.https://doi.org/10.1589/jpts.28.596

Park, S. H., & Lee, Y. S. (2017). The Diagnostic Accuracy of the Berg Balance Scale in Predicting Falls. *Western journal of nursing research*, *39*(11), 1502–1525. https://doi.org/10.1177/0193945916670894

Piotrowska, K., & Pabianek, Ł. (2019). Physical activity – classification, characteristics and health benefits. *Quality In Sport, 5*(2), 7-14. doi:http://dx.doi.org/10.12775/QS.2019.007

Rossit, S., Benwell, C., Szymanek, L., Learmonth, G., McKernan-Ward, L.,Corrigan, E., … & Harvey, M. (2019). Efficacy of home-based visuomotor feedback training in stroke patients with chronic hemispatial neglect. *Neuropsychological rehabilitation*, *29*(2), 251–272. https://doi.org/10.1080/09602011.2016.1273119

Spaccavento, S., Cellamare, F., Falcone, R., Loverre, A., & Nardulli, R. (2017). Effect of subtypes of neglect on functional outcome in stroke patients. *Annals of physical and rehabilitation medicine*, *60*(6), 376–381. https://doi.org/10.1016/j.rehab.2017.07.245

Teasell, R., Foley, N., Hussein, N., Salter, K., Cotoi, A., &Richardson, M. (2016). Evidence-Based Review of Stroke Rehabilitation (17th Edition). Retrieved fromhttp://www.ebrsr.com/sites/default/files/documents/executive-summary-srebr_final_16ed.pdf

Tomanek, M., & Lis, A. (2020). Managing information on the physical education research field: Bibliometric analysis. Physical Education of Students, 24(4), 213-226. https://doi.org/10.15561/20755279.2020.0404

Turgut, N., Möller, L., Dengler, K., Steinberg, K., Sprenger, A., Eling, P., … & Hildebrandt, H. (2018). Adaptive Cueing Treatment of Neglect in Stroke Patients Leads to Improvements in Activities of Daily Living: A Randomized Controlled, Crossover Trial. *Neurorehabilitation and neural repair*, *32*(11), 988–998. https://doi.org/10.1177/1545968318807054

Ullberg, T., Zia, E., Petersson, J., & Norrving, B. (2015). Changes in functional outcome over the first year after stroke: an observational study from the Swedish stroke register. *Stroke, 46*(2), 389–394. https://doi.org/10.1161/STROKEAHA.114.006538

Volkova, S.,& Blazhko, D. (2017). [Physical rehabilitation of patients after acute stroke]. *Sport science of Ukraine,* (1(77)), 9–15.

Wist, S., Clivaz, J., & Sattelmayer, M. (2016). Muscle strengthening for hemiparesis after stroke: A meta-analysis. *Annals of physical and rehabilitation medicine*, *59*(2), 114–124. https://doi.org/10.1016/j.rehab.2016.02.001

World Medical Association (2013). World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. *JAMA, 310*(20), 2191-2194. https://doi.org/10.1001/jama.2013.281053

Yukhymchuk, Kh. V. (2018). Reabilitatsiia khvorykh z insultom [Rehabilitation of patients with stroke]. *Nursing*, (3), 23–26. https://doi.org/10.11603/2411-1597.2018.3.9640

Zakaliak, N. R., & Sprynska, O. M. (2017). Rol likuvalnoi himnastyky u vidnovlenni rukhovoi funktsii verkhnoi kintsivky u khvorykh z pisliainsultnymy hemiparezamy [The role of therapeutic gymnastics in the restoration of motor function of the upper extremity in patients with post-stroke hemiparesis], *Problemyzdorovia, fizychnoiterapii, reabilitatsiita erhoterapii*, materialy III [Health problems, physical therapy, rehabilitation and occupational therapy, Proceeding of the 3nd All-Ukrainian Correspondence Scientific and Practical Internet Conference]. Sumy.

Zamergrad, M.V., &Khatkova, S.E. (2018). Prakticheskie aspektyi reabilitatsii pri postinsultnyih rasstroystvah ravnovesiya [Practical aspects of balance and vestibular rehabilitation after stroke]. *Meditsinskiy sovet = Medical Council*, (12), 36-38.https://doi.org/10.21518/2079-701X-2018-12-36-38.

Żołądkiewicz, K. (2019). Impact of physical activity on the human body - the physiological basis of physical activity. *Quality In Sport, 5*(2), 40-46. doi:http://dx.doi.org/10.12775/QS.2019.010.