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Case Series

The effect of task oriented approach on gait of hemiplegic patients: a case series study

Myrto Kesidou[1], Thomas Besios[1], George Paras[2], Konstantinos Chandolias[2], Georgios M. Kyriakatis[2]*, Vasiliki Kouvelioti[3], Eleftherios Stefas[3]

[1]Department of Physiotherapy, School of Health Sciences, University of Thessaly, Human Performance and Rehabilitation Laboratory, Lamia, Greece
[2]Department of Physiotherapy, School of Health Sciences, University of Thessaly, Lamia, Greece
[3]"Evexia" Rehabilitation Center, Halkidiki, Greece

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***Correspondence:**
Georgios M. Kyriakatis,
E-mail: georgemarioskiriakatis2000@gmail.com

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ABSTRACT

The last few years, the main purpose of the treatment of the hemiplegic patient, is to regain his ability to execute functional activities of daily living independently. According to the latest studies, the effectiveness as well as the importance of task-oriented approach (TOA), is apparent and determining to reacquire the patient's lost independency, through the practice of the specified functional activities. The aim of this study is to investigate a program of TOA on gait of hemiplegic patients. A sample of 5 post stroke patients was selected from according to the inclusion criteria. A TOA intervention was executed through the practice of 10 functional activities, related to gait, from Monday to Friday for 4 weeks. At the end of each week, gait and balance assessments were performed through the 10-meter walk test (10 MWT), the Berg balance scale (BBS), and the timed up and go test (TUG). The analysis indicates that TOA is extremely effective for stroke patients with mediocre and minor gait and balance deficits, as the difference was statistically significant ($p<0.05$). The statistically significant difference was from the first assessment T1 to the final assessment T5 and was proven through BBS, TUG and 10 MWT. In conclusion, TOA is a quite beneficial and a cost-effective intervention for the rehabilitation of gait and balance for stroke patients, while consequently improving the quality of their everyday life, independently from their original functional status.

Keywords: Task oriented approach, Hemiplegia, Stroke, Gait-retraining, Case series study

INTRODUCTION

Cerebrovascular accident

Stroke is the third leading cause of death after cancer and heart disease and is a major public health problem worldwide.[1] The cerebrovascular accident (CVA) is a cerebral attack of vascular etiology, which is typically characterized by a sensorimotor deficit on the opposite side of the body. Motor deficits are the most frequent, compared to the other deficits (orofacial, cardiorespiratory, orthocystic disorders etc).

Motor deficits created after brain damage are not solely due to functions lost in the injured motor area of the brain. They are also an expression of the ability of the rest of the brain centres to maintain motor function without the injured area. For example, movement after stroke is associated with aberrant patterns of brain activation that reflect the brain's attempt to adapt to lost neural tissue.[2]

In addition, reduced walking speed in ambulatory patients, temporal, and spatial asymmetries between the two lower limbs, reduced postural control, flexion of the toes of the affected foot, abnormal muscle tone and

reduced range of motion are additional symptoms of the condition, which subsequently affect the patient's functionality.[3]

Patient's safe gait, as well as his participation in the activities of daily living, is particularly important. Gait retraining is a complex problem with a variety of approaches, depending on the deficits and expectations-goals of each patient. In recent years, the TOA has begun to be used for gait rehabilitation after stroke, with the study by Scrinever and colleagues, reporting that the application of the TOA for gait retraining had better results compared to the Bobath method.[4]

Task oriented approach

TOA is defined as the application of therapeutic interventions, which are specialized for the activity under training and is based on research results that have emerged from the fields of motor control, motor learning and rehabilitation science.[5] Additionally, it is based on the subjective assumptions underlying neurofacilitation techniques and argues that normal movement is the result of interaction between different systems.[6,7]

In addition, task-oriented walking interventions address the practice of functional activities related to mobility. They may also include interventions to improve deficits in strength, flexibility, balance, and cardiovascular endurance. Furthermore, TOA causes reorganization of the motor cortex and enhances neuroplasticity, as it has a positive effect due to the intensive practice.[8-10] It is also shown that TOA improves the functionality of post-stroke patient's more than conventional treatments and also, the general quality of life of these patients is enhanced and with much faster and easier results.[11-13]

In summary, while the exercise protocol (frequency, intensity, duration, choice of activities) of each study was beneficial and efficient in retraining the gait of hemiplegic patients, it differed from the rest, with a common finding of the positive effect of intensive exercise. Additionally, according to the literature, it has not yet been investigated at which stage of recovery this specific intervention is more effective (acute, hypo-acute or chronic). It is also observed that in the recent studies, the effectiveness of TOA is clearer, as well as the importance of improving balance through functional walking activities. Consequently, based on the above review and the encouraging results regarding TOA, it is the evident that additional study of the approach is required.

CASE SERIES

Subjects

First of all, the study was approved by the research ethics committee of the University of Thessaly. The patients were selected from the "Evexia" rehabilitation center located in Nea Kallikrateia, Halkidiki. The sample number was sufficient to perform multiple post-intervention measurements for this case series. Non-random sampling was preferred due to the conditions of the COVID-19 pandemic because the inpatient status within the rehabilitation center was highly variable, creating difficulty in random sampling. During the study with this research design, there were no drop-outs.

Inclusion criteria were as follows: 1) hemiplegia after stroke, 2) time interval of ≤30 days after stroke, 3) number of strokes ≤ 1, 4) patient age 50-75 years, 5) assessment of strength and of the functionality of the lower limb with the Multicity Index scale with a score ≥ 57/99 6) ability to independently walk a distance >5 meters with or without the use of an orthotic device and/or aid. Exclusion criteria were: 1) cognitive, communication, audiovisual, sensory, attention deficits, 2) recent surgeries, or some other injury to the hemiplegic lower limb, 3) seizures, 4) severe cardiorespiratory diseases.

Measurements

Considering that for the present study it was necessary to choose valid and reliable assessment tools, the 10 MWT, the BBS and the TUG test were chosen.

Regarding the 10 MWT, it is an executive measure in which participants are assessed for their walking speed in m/s over a short 10-meter course. A 14-meter runway is created, 2 meters after the start of this route and 2 meters before the end, 2 cones are placed. This creates within the 14 m corridor a smaller 10 m corridor between the cones, with the extra 2 m at the start and the extra 2m at the end helping to accelerate and decelerate the subject respectively. Timing starts from the moment the examinee reaches the first cone, until the second cone, while he continues walking to the end.

TUG is widely used to determine fall risk, to assess balance, standing, and walking.[14] A chair, a timer, a cone, and a tape measure are required to carry out this procedure. The examinee is initially seated in the chair and is asked to stand up, walk 3 meters to the cone, turn around it and walk another 3 meters to return and sit back in the starting chair. Timing starts from the moment the examinee is asked to stand up, after the appropriate instructions have been given. Three measurements are taken, and the average is taken from them.

BBS is used to objectively assess a patient's ability to balance while performing 14 specific tasks. The scale score ranges from 0-4 for each test, with 0 representing the lowest level of performance and 4 the highest level of performance. According to the literature, all 3 of these assessment scales evaluate with high reliability and validity the gait as well as balance of the post-stroke patients.[15]

Intervention

To investigate the specific research question, a non-random sample of 5 patients from the "Evexia" Rehabilitation Center, after a stroke and diagnosis of hemiplegia, who met the admission criteria, was selected. A TOA program was applied to the patients, through the practice of 10 functional activities related to walking and based on their functional level: 1) weight transfers from a standing position and stepping in various star-type directions, 2) sit-ups from different heights with the hemiplegic lower limb behind the normal lower limb, 3) from a kneeling position alternately projecting the lower limb forward, 4) from a standing position with a limited base of support turning head and trunk right to left, 5) continuous walking on a treadmill for 10', 6) ascending and descending of stairs, 7) crossing 4 obstacles with continuous walking, 8) walking while simultaneously pushing a stroller, 9) walking while holding an object, 10) walking on different surfaces and slopes.

The intervention took place every day, Monday to Friday for 4 weeks. At the end of each week, the corresponding measurements were also performed (T1 initial, T2 1st week, T3 2nd week, T4 3rd week, T5 4th week). Patient measurements were performed under the same conditions each time, by an independent investigator. During the intervention, as well as the measurements, there was no fall or injury. Finally, the intervention was performed by a therapist, while the measurements and data analysis were performed by an experienced and familiar with the test's evaluator, who was unrelated to the research.

Statistical methods

A significance level of $p<0.05$ was set. Therefore, because the sample was small, the condition of normal distribution could not be satisfied and therefore non-parametric methods were used to estimate Shapiro Wilk confidence intervals of means. A two-way ANOVA for repeated measures was applied for each test with a repetition factor the time of application of test (T1 initial, T2 1st week, T3 2nd week, T4 3rd week, T5 4th week). For multiple comparisons of averages of variables between the various levels of above factors, Bonferroni test used.

Demographics

Demographics, baseline data, corresponding means and standard deviations between patients are listed in the Table 1. The results show that the standard deviation of days after stroke and age is small, which shows homogeneity in the sample in terms of patients' stage of recovery, as well as in age. This is an important finding, since the stage of recovery and the age of the patient, significantly influence the progress of rehabilitation, as well as the prospects of neuroplasticity. Regarding the height and weight of the patients, there was a large standard deviation, but this finding does not significantly affect the outcome of the patients' gait rehabilitation.

10 MWT results

The statistical analysis showed that the execution time of the 10MWT decreased from the 1st (T1) attempt to the 5th (T5) with statistical significance ($p<0.05$) (Table 2). The corresponding standard deviations are large, which may indicate heterogeneity in the sample, regarding their functional level before the start of the intervention (Table 3). Also from the statistical analysis, it seems that the biggest difference in the measurements was between T1 and T4 measurement, with $p=0.046<0.05$.

BBS results

Regarding the BSS, the analysis of the results showed that the scale score improved from the 1st (T1) to the last test (T5) statistically significantly ($p<0.05$). The corresponding average of the first measurement T1, increased significantly with the average of the last measurement T5 having doubled (Table 2 and 3). In addition, it is observed that the greatest difference in measurements was between T1 and T2, as well as between T1 and T4 and T5. Furthermore, it is observed that the T4 measurement compared to T5 does not show a statistically significant difference for all patients. Possibly, this particular result suggests a probable plateau regarding the improvement of patients on BBS.

TUG results

The results regarding the TUG showed a statistically significant difference from the 1st (T1) to the last (T5) measurement ($p<0.05$). The corresponding average of the first measurement T1, significantly decreased and doubled compared to the average of the last measurement T5 (Table 2 and 3). Based on the statistical analysis, it also appears that the biggest difference between the measurements, statistically significant was between the first measurement T1 and T2, as well as between T1 and T3.

Table 1: Demographics.

Variables	N	Minimum	Max	Mean	Standard deviation
DAS	5	21	40	29.40	7.301
Height	5	153.00	183.00	168.8000	10.77961
Weight	5	52.00	87.00	69.0000	13.09580
Age (years)	5	42.00	56.00	47.8000	6.41872

(N=number of each different patient, DAS=Days after stroke).

Table 2: 10 MWT, BBS and TUG results for each patient.

N	10 MWT 1	10 MWT 2	10 MWT 3	10 MWT 4	10 MWT 5	BBS 1	BBS 2	BBS 3	BBS 4	BBS 5	TUG 1	TUG 2	TUG 3	TUG 4	TUG 5
1	5.2	4.35	3.63	3.06	1.79	26	30	33	49	51	51.7	43.2	35.7	28.6	16.8
2	2	1.86	1.43	1.22	0.97	23	29	35	48	52	20.6	17.5	14.7	12.8	10.89
3	6.1	6.05	4.52	3.63	3.15	21	30	33	49	51	60.03	51.85	43.6	34.2	27.36
4	2.1	1.36	1.27	1.16	0.95	22	30	40	48	52	20.5	13.65	12.7	12.35	10.65
5	4.4	3.6	3.23	3.14	3.03	33	40	46	50	51	42.6	37.8	31.2	30.1	29.6

(N=number of each different patient, 10 MWT: 10 meter walk test, BBS: Berg balance scale, TUG: Timed up and go test).

Table 3: Mean and standard deviation of results for all patients of each test.

Tests	Mean	Standard deviation	Scale	Mean	Standard deviation	Tests	Mean	Standard deviation
10 MWT1	3,8000	1,78885	BBS1	25,0000	4,84768	TUG1	39,4000	17,84096
10 MWT2	3,4000	1,94936	BBS2	31,8000	4,60435	TUG2	33,0000	16,37071
10 MWT3	2,8000	1,78885	BBS3	39,0000	7,38241	TUG3	27,8000	13,44247
10 MWT4	2,4000	1,34164	BBS4	49,0000	0,70711	TUG4	23,6000	10,31019
10 MWT5	2,0000	1,00000	BBS5	51,4000	0,54772	TUG5	19,2000	8,89944

(10 MWT: 10 meter walk test, BBS: Berg balance scale, TUG: Timed up and go test).

DISCUSSION

From the above results it follows that TOA is a useful approach for the retraining of walking and balance in patients with hemiplegia after a stroke. The fact of homogeneity in the sample for days post-stroke and age is an important finding, as well as the stage of recovery and the age of the patient, significantly influence the progress of rehabilitation, as well as the prospects of neuroplasticity, regarding the importance of time for recovery, in which it is stated that early intervention brings about better results.[16,17] Furthermore, it is proven that there is globality in the research ($p<0.05$). In addition, it has been found that an important factor for neuroplasticity is the younger age and the specialization of the desired activity, as when it is focused on the desired goal (e.g., gait), it causes cortical reorganization and significant functional benefits.[5,18] Therefore, in the present study, the patients due to their young age, but also the specialization of the activities being practiced, had particularly favourable conditions for neuroplasticity and cortical reorganization.

Additionally, in the TUG and BBS evaluation scales was an immediate improvement with a statistically significant difference, from the first week of intervention as opposed to the 10 MWT scale where statistically significant difference occurred after the 3-week interval. This result may be due to the nature of the tools and the assessment content. Also, the first two scales mainly assess balance, while the third one assesses gait. Therefore, it makes sense since walking is a more complex function than balance that it would require more weeks of practice to make a noticeable difference. Finally, the present research is an original study, as it was carried out for the first time in Greece.

It is also reported that regardless of the functional level of the patients, there was a statistically significant difference in the improvement of walking and balance. Based on the inclusion criteria, patients with major gait and balance deficits were not included in the study and that concluded that in patients with moderate or small walking deficits TOA is particularly effective, as there was a statistically significant difference ($p<0.05$) from the first T1 measurement to the last T5 measurement in all 3 used evaluation scales. This agrees with a study, in which it is stated that in 96 patients with moderate walking deficits who assessed with BBS, TUG, 6-minute walk test (6 MWT) and 5-meter walk test, TOA is effective for improving the distance covered and walking speed, within a period one year after stroke.[19] Furthermore, based on the above conclusions, there is a need for new studies in which the effectiveness of TOA will be investigated in patients with more severe walking deficits.

Also, even though TOA intervention lasted 1 month, there was a statistically significant difference in the results of the first T1 measurement compared to the last T5 measurement for all 3 used scales. Similar results are obtained from a study with 144 patients after stroke in which 6 TOA sessions were carried out, lasting 1 hour each, to investigate the effectiveness of TOA in the minimum dosage. The results with a follow-up performed 12 weeks later were obtained through BBS, TUG and 6 MWT and indicate that the minimum dosage of TOA administered, was particularly effective in the mobility and walking ability of the patients, compared to the other 2 groups.[20]

It is also worth noting that the present study included patients in the acute stage after stroke, which provided more favourable conditions for rehabilitation and neuroplasticity for the patients. It has been studied that

chronic patient after stroke, regarding their improvement after a TOA intervention and when the activities were goal-oriented, the results were much better, while they were maintained 5 months later in the follow-up.[21] Consequently, patients in the acute stage participated in the present study and given the lack of research data regarding the remaining stages, it is deemed necessary to create studies that determine the effect of TOA, for each stage specifically.

Furthermore, given the economic situation in Greece and the health benefits, it is particularly important that TOA is a cost-effective treatment, in which no special equipment is required and bringing significant improvements, even in the short period of one month.

This intervention can also be carried out at home after training the patient, through telerehabilitation by the therapist, which further reduces costs. The application of TOA through telerehabilitation is a safe option for the treatment of patients, as well as for the assurance of research data. The need therefore arises for the adaptation of a specific TOA program through telerehabilitation, as well as the creation of such study including follow-up results. It has been also reported that telerehabilitation with moderate supervision enhances patient motivation, participation, satisfaction and functionality, while being a safe option.[22,23]

Limitations

Regarding the limitations of the present study, it is stated that due to the COVID-19 pandemic, the sample was limited and consequently the results cannot be generalized to the wider population. Therefore, there is a need to create studies with a larger sample and control group to better understand the effect of TOA on the gait of patients with hemiplegia. Another limitation of the present study is therefore the fact that while its effectiveness is proven, there is no follow-up data. Also, the type of protocol (duration, frequency) as well as the selection of the corresponding walking-simulating activities has not been established and their selection for the present study was based on the available literature.

CONCLUSION

In summary, present study shows that TOA is particularly effective approach for the retraining of walking in hemiplegic patients after a stroke with no special high-cost equipment. In addition, it appears that the benefit of this intervention appears in a short period of time, even for 1 month of implementation and improvement of balance is faster than the improvement of gait.

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REFERENCES

1. Murray CJ, Lopez AD. Alternative projections of mortality and disability by cause 1990-2020: Global Burden of Disease Study. Lancet. 1997;349(9064):1498-504.
2. Ward NS, Newton JM, Swayne OBC, Lee L, Thompson AJ, Greenwood RJ et al. Motor system activation after subcortical stroke depends on corticospinal system integrity. Brain. 2006;129(3):809-19.
3. Lewek MD. The value of overground gait training for improving locomotion in individuals with chronic stroke. In J Neurol Phys Ther. 2009;33:187-8.
4. Scrivener K, Dorsch S, McCluskey A, Schurr K, Graham PL, Cao Z et al. Bobath therapy is inferior to task-specific training and not superior to other interventions in improving lower limb activities after stroke: a systematic review. J Physiotherapy. 2020;66(4):225-35.
5. Bayona NA, Bitensky J, Salter K, Teasell R. The Role of Task-Specific Training in Rehabilitation Therapies. Top Stroke Rehabilitation. 2005;12(3):58-65.
6. Ivey FM, Hafer-Macko CE, Macko RF. Task-oriented treadmill exercise training in chronic hemiparetic stroke. J Rehabil Res Dev. 2008;45(2):249-59.
7. Taylor JA, Ivry RB. The role of strategies in motor learning. Annals of the New York Academy of Sciences. 2012;1251(1):1-12.
8. Jang SH, Kim YH, Cho SH, Lee JH, Park JW, Kwon YH. Cortical reorganization induced by task-oriented training in chronic hemiplegic stroke patients. Neuroreport. 2003;14(1):137-41.
9. Schaechter JD. Motor rehabilitation and brain plasticity after hemiparetic stroke. Prog Neurobiol. 2004;73(1):61-72.
10. Lord SE, Rochester L. Measurement of Community Ambulation After Stroke. Stroke. 2005;36(7):1457-61.
11. Rensink M, Schuurmans M, Lindeman E, Hafsteinsdóttir T. Task-oriented training in rehabilitation after stroke: systematic review. J Adv Nursing. 2009;65(4):737-54.
12. Khan A, Yaseen A, Atif M, Afzal F, Khurshid A. The effects of a task-oriented walking interventions on balance in chronic stroke patients. J Exp Stroke Translational Med. 2021;13:1-8.
13. Nair RM, Augustine J. Effectiveness of task-oriented walking intervention on improving balance in MCA stroke patients. Int J Physical Education, Sports Health. 2021;8(2):103-8.
14. Podsiadlo D, Richardson S. The timed "Up and Go": a test of basic functional mobility for frail elderly persons. J Am Geriatr Soc. 1991;39(2):142-8.
15. Besios T, Nikolaos A, Vassilios G, Giorgos M. Comparative Reliability of Berg Balance Scale and MAS Tests in People with Neurological Disorders. Neurosci Med. 2019;10:8.

16. Biernaskie J, Chernenko G, Corbett D. Efficacy of Rehabilitative Experience Declines with Time after Focal Ischemic Brain Injury. J Neurosci. 2004;24(5):1245.
17. Harvey RL. Improving poststroke recovery: Neuroplasticity and task-oriented training. Curr Treat Options in Cardiovascular Med. 2009;11(3):251-9.
18. Nieto-Sampedro M, Nieto-Diaz M. Neural plasticity: Changes with age. J Neural Transmission. 2005;112:3-27.
19. Salbach NM, Mayo NE, Wood-Dauphinee S, Hanley JA, Richards CL, Côté R. A task-orientated intervention enhances walking distance and speed in the first-year post stroke: a randomized controlled trial. Clin Rehabil. 2004;18(5):509-19.
20. Knox M, Stewart A, Richards CL. Six hours of task-oriented training optimizes walking competency post stroke: a randomized controlled trial in the public health-care system of South Africa. Clin Rehabil. 2018;32(8):1057-68.
21. Combs SA, Kelly SP, Barton R, Ivaska M, Nowak K. Effects of an intensive, task-specific rehabilitation program for individuals with chronic stroke: a case series. Disabil Rehabil. 2010;32(8):669-78.
22. Atmojo J, Sudaryanto W, Widiyanto A, Ernawati E, Arradini D. Telemedicine, Cost Effectiveness, and Patients Satisfaction: A Systematic Review. J Health Policy Management. 2020;5:103-7.
23. Jarbandhan A, Toelsie J, Veeger D, Bipat R, Vanhees L, Buys R. Feasibility of a home-based physiotherapy intervention to promote post-stroke mobility: A randomized controlled pilot study. Plos one. 2022;17(3):e0256455.

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