ORİJİNAL ARAŞTIRMA ORIGINAL RESEARCH

DOI: 10.31609/jpmrs.2021-83304

The Effect of Occupational Therapy on Upper Extremity Function and Daily Life Activities in Stroke Patients

İnmeli Hastalarda İş-uğraşı Terapisinin Üst Ekstremite Fonksiyonu ve Günlük Yaşam Aktiviteleri Üzerine Etkisi

Merve AYDİLEK[a], Mustafa Fatih YAŞAR[b], Elif YAKŞİ[b]

[a]Clinic of Physical Therapy and Rehabilitation, Karasu State Hospital, Sakarya, TURKEY
[b]Department of Physical Therapy and Rehabilitation, Bolu Abant İzzet Baysal University Faculty of Medicine, Bolu, TURKEY

ABSTRACT Objective: This study aims to assess the effectiveness of occupational therapy (OT) added to standard rehabilitation treatments on hemiplegic stroke patients' daily life activities and upper extremity functions. **Material and Methods:** This prospective, randomized, controlled clinical study included 50 patients aged between 20 and 80 who had suffered a stroke and developed hemiplegia due to cerebrovascular accident and applied to Bolu Abant İzzet Baysal University Physical Therapy and Rehabilitation Hospital. The study patients were divided into two groups: an OT [treatment] group receiving standard rehabilitation (five days a week for six weeks) and OT (three days a week for six weeks, 45 minutes per day) and a standard treatment (ST) [control] group receiving standard rehabilitation only. All patients were evaluated before (at initial) and after the treatment (at the end of the 6-week treatment). The Barthel Index (BI), Fugl-Meyer Assessment of Motor Recovery (FMA) Scale, and Action Research Arm Test (ARAT) were used to investigate treatment effectiveness. **Results:** There was a significant increase in the post-treatment (at the end of the 6-week treatment) BI, FMA Scale, and ARAT scores in both OT and ST groups compared to the pre-treatment (at initial) scores. The FMA scale and ARAT scores significantly differed between groups 6 weeks after the treatment; the post-treatment ARAT and FMA scale scores were statistically significantly higher in the OT group than in the ST group. No significant difference was found between the groups in pre-treatment and post-treatment BI scores. **Conclusion:** The present study revealed that occupational therapies added to the standard rehabilitation practices contribute to developing motor functions of the upper extremity in hemiplegic stroke patients.

Keywords: Activities of daily living; stroke rehabilitation; occupational therapy

ÖZET Amaç: Bu çalışmanın amacı, hemiplejik hastalarda standart rehabilitasyon tedavilerine eklenen iş-uğraşı tedavisinin günlük yaşam aktiviteleri ve üst ekstremite fonksiyonları üzerine etkinliğini araştırmaktır. **Gereç ve Yöntemler:** Bu çalışma, Bolu Abant İzzet Baysal Üniversitesi Fizik Tedavi ve Rehabilitasyon Hastanesine başvuran ve serebrovasküler olay nedeniyle hemipleji gelişen, 20-80 yaşları arasındaki hastalar üzerinde gerçekleştirildi. Çalışma prospektif, randomize ve kontrollü bir klinik çalışma olarak planlandı. Çalışmaya inme sonrası hemipleji tanısı olan 50 hasta dâhil edildi. Hastalar 2 gruba ayrıldı. Birinci gruptaki hastalara standart rehabilitasyon (6 hafta süresince haftada 5 gün) ve ayrıca iş-uğraşı tedavisi (6 hafta süresince haftada 3 gün, günde 45 dk) uygulandı. İkinci grupta olan hastalara yalnızca standart rehabilitasyon uygulandı. Tüm hastalar tedavi öncesi ve tedavi sonrası olmak üzere değerlendirildi. Tedavi etkinliğini değerlendirmek için Barthel İndeksi (Bİ), Fugl-Meyer Motor Değerlendirme (FMD) Ölçeği ve Action Research Arm Test (ARAT) kullanıldı. **Bulgular:** Hem tedavi hem de kontrol grubunda bulunan hastaların tedavi öncesine göre Bİ, FMD Ölçeği ve ARAT skorlarında istatistiksel olarak anlamlı artış olduğu görüldü. FMD Ölçeği ve ARAT skorlarının tedavi öncesi ve sonrası gruplar arası karşılaştırmasında istatistiksel olarak anlamlı farklılık saptandı. Bİ skorları ise gruplar arasında anlamlı farklılık göstermedi. **Sonuç:** Standart rehabilitasyon uygulamalarına eklenen iş uğraşı tedavilerinin üst ekstremite motor fonksiyonlarının gelişmesine katkısı olduğunu saptadık.

Anahtar Kelimeler: Günlük yaşam aktiviteleri; inme rehabilitasyonu; iş-uğraşı tedavisi

Stroke is a major health problem that affects a large part of society with its high frequency and mortality rate.[1] This disease, the second leading cause of death worldwide, ranks third in developed countries, just behind cardiovascular diseases and cancer.[2]

Correspondence: Mustafa Fatih YAŞAR
Department of Physical Therapy and Rehabilitation, Bolu Abant İzzet Baysal University Faculty of Medicine, Bolu, TURKEY/TÜRKİYE
E-mail: mustafafy@hotmail.com

Peer review under responsibility of Journal of Physical Medicine and Rehabilitation Science.

Received: 24 Mar 2021 ***Received in revised form:*** 16 May 2021 ***Accepted:*** 08 Aug 2021 ***Available online:*** 18 Jun 2021

Post-stroke disability reduces the patients' quality of life and leads to socioeconomic and social problems.[3] In stroke cases, one of the biggest challenges to functional gains is upper extremity problems.[4,5] Upper extremity disorders developed in stroke have been found to limit the level of functional independence and personal well-being in approximately 50-70% of the patients.[4,6] Therefore, upper extremity rehabilitation has gained increased momentum in stroke patients in recent years. In addition to conventional treatment methods, functional movement-based, and assistive technology interventions, pharmacological and complementary approaches have also been introduced. Another treatment method that has gained greater importance and increasing popularity recently due to some advantages in hemiplegic stroke patients' treatment processes is occupational therapy (OT).[7]

OT is a complementary part of the rehabilitation program carried out so that a hemiplegic patient can be self-sufficient in their home, work, and social life.[8] It aims to achieve functional independence and to develop psychosocial adaptation to permanent disability. However, the criteria to guide patient selection for OT programs have not yet been fully determined. The heterogeneity of stroke patients' functional issues and health problems makes it difficult to evaluate rehabilitation outcomes. The most critical factors affecting rehabilitation programs are the location and size of the lesion, age, gender, socio-cultural status, sensation-perception, vision, motor functions, and mental state. To summarize, it is essential to consider all of these factors mentioned above for treatment effectiveness.[9]

This study aimed to assess the effectiveness of OT added to standard rehabilitation treatments on hemiplegic stroke patients' daily life activities and upper extremity functions.

MATERIAL AND METHODS

PATIENTS AND STUDY DESIGN

This prospective, randomized, controlled clinical study included 50 patients aged between 20 and 80 who had suffered a stroke and developed hemiplegia due to cerebrovascular accident (CVA) and applied to Bolu Abant İzzet Baysal University Physical Therapy and Rehabilitation Hospital between August 2018 and February 2019. The diagnosis of stroke was made according to the World Health Organization criteria. By randomizing them with simple sampling, the study patients were divided into two groups: an OT [treatment] group (n=25) receiving standard rehabilitation (five days a week for six weeks) in addition to upper extremity OT (three days a week for six weeks, 45 minutes per day) and a standard treatment (ST) [control] group (n=25) receiving standard rehabilitation only. Exclusion criteria were defined as follows: those with grade ≥3 spasticity in the upper extremity according to the Modified Ashworth Scale (MAS), and those with a history of trauma, cranial surgery, and brain tumor, psychological disorders, and mental problems. A total of 48 patients, 24 patients in each group, completed the study. Information of patients who met the inclusion criteria and were evaluated twice (at initial and at the end of the 6-week treatment program) during the study period was recorded in the patient evaluation form; subsequently, the results were analyzed statistically. The ethics committee's approval was received from Bolu Abant İzzet Baysal University Faculty of Medicine Clinical Research Ethics Committee (no: 2018/101, date: 10.05.2018). The study was conducted in accordance with the principles of the Helsinki Declaration. All study subjects who agreed to participate in the study and whose written consents were obtained by signing an "Informed Consent Form" were extensively informed in writing and verbally about the study's purpose and duration, treatment methods to be applied within the scope of the research, possible side effects and problems that may be encountered during the follow-ups.

TREATMENT PROTOCOL

According to the treatment protocol, the OT [treatment] group consisting of 25 participants received standard rehabilitation treatment for 45 minutes and upper extremity OT for 45 minutes, 3 sessions per week. Also, the ST [control] group consisting of 25 patients received standard rehabilitation treatment only. Randomization was performed using a computerized randomization list with the Microsoft

Excel© 2013 software via a random number generator function. Subjects in the ST group underwent conventional rehabilitation exercises such as passive, active, and active-assistive range-of-motion, also strengthening, transfer training exercises, and transfers, walking, and climbing stairs performed, with the physiotherapist.

A trained occupational therapist performed OT. The ancillary materials of playdough, treatment balls, colored cylinders, perforated circles, wooden blocks, screws, balls, and skill house (door handle, padlock, key, lamp, socket, faucet) were used during the treatment. We aimed to improve normal movement patterns and muscle tone, coordinate the two hands with each other, develop fine hand skills, and ensure independence in daily life activities with OT.

OUTCOME MEASUREMENTS

A detailed medical history was obtained from all patients, and each patient received a physical, musculoskeletal, and neurological examination. The study participants were questioned in detail in terms of age, gender, educational status, history of stroke, affected side, hemiplegia etiology, hand preference, the presence of systemic diseases, and previous medical operations.

Barthel Index (BI) was used before (at initial) and after treatment (at the end of the 6-week treatment) to evaluate daily life activities, upper extremity motor functions, and Fugl-Meyer Assessment of Motor Recovery (FMA) scale and Action Research Arm Test (ARAT) upper extremity motor functions.

Barthel Index: BI evaluates physical independence in daily life activities with 10 items (transfer, ambulation/wheelchair use, climbing up and downstairs, feeding, dressing, tidying up, bathing, toilet use, urine continence, stool continence).[10] Each item is scored separately as 0,5, 10, or 15 points. A total score between 0-20 means wholly dependent, 21-61 highly dependent, 62-90 moderately dependent, 91-99 mildly dependent, and 100 wholly independent. In our study, the BI version adapted to Turkish and whose validity and reliability tests were made was used.[11]

Fugl-Meyer Upper Extremity Assessment of Motor Recovery Scale: This scale is a disease-specific, objective motor disorder scale specifically designed to evaluate the recovery in post-stroke hemiplegic patients. It contains sub-sections that evaluate joint movements, coordination, and reflex activities of the shoulder, elbow, forearm, wrist, and hand. The movements of the affected joints are scored as 0 (no movement), 1 (partial movement), and 2 (normal movement). A reflex hammer is used to assess reflex activities. The reflex activities are scored in the following order: 0: no reflex activity, 2: reflex activity can be elicited. The Finger-to-Nose Test measured upper limb coordination as 5 repetitions and the speed of the movements performed during the test as follows: 0: completed before two seconds, 1: completed between two and five seconds, 2: cannot be completed before six seconds; tremor (0: marked tremor, 1: mild tremor, 2: no tremor) and dysmetria (0: marked dysmetria, 1: mild dysmetria, 2: no dysmetria) were also evaluated by scoring as mentioned above.[12]

Action Research Arm Test: This test evaluates the upper extremity motor functions in individuals with hemiplegia. It has 4 subgroups measuring coarse, fine, and fingertip grip and coarse motion and 19 evaluation items. The upper extremity motor function assessment was done in the current study by scoring each item in the following order as 0: cannot do movement, 1: does (completes) movement partially, 2: does the movement with difficulty in an abnormally long time, and 3: does the movement normally (with no difficulty).[13] The previous studies have reported high reliability and validity of the ARAT.[14] Its main advantage is assessing a wide range of upper extremity functions after stroke.[15]

STATISTICAL ANALYSIS

Statistical Package for Social Sciences software (Mac version 21, SPSS Inc., Chicago, IL, USA) was used to evaluate the research data. Descriptive statistics were presented as numbers and percentages for categorical variables, mean, standard deviation, and median for continuous data. Homogeneity was made according to Levene's test, and $p>0.05$ was considered homogeneous. Non-parametric data were ana-

lyzed using the Wilcoxon signed ranks test to investigate within-group differences; a paired sample t-test was applied to compare intragroup changes of normally distributed variables. Independent t-tests were performed to compare the means between the groups for normally distributed data, while Mann-Whitney U test was utilized for non-parametric variables without normal distribution. The nominal variables were examined by the Pearson Chi-square test or Fisher's Exact test. The results were assessed within 95% reliance and at a significance level of $p<0.05$.

RESULTS

Of 50 patients included in the study, 48 completed the evaluation process; 1 in the OT [treatment] group wanted to leave the hospital before completing the treatment process, and 1 in the ST [control] group was transferred to another ward due to a general condition deterioration. Considering both groups in terms of demographic characteristics and disease symptoms, the variables other than stroke etiology showed no statistically significant difference (Table 1). According to stroke etiology, 4.2% hemorrhagic stroke and 95.8% ischemic stroke patients formed the ST group, while the OT group composed of 29.2% hemorrhagic stroke and 70.8% ischemic stroke patients; a statistically significant difference differed between groups ($p<0.05$) (Table 1). Hemorrhagic stroke patients tended to need the combination of OT and standard rehabilitation more than ischemic stroke patients. Similarly, ischemic stroke patients were more likely to have standard rehabilitation alone compared to hemorrhagic stroke patients.

Remarkably, we found a statistically significant increase in the post-treatment ARAT, BI, and FMA scale scores in both OT and ST groups compared to the pre-treatment scores ($p<0.01$) (Table 2); moreover, the post-treatment ARAT and FMA scale scores were statistically significantly higher in the OT group than in the ST group ($p<0.01$). On the other hand, no significant difference was found between the OT and ST groups in terms of the pre-and post-treatment BI scores ($p>0.05$) (Table 3).

TABLE 1: Demographic characteristics of the groups and comparison of the disease data.

	OT (n=24)	ST (n=24)	p value
Age	63 (30-79)	67 (49-80)	0.096
Stroke duration (month)	7 (2-22)	11 (2-36)	0.064
Gender			
Female	41.7% (10)	50% (12)	0.562
Male	58.3% (14)	50% (12)	
Educational status			
Illiterate	12.5% (3)	16.7% (4)	0.280
Primary school	58.3% (14)	66.7% (16)	
Middle school	4.2% (1)	12.5% (3)	
High school	16.7% (4)	4.2% (1)	
University	8.3% (2)	0% (0)	
Etiology			
Haemorrhagic	29.2% (7)	4.2% (1)	0.020
Ischemic	70.8% (17)	95.8% (23)	
Affected side			
Right	54.2% (13)	41.7% (10)	0.386
Left	45.8% (11)	58.3% (14)	
Dominant extremity			
Right	91.7% (22)	91.7% (22)	0.149
Left	8.3% (2)	8.3% (2)	
Brunnstrom			
Hand	5 (4-6)	5 (4-6)	0.086
Up	5 (3-6)	5 (4-6)	0.129
Down	5 (3-5)	5 (1-6)	0.163
Spasticity			
Hand	0 (0-1)	0 (0-1)	0.301
Elbow	0 (0-2)	0 (0-2)	0.727
Shoulder	0 (0-2)	0 (0-2)	1.000

ST: Standard treatment; OT: Occupational therapy.

TABLE 2: Evaluation of the patients in the ST group at the pre-treatment and 6th week of the treatment according to ARAT, BI and FMA scales.

	Pre-T Median (minimum-maximum)	6th Week Median (minimum-maximum)	p value
ST group			
ARAT	57 (3-57)	57 (10-57)	0.001
BI	85 (40-100)	90 (45-100)	0.003
FMA	58.5 (38-65)	60 (42-66)	0.001
OT group			
ARAT	50.5 (6-57)	54.5 (11-57)	0.017
BI	80 (50-100)	85 (60-100)	0.001
FMA	55 (33-64)	60 (40-65)	0.001

Pre-T: Pre-treatment; ST: Standard treatment; OT: Occupational therapy; FMA: Fugl-meyer upper extremity assessment; ARAT: Action research arm test; BI: Barthel index.

TABLE 3: Comparison of differences in ARAT, BI and FMA scales scores between groups.

	ST		OT		
	Mean±SEM	Median (minimum-maximum)	Mean±SEM	Median (minimum-maximum)	p value
ARAT	52.1±2.4	57 (10-57)	47.0±2.7	54.5 (11-57)	0.003
BI	83.1±3.4	90 (45-100)	84.3±2.1	85 (60-100)	0.431
FMA	58.7±1.0	60 (42-66)	56.5±1.5	60 (40-65)	0.001

ST: Standard treatment; OT: Occupational therapy; FMA: Fugl-meyer upper extremity assessment; ARAT: Action research arm test; BI: Barthel index; SEM: Standart error of mean.

DISCUSSION

This study showed that OT added to standard rehabilitation treatments positively affects upper extremity functions and daily life activities in stroke-related hemiplegia patients. There was a statistically significant increase in the post-treatment BI, FMA scale, and ARAT scores in both OT [treatment (consisting of patients who received a 6-week OT in addition to a 6-week ST)] and ST [control (involving patients who received a 6-week ST alone)] groups compared to the pre-treatment scores. More importantly, the post-treatment FMA scale and ARAT scores appeared to be statistically significantly higher in the OT group than in the ST group. In contrast, the change in the pre-and post-treatment BI scores was similar in both groups.

Stroke is a major cause of disability and a crucial public health problem in developing countries. Advances in acute stroke treatment have significantly increased survival rates. The hand, one of the essential motor structures in the body, is unlikely to recover after a stroke.[9] Recovery of functional losses is vital in CVA rehabilitation. Conventional rehabilitation and OT focus on reducing motor disorders by improving the functional capacity of patients in the early period. The primary purpose of OT is to enable the individual to participate in daily life activities independently.[16] OT is a key component for the rehabilitation of patients with disabilities and includes a wide variety of practices to help people gain independence.[17] In the therapeutic process, attention has been paid to intensive motor training, including the necessary movements for daily life activities.[9]

The previous studies have reported that OT reduces disabilities in stroke patients.[18,19] Although the effectiveness of occupational therapies is known, there are conflicting results regarding evidence levels in the literature. No consensus exists about the optimal duration of OT, when and where it should be done. It has been considered that improving functional performance may be related to the early start of the rehabilitation program.[17]

In a published review, OT practices were classified as an inpatient, outpatient, in-house practices, and group practices. According to the review results, post-stroke OT was supported in all treatment settings to perform daily life activities independently.[20] In our study, statistical evaluations were not done separately for patients in outpatient and inpatient settings; in a treatment setting composed of both outpatients and inpatients, OT positively affected daily life activities.

In a study conducted by Gilbertson et al. with 138 hemiplegic patients, OT was applied to the patients in the treatment group and traditional rehabilitation to those in the control group. The 6th-month BI values in the treatment group were found to be significantly higher than those at initial. It was concluded that stroke patients could be improved with a short OT program at home immediately after discharge, but further studies are needed to confirm and delineate the continuity of treatment outcomes.[21]

Landi et al. applied a traditional rehabilitation program for 50 patients diagnosed with stroke 3 sessions per week for 8 weeks. In the treatment group, OT was added to the ST 3 days a week. All patients were evaluated at initial and after treatment with the Minimum Data Set for Post-acute Care. At the end of the treatment, both groups showed physical function improvement in daily life activities. However, no statistically significant difference existed in terms of

functional development between the two groups.[17] BI analysis results showed no statistically significant difference in daily life activities and functionality between groups in our trial.

A systematic review evaluated upper extremity functions determined that OT had no significant effect on upper extremity functions; besides, only two studies assessed in this review involved aphasic stroke patients.[19] Contrarily, a significant improvement was found in the FMA scale and ARAT scores in the treatment group where OT was applied in our study, including patients with upper extremity muscle strength of 3/5 and above without severe apraxia.

Narayan et al.'s study evaluated 103 stroke patients by separating them into two groups. The first group received one hour of OT for meaningful tasks for four weeks, and the second group standard rehabilitation therapy during the same period. The patients were assessed with ARAT, FMA Scale, Wolf Motor Function Test, and Motor Activity Diary-28 at initial, at the 4th and 8th weeks of the treatment. Finally, it was revealed that OT provided statistically and clinically significant improvements in stroke patients' upper extremity motor recovery.[22] In our study, too, upper extremity functions demonstrated statistically significant improvement in the treatment (OT) group similarly received OT.

In a prospective randomized controlled study carried out by Rabadi et al. with 30 acute stroke patients, the study patients were divided into 3 groups. The 1st group received ergotherapy training, 2nd group non-resistant continuous arm ergometry, and 3rd group robot-assisted therapy. In addition, standard rehabilitation treatment was applied to all groups. The study results yielded no statistically significant difference in the Functional Independence Measure (FIM) scale, FMA scale, ARAT, and MAS scores. Ultimately, robotic rehabilitation and arm ergometry appeared not to show superiority to OT in improving upper extremity motor functions in acute stroke patients.[23] In contrast, our study found a significant improvement in the FMA scale and ARAT scores in patients whom OT was added to standard rehabilitation. Similarly, Ayna et al. conducted a randomized controlled study with 51 hemiplegia patients and compared the standard rehabilitation treatment with OT added to standard rehabilitation; no statistically significant difference emerged in outcome parameters.[24]

Aran et al.'s study evaluating 16 stroke-related hemiplegia patients after the OT program concluded that ergotherapy interventions based on person-centered and holistic leisure-time activities improved the activity performance of stroke-affected individuals.[25] Although the evaluation tests we used in our study were different, interestingly, we obtained similar results to Aran et al.'s study. To summarize, our study detected a significant improvement in upper extremity motor functions with OT.

LIMITATIONS

Some of the limitations of our study appear to be having a single-center study design, its coverage of a limited number of study patients, the lack of long-term results, and unable to categorize stroke patients as acute, subacute, and chronic.

CONCLUSION

OT is a treatment method that patients can well tolerate, it is cheap, has no undesirable effects, can be shaped based on the patients' individual needs, and encourages the patient's participation in the treatment. OT aims to provide as much as possible functional independence and psychosocial adaptation to permanent disability. As a result of increased independence in self-care and mobilization, quality of life increases, and the burden on the health system decreases. Post-stroke OT programs are likely to receive more attention in the future, given the increased morbidity and long-life span in the population. Nevertheless, studies do not provide clear information about when and where OT should be performed, how treatment protocols will be, and which patients will benefit more from treatment. We consider that multicentered studies with a larger group of patients will provide more scientific evidence on this subject.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

REFERENCES

1. Lavados PM, Hennis AJ, Fernandes JG, et al. Stroke epidemiology, prevention, and management strategies at a regional level: Latin America and the Caribbean. Lancet Neurol. 2007;6:362-72. [Crossref] [Pubmed]
2. Sergeev AV, Carpenter DO. Increased hospitalizations for ischemic stroke with comorbid diabetes and residential proximity to sources of organic pollutants: a 12-year population-based study. Neuroepidemiology. 2010;35: 196-201. [Crossref] [Pubmed] [PMC]
3. Jun HJ, Kim KJ, Chun IA, et al. The relationship between stroke patients' socio-economic conditions and their quality of life: the 2010 Korean community health survey. J Phys Ther Sci. 2015;27:781-4. [Crossref] [Pubmed] [PMC]
4. Doyle S, Bennett S, Fasoli SE, et al. Interventions for sensory impairment in the upper limb after stroke. Cochrane Database Syst Rev. 2010;2010:CD006331. [Crossref] [Pubmed] [PMC]
5. Shim S, Kim H, Jung J. Comparison of upper extremity motor recovery of stroke patients with actual physical activity in their daily lives measured with accelerometers. J Phys Ther Sci. 2014;26:1009-11. [Crossref] [Pubmed] [PMC]
6. Yavuzer G, Selles R, Sezer N, et al. Mirror therapy improves hand function in subacute stroke: a randomized controlled trial. Arch Phys Med Rehabil. 2008;89:393-8. [Crossref] [Pubmed]
7. Sezer N. İnme sonrası üst ekstremitede motor ve duyusal bozuklukların rehabilitasyonu [The rehabilitation of sensorimotor disorders in upper extremity after stroke]. Turkiye Klinikleri J PM&R-Special Topics. 2016;9:63-9. [Link]
8. Legg LA, Lewis SR, Schofield-Robinson OJ, et al. Occupational therapy for adults with problems in activities of daily living after stroke. Cochrane Database Syst Rev. 2017; 7:CD003585. [Crossref] [Pubmed] [PMC]
9. Ilić NV, Dubljanin-Raspopović E, Nedeljković U, et al. Effects of anodal tDCS and occupational therapy on fine motor skill deficits in patients with chronic stroke. Restor Neurol Neurosci. 2016;34:935-45. [Crossref] [Pubmed]
10. Mahoney FI, Barthel DW. Functional evaluation: the barthel index. Md State Med J. 1965;14:61-5. [Crossref] [Pubmed]
11. Küçükdeveci AA, Yavuzer G, Tennant A, et al. Adaptation of the modified Barthel Index for use in physical medicine and rehabilitation in Turkey. Scand J Rehabil Med. 2000;32:87-92. [Crossref] [Pubmed]
12. Gladstone DJ, Danells CJ, Black SE. The fugl-meyer assessment of motor recovery after stroke: a critical review of its measurement properties. Neurorehabil Neural Repair. 2002;16:232-40. [Crossref] [Pubmed]
13. Hsieh CL, Hsueh IP, Chiang FM, et al. Inter-rater reliability and validity of the action research arm test in stroke patients. Age Ageing. 1998;27:107-13. [Crossref] [Pubmed]
14. Nomikos PA, Spence N, Alshehri MA. Test-retest reliability of physiotherapists using the action research arm test in chronic stroke. J Phys Ther Sci. 2018;30:1271-7. [Crossref] [Pubmed] [PMC]
15. Rabadi MH, Rabadi FM. Comparison of the action research arm test and the Fugl-Meyer assessment as measures of upper-extremity motor weakness after stroke. Arch Phys Med Rehabil. 2006;87:962-6. [Crossref] [Pubmed]
16. Utku U. İnme tanımı, etyolojisi, sınıflandırma ve risk faktörleri [Stroke: definition, etiology, classification and risk factors]. Türk Fiz Tıp Rehab Derg 2007;53:1-3. [Link]
17. Landi F, Cesari M, Onder G, et al. Effects of an occupational therapy program on functional outcomes in older stroke patients. Gerontology. 2006;52:85-91. [Crossref] [Pubmed]
18. Walker WF, Drummond AER, Lincoln NB. Evaluation of dressing practice for stroke patients after discharge from hospital: a crossover design study. Clin Rehabil. 1996;10:23-31. [Crossref]
19. Steultjens EM, Dekker J, Bouter LM, van de Nes JC, Cup EH, van den Ende CH. Occupational therapy for stroke patients: a systematic review. Stroke. 2003;34:676-87. [Crossref] [Pubmed]
20. Wolf TJ, Chuh A, Floyd T, et al. Effectiveness of occupation-based interventions to improve areas of occupation and social participation after stroke: an evidence-based review. Am J Occup Ther. 2015;69:6901180060p1-11. [Crossref] [Pubmed] [PMC]
21. Gilbertson L, Langhorne P, Walker A, et al. Domiciliary occupational therapy for patients with stroke discharged from hospital: randomised controlled trial. BMJ. 2000;320:603-6. [Crossref] [Pubmed] [PMC]
22. Arya KN, Verma R, Garg RK, et al. Meaningful task-specific training (MTST) for stroke rehabilitation: a randomized controlled trial. Top Stroke Rehabil. 2012;19:193-211. [Crossref] [Pubmed]
23. Rabadi M, Galgano M, Lynch D, et al. A pilot study of activity-based therapy in the arm motor recovery post stroke: a randomized controlled trial. Clin Rehabil. 2008;22:1071-82. [Crossref] [Pubmed]
24. Ayna AB, Yıldırım MA, Önes K. Hemiplejik hastalarda iş uğraşı tedavisi etkinliği [Effectiveness of occupational theraphy in hemiplegic patients]. Pamukkale Tıp Derg. 2019;12:23-32. [Crossref]
25. Aran OH, Kayıhan H. İnmeli bireylerde serbest zaman aktivitelerine yönelik ergoterapi yaklaşımlarının aktivite performansına etkisi [The effect of leisure based occupational therapy approaches on occupational performance in stroke survivors]. Ergoterapi ve Rehabilitasyon Dergisi. 2019;7:1-10. [Crossref]