

Occupational therapy assessment and treatment approach in patients with subacute and chronic stroke: A single-blind, prospective, randomized clinical trial

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ABSTRACT

Objectives: The aim of this study was to examine the effects of occupational therapy (OT) combined with standard rehabilitation (SR) on the activities of daily living, quality of life, and psychological symptoms of hemiplegic patients.

Patients and methods: Between August 2014 and February 2016, a total of 35 hemiplegic patients with post-diagnostic periods (19 males, 16 females; mean age 58.3 years; range 37 to 77 years) were included. The patients were randomized into two groups as OT+SR group (n=17) and SR only group (n=18). The study was completed by 16 patients in each group. The patients in the OT group were given 45-min SR five days a week plus 45-min OT three days a week over an eight-week period, while the patients in the SR group received SR only (of the same duration and frequency as the OT group). The patients were assessed at enrolment (pre-treatment), and again after eight weeks of treatment using the Pinch and Grip Strength and the Purdue Pegboard tests, Global Daily Living Activities Scale, Performance Assessment of Self-care Skills (PASS), Nottingham Extended Activities of Daily Living (NEADL) Scale, Quality of Life Short Form (SF-36) Questionnaire, and Hospital Anxiety and Depression Scale (HAD) for their psychological state.

Results: Significant improvements were observed in within-group scores for PASS, Pinch and Grip Strength Test, NEADL Scale, and Purdue Pegboard test ($p<0.05$). After treatment, a significant increase was found in the SF-36 physical function, general health and physical total in-group scores of the OT group, whereas a significant increase was observed only in the physical total scores of the SR group ($p<0.05$). There was no significant improvement in the HAD scores within both groups ($p>0.05$). Inter-group comparisons revealed a further significant improvement in PASS instrumental daily activity index-physical subscale and Purdue Pegboard Test scores of the OT group ($p<0.05$). However, there was no significant difference in PASS activity, self-care and instrumental daily activity cognitive subscale, SF-36, HAD and hand grip and pinch strength scores between the groups ($p>0.05$).

Conclusion: Occupational therapy combined with SR applications has a beneficial impact on certain daily living activities and hand functions. Occupational therapy does not have any additional benefits on the quality of life, pinch and grip strength, and the psychological state.

Keywords: Activities of daily living, occupational therapy, pass test, stroke.

Stroke patients may develop varying degrees of movement-coordination problems, mobility, vision-speech and sensory disorders, and cognitive and psychological problems. More than half of the patients affected by stroke display symptoms of hemiplegia, a major source of stroke-related functional motor disorder. Functional motor losses in the upper extremities have been reported in 69% of individuals

affected by stroke.^[1] Kwakkel et al.^[1] reported that weak hand-arm functions continued for up to six months after the onset of hemiplegia in 30 to 66% of these patients. Considering such losses in functions, the basic activities of daily living (ADL) including feeding, grooming, dressing, maintaining continence, transfer and mobility, which are closely associated with the quality of life and hand-arm functions,

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are likely to have a serious impact on instrumental ADL such as domestic chores and leisure activities.^[2,3] Therefore, development in motor skills, particularly the functional use of upper extremities, is one of the primary objectives of post-stroke rehabilitation.^[2,3]

According to the American Occupational Therapy Association (AOTA), occupational therapy (OT) is the therapeutic use of work, self-care, and playing activities to prevent disability and increase development of the functional skills of individuals with a disorder.^[4] Previous compilation reviews and meta-analyses reveal that OT increases the basic ADL performance.^[5] However, despite a large number of studies on the use of OT in stroke rehabilitation, these studies have been inefficient as far as content and capacity are concerned due to the fact that they have failed to have consistent control groups, make use of appropriate sensitive performance-based devices to measure the outcomes, and to disclose the content of the OT applied. Consequently, it has been reported that new randomized-controlled trials (RCTs) are needed in this field.^[1,6-8]

The primary objective of this study was to investigate the effects of OT on basic and instrumental ADL, pinch strength, and hand skills in chronic stroke patients. The secondary objective was to identify the effects of OT on the quality of life and psychological symptoms in these patients.

PATIENTS AND METHODS

The study was designed as a single-blind, prospective, randomized clinical trial. A total of 35 patients (19 males, 16 females; mean age 58.3 years; range 37 to 77 years) with hemiplegia who were admitted to the Physical Medicine and Rehabilitation outpatient clinic of Ege University, Faculty of Medicine between August 2014 and February 2016 were recruited for the study. *Inclusion criteria were as follows:* age >18 years; having been diagnosed with hemiplegia associated with a cerebrovascular event during the six to 24 months prior to the study; having a cognitive level sufficient to be able to cooperate with given directions (a score of at least 22 in Montreal Cognitive Assessment [MoCA]); having at least one of hand, upper or lower extremities at Stage 2 phase of Brunnstrom Motor Approach; having Grade ≤ 2 spasticity in the shoulder, wrist, elbow, and hand joints according to the Medical Research Council Assessment; understanding and speaking Turkish; not having apraxia; not having received rehabilitation during the three months prior to the study. *Exclusion criteria were as follows:*

having uncontrolled hypertension, a peripheral vascular disease, a serious pulmonary disease or a musculoskeletal disorder preventing exercise; having a major psychiatric problem hindering adaptation to the study; having a neurological disease or major joint contracture other than hemiplegia; having undergone muscle neural blockade with botulinum toxin or phenol-like agents during the last six months. A written informed consent was obtained from each patient. The study protocol was approved by the Medicine Faculty of Ege University Ethics Committee (Date: 07.07.2014; No.14-1.1/6). The study was conducted in accordance with the principles of the Declaration of Helsinki.

All patients participating in the study were randomized (1:1) into two groups using a computed randomization in a random number table. The OT and standard rehabilitation (SR) group (OT+SR group) consisted of 17 patients receiving OT in addition to SR, while the SR group (SR group) consisted of 18 patients receiving SR only.

A neutral observer assigned the patients to one of the two groups according to the randomization chart and referred them to their therapy programs. Assessment of the patients was conducted by another researcher who was blinded to the patient groups.

Demographic (age, sex, education, occupation) and clinical data (duration of hemiplegia, affected body side, etiology, hand preference, risk factors, Brunnstrom motor stages) of the patients were obtained through face-to-face interviews or from patient files and recorded on case report forms. Routine physical examinations, musculoskeletal examinations, and neurological examinations of the patients were performed.

All the patients were assessed before and after the eight-week therapy protocol during a series of visits. The patients were assessed based on muscular strength, hand dexterity, global ADL, and psychological outcomes.

Assessment of muscular strength

Pinch strength

A pinch meter gauge (Jamar® Pinch Gauge-Hydraulic - 50 lb Capacity; Patterson Medical Illinois, USA) was used to assess pinch strength. As stroke patients in our study were unable to perform three pinch and tip pinch tests, lateral/key pinch measurements were taken. The patients were asked to place the pinch meter between the distal pad of the thumb and the lateral aspect of the index finger and squeeze the pinch gauge with maximum effort. When the measurements were taken,

the patients were seated with the shoulder adducted and neutrally rotated, elbow flexed at 90°, forearm in neutral position and wrist in about 20° extension. Each grip test was repeated three times and the highest score for the affected extremity was used for further analysis. All the scores were recorded in kg.^[9]

Grip strength

A hand dynamometer (pinch meter gauge; Jamar® Hand Dynamometer - Hydraulic - 200 lb Capacity. Patterson Medical Illinois, USA) was used to determine the grip strength of the patients. While taking the measurements, the patients were seated with the shoulder adducted and neutrally rotated, elbow flexed at 90°, forearm and wrist in neutral position. Each grip test was repeated three times and the highest score for the affected extremity was used for further analysis.

Assessment of hand dexterity

Purdue pegboard

The Purdue Pegboard consists of a board with holes into which metal pegs are inserted by the patient. It also comes with washers and collars to be placed on the pins. The test measures movements, coordination and speed of hand and finger dexterity.^[10]

In the test procedures, the patient is first asked to use the right hand to properly insert as many pins as possible in the holes. Then, the same procedure is repeated for the left hand. In the final stage the patient is given 60 sec to place the pins, washers and collars using both hands.

Assessment of global ADL

Nottingham Extended Activities of Daily Living Index (NEADL)

The NEADL was primarily designed for stroke patients.^[11] It consists of 22 items scored on a scale of 0-3. The index has four subscales including mobility, kitchen, domestic, and leisure activities. The total scores given to each subscale make up the overall score. A reliability and validity study of the Turkish version of NEADL were conducted by Sahin et al.^[12]

Performance Assessment of Self-Care Skills (PASS)

The PASS is a performance-based, criterion-referenced, and patient-centered observational tool. It is used for objective assessment of performance in OT and helps the therapist tailor the most optimal OT plan for the patient.^[13]

It is mainly used with physically and cognitively impaired adults and the elderly population, and in

various clinical cases such as cerebrovascular disease, bipolar disorder, congestive heart failure, dementia, Parkinson's disease, macular degeneration, heart transplantation, and osteoarthritis as well as a number of research studies. It is an effective tool for measuring the complicated person/task/environment interactions and is unique in that it rates safety and independence separately while performing tasks.^[14]

The PASS consists of 26 tasks and 163 sub-tasks used for assessing occupational performance. Each task has 2-12 sub-tasks, each of which has three criteria and is rated for independence, safety, and adequacy on a scale from 0-3. These 26 tasks make up four different domains including functional mobility (5 tasks), personal self-care (3 tasks), instrumental ADL-physical emphasis (4 tasks), and instrumental ADL-cognitive emphasis (14 tasks).

In the test procedures, first, the required task objects, an organized environment and proper instructions are prepared. The examiner reads the verbal instructions to the patient. During the test, the examiner provides nine levels of assistance in hierarchical order, if the patient makes a mistake or stops performing the task. The assistance levels, from least to most assistive are: (i) verbal supportive (encouragement); (ii) verbal non-directive (cue to alert); (iii) verbal directive (instruct); (iv) gestures (point at object); (v) task/environment rearrangement (break task down); (vi) demonstration (demonstrate task/subtask); (vii) physical guidance ('hands down' - move body part needed); (viii) physical support ('hands up' - lift body part/clothes/support); and (ix) total assistance (do task/sub-tasks for the person). Assistance is provided only when needed, with the least assistive prompt used first, followed by progressively more assistive prompts. The level and number of prompts required are used to determine the independence score of the patient. The PASS is a task-specific tool where each item stands alone. The therapist may administer only those tasks deemed relevant to the patient's personal or clinical situation. Also, therapists or clinicians may even develop new PASS items in addition to the 26 tasks using the PASS template for situations important in everyday life.^[14] In the current study, tasks numbered 9, 10, and 11 were omitted as they are not extensively used in the Turkish society and can cause misunderstanding. Therefore, the test was administered using only 23 tasks. The Turkish reliability study was carried out as a second study with the same patient group in parallel with the current study and was found to

have excellent reliability (test-retest reliability >0.9). The reliability outcomes were compatible with those of the English version and the other versions in other languages (test-retest reliability; 0.92-0.96).^[13,15]

Short Form-36 (SF-36)

The SF-36 is one of the most frequently used surveys for the evaluation of quality of life. It covers general health concepts and is composed of two main components each with four subscales. The physical component scale comprises physical role function, limitations in physical role, bodily pain and general health perceptions. The mental health scale is composed of vitality, social role function, limitations in emotional role, and mental health perceptions. The self-assessment scale has 36 items rated on a scale of 0-100, where 0=maximum disability and 100=no disability. A validation study of the SF-36 among stroke patients was carried out by Anderson et al.^[16] It was translated into Turkish and the validity and reliability study were conducted in 1999 by Kocyigit et al.^[17]

Psychological assessment

Hospital Anxiety and Depression Scale (HAD):

The HAD is a self-assessment scale frequently used for screening symptoms of anxiety and depression in hospital environments.^[18] The scale consists of 14 items, seven of which (odd numbers) relate to depression and seven (even numbers) to anxiety. A validity study of the Turkish translation of HAD was performed by Aydemir^[19]

Therapy protocol

The patients in the OT group were given 45-min sessions of SR five days a week, plus 45-min sessions

of OT three days a week (Monday, Wednesday, and Friday) over an eight-week period. The patients in the SR group received SR only, of the same duration and frequency as the SR group.

In SR, therapy, conventional rehabilitation exercises including passive and active joint movement, stretching, strengthening exercises, transfers, walking, stair climbing and descending stairs, and weight transfer training were administered to the patients under the supervision of a physiotherapist.

In the OT program, the patients were given one-to-one therapy by a physiotherapist experienced in OT applications. The exercises to be administered were determined according to the patient-specific functional condition. Thus, five occupational activities were selected for each patient. Each week, the progress of the patient was monitored, and necessary modifications were made accordingly. If a patient started performing an exercise without difficulty, it was either replaced with a new exercise or made more difficult. The equipment used in OT is summarized in Table 1.

Statistical analysis

Power analysis and sample size calculation were performed using the G*Power version 3.1 (Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Germany). It was determined that at least 15 patients were needed in each group to show 0.6 points of change in the PASS independency scores with 80% power and 0.05 type 1 error.

Statistical analysis was performed using the IBM SPSS for Windows version 22.0 software (IBM Corp., Armonk, NY, USA). The intention-to-treat (ITT) approach was used for all statistical analyses. Descriptive data were expressed in mean \pm standard deviation (SD), median (min-max) or

TABLE 1
Equipment used in occupational therapy

<ul style="list-style-type: none"> • Stringing beads • Threading string through a buttonhole • Chinese ball • Mikado pick-up sticks game • Screw pegboard exercise • Jenga game • Colored tower • Cylindrical weights • Colored geometric shapes • Exer-board hand exercise • Square channel exercise • Digi-extend set • Quoits/throwing & tagging rings • Motor activity board (door handle, padlock, key, light, socket, bolt, faucet) 	<ul style="list-style-type: none"> • Colored putty at different consistencies • Colored cylinders • Circular boards with holes • Mushroom pegboard game • Large peg game • Cleaning rice grains • Ball balance • Spiral spring • Digi-flex set • Silicon eggs • Basketball game • Small roller • Square channel workout • Clothes peg tag game • Wooden blocks
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number and frequency. The Shapiro-Wilk test was used to determine whether there was any deviation in the normal distribution of variables and non-parametric tests were preferred, when at least one of group or variable was not compatible with normal distribution. In cases where both groups or variables were compatible with normal distribution, parametric analysis methods were used. While the comparison of independent groups was made using the parametric t-test or the non-parametric Mann-Whitney U test, the Wilcoxon paired signed-rank sum test was used for time-related comparisons within the same group. The chi-square test and Fisher's exact test were used to compare the non-numerical data in descriptive statistics, and a t-test or a Mann-Whitney U test was used for constant variables. A p value of <0.05 was considered statistically significant.

RESULTS

Of a total of 35 patients, three patients did not complete the study ($n=1$ in OT group and $n=2$ in SR group). One patient in each group withdrew from the study on their own accord and the other patient in the SR group dropped out of the study due to the deterioration of general condition associated with the development of hydrocephalus. Finally, 32 patients completed the study at the end of the eight-week therapy program (Figure 1).

Demographic and disease characteristics are summarized in Table 2. There was no statistically

significant difference in the age and sex between the groups ($p>0.05$ for both). In addition, there was no significant difference between the two groups in terms of the occupation and education status ($p>0.05$). In the clinical data, there was no significant difference in the affected body side, hand preference, etiology, duration of hemiplegia, and risk factors between the groups ($p>0.05$). Also, we found no significant difference in the baseline scale scores between the groups ($p>0.05$). Although a significant difference was found between the baseline and post-treatment pinch and grip strength for both groups ($p<0.05$), the difference was not significant between the groups ($p>0.05$).

A significant increase was observed in the Purdue Pegboard scores within both groups ($p<0.05$). In the comparison of the changes between the groups, the difference in the OT group was statistically significantly higher ($p<0.05$, Table 3).

Compared to the baseline scores, a significant increase was observed in the SF-36 physical function, general health, and physical total scores in the OT group, and a significant increase only in the physical total score in the SR group ($p<0.05$, Table 4). The comparison of the changes between the groups revealed no significant differences in physical function, pain, general health, vitality, social function, emotional role, mental health, emotional total, and physical total scores.

In the HADS, no significant improvement from pre- to post-treatment was found in the anxiety and

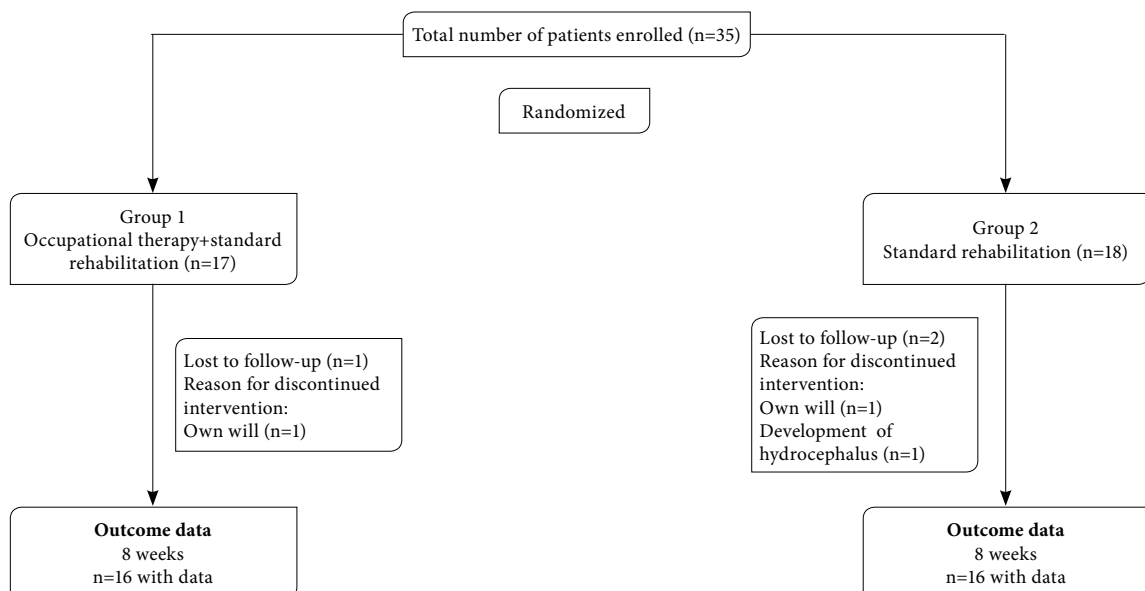


Figure 1. Flow diagram of the study.

TABLE 2
Baseline demographic and clinical characteristics of patient groups

	Groups												<i>p</i>				
	Occupational therapy + standard rehabilitation						Standard rehabilitation							Total			
	n	%	Mean±SD	Median	Min-Max	n	%	Mean±SD	Median	Min-Max	n	%		Mean±SD	Median	Min-Max	
Age (year)*	17		56.9±11.0			18		59.7±11.9			35		58.3±11.4			0.50	
Sex																	
Female	8	47.1				8	44.4				16	45.7				0.88	
Male	9	52.9				10	55.6				19	54.3					
Education																	0.83
Literate	1	5.9				2	11.1				3	8.6					
Elementary	6	35.3				7	38.9				13	37.1					
High School	4	23.5				5	27.8				9	25.7					
University	6	35.3				4	22.2				10	28.6					
Occupation†																	0.91
Civil servant	2	11.8				3	16.7				5	14.3					
Worker	3	17.6				4	22.2				7	20.0					
Housewife	4	23.5				5	27.8				9	25.7					
Retired	4	23.5				4	22.2				8	22.9					
Other	4	23.5				2	11.1				6	17.1					
Etiology																	0.58
Ischemic	14	82.4				16	88.9				30	85.8					
Hemorrhagic	3	17.6				2	11.1				5	14.2					
Affected side																	0.61
Right	9	52.9				8	44.4				17	48.6					
Left	8	47.1				10	55.6				18	51.4					
Hand preference																	0.58
Right	16	94.1				16	88.9				32	91.4					
Left	1	5.9				2	11.1				3	8.6					
Number of risk factors‡			2.6±1.4	2	0-5			2.3±1.1	2	1-4			2.5±1.2	2	0-5		0.56
Duration of disease‡			11.6±5.7	10	6-24			13.7±6.3	6	24			12	6-24			0.27

SD, Standard deviation; Min: Minimum; Max: Maximum; Chi-square test; * Independent t-test; † Fisher's exact test; ‡ Mann-Whitney U test; § p<0.05.

TABLE 3
Changes over the scores for time in pinch strength, hand grip strength and purdue pegboard and comparison of differences between groups

	Occupational therapy + standard rehabilitation						Standard rehabilitation								
	Pre-treatment			Post-treatment week 8			Pre-treatment			Post-treatment week 8					
	Mean±SD	Median	Min-Max	Mean±SD	Median	Min-Max	Mean±SD	Median	Min-Max	Mean±SD	Median	Min-Max	p ¹	p ²	p ³
Pinch strength (kg)	2.9±2.5	1.9	0.0-7.5	3.8±3.1	2.4	0.0-10.0	0.001*	2.4±2.3	1.3	0.0-6.0	2.51±2.3	1.9	0.0-6.0	0.004*	0.067
Hand grip strength (kg)	7.7±6.1	6.5	0.0-23.0	9.64±6.90	9.45	0.0-28.0	0.004*	7.53±5.1	7.7	0.0-15.0	8.0±5.1	7.5	0.0-16.0	0.008*	0.445
Purdue pegboard	14.3±6.55	13	6.0-33.0	17.6±9.89	14	6.0-48.0	0.001*	12.4±5.1	12	7.0-28.0	13.6±6.6	12	7.0-33.0	0.013*	0.045*
FIM-motor	68.7±14.2	72	40.0-86.0	72.3±14.7	78	43.0-90.0	0.001*	63.8±16.0	68	34.0-85.0	65.3±17.5	70	35.0-87.0	0.001*	0.001*
FIM-cognitive	29.2±7.7	33	9.0-35.0	29.7±7.7	34	10.0-35.0	0.075	26.5±7.4	29.5	9.0-35.0	26.7±7.5	27.5	10.0-35.0	0.084	0.642
FIM total	97.9±18.7	99	49.0-121.0	102.0±19.4	106	53.0-125.0	0.001*	90.5±22.7	99.5	51.0-118.0	92.2±23.3	96	54.0-120.0	0.001*	0.029*

SD: Standard deviation; Min.: Minimum; Max: Maximum; FIM: Functional independence measure; p1: Changes in group 1 over time; p2: Changes in group 2 over time; p3: Comparison of changes in groups over time; * p<0.05; Mann Whitney U test for independent groups; Wilcoxon Paired Sign Rank Sum Test for changes within groups.

TABLE 4
Changes over time in the SF-36 scores and comparison of differences between groups

	Occupational therapy + standard rehabilitation						Standard rehabilitation								
	Pre-treatment			Post-treatment week 8			Pre-treatment			Post-treatment week 8					
	Mean±SD	Median	Min-Max	Mean±SD	Median	Min-Max	Mean±SD	Median	Min-Max	Mean±SD	Median	Min-Max	p ¹	p ²	p ³
SF-36 Physical function	50.2±24.3	60.0	10.0-80.0	53.7±26.7	52.5	10.0-90.0	0.044*	44.7±21.8	50.0	5.0-70.0	44.8±21.2	47.5	10.0-75.0	0.128	0.441
SF-36 Physical role	22.1±29.2	25.0	0.0-100.0	21.8±20.1	25.0	0.0-50.0	0.818	20.8±26.1	25.00	0.0-100.0	18.4±22.4	12.5	0.0-70.0	0.757	0.829
SF-36 Pain	67.7±27.0	74.0	25.0-100.0	76.2±25.5	82.0	32.0-100.0	0.135	75.9±24.8	79.00	31.00-100.00	75.4±24.0	73.00	42.00-100.00	0.227	0.268
SF-36 General health	44.8±25.8	45.0	15.0-100.0	47.5±25.3	47.50	10.00-97.00	0.045*	33.1±15.7	30.00	10.00-67.00	35.6±21.2	27.50	10.00-84.00	0.262	0.875
SF-36 Vitality	49.1±11.6	50.0	25.0-70.0	53.4±13.3	50.0	25.0-80.0	0.397	45.6±12.6	47.50	25.00-65.00	43.3±13.6	45.00	20.00-60.00	0.722	0.181
SF-36 Social function	51.7±27.8	50.0	12.0-100.0	50.3±25.4	62.0	10.0-100.0	0.363	51.8±26.1	62.0	0.0-87.0	48.5±21.3	50.0	12.0-87.0	0.952	0.935
SF-36 Emotional role	44.4±19.7	33.0	0.0-66.0	43.4±31.4	33.0	0.0-100.0	0.635	40.3±24.3	33.0	0.0-100.0	39.7±22.4	33.0	0.0-75.0	0.656	0.693
SF-36 Mental health	46.12±26.3	48.0	0.0-84.0	52.0±21.0	52.	4.0-88.0	0.102	50.0±12.0	50.0	20.00-64.00	50.5±11.2	52.0	28.0-64.0	0.512	0.341
SF-36 Physical (total)	37.6±8.8	38.0	25.0-54.0	38.8±9.0	38.00	25.00-55.00	0.025*	35.39±4.1	36.00	20.00-49.00	37.2±8.3	39.50	23.0-50.0	0.01*	0.521
SF-36 Emotional (total)	39.4±8.1	38.0	24.0-54.0	42.1±8.8	42.0	23.0-59.50	0.087	38.8±4.1	39.0	31.0-49.0	38.4±3.3	39.0	29.0-43.0	0.698	0.138

SD: Standard deviation; Min.: Minimum; Max: Maximum; SF-36: Short Form; p1: Changes in group 1 over time; p2: Changes in group 2 over time; p3: Comparison of changes in groups over time; * p<0.05; Mann Whitney U test for independent groups; Wilcoxon Paired Sign Rank Sum Test for changes within groups.

TABLE 5
Changes over time in the scores for HAD nottingham extended ADL index and comparison of differences between groups

	Occupational therapy + standard rehabilitation						Standard rehabilitation								
	Pre-treatment			Post-treatment week 8			Pre-treatment			Post-treatment week 8					
	Mean±SD	Median	Min-Max	Mean±SD	Median	Min-Max	Mean±SD	Median	Min-Max	Mean±SD	Median	Min-Max	p ¹	p ²	p ³
HAD-anxiety	9.5±2.7	9.0	5.0-15.0	9.1±2.6	8.0	6.0-15.0	10.9±2.5	10.0	7.0-14.0	11.0±2.9	10.0	7.0-15.0	0.163	0.382	0.575
HAD-depression	9.7±1.6	10.0	6.0-13.0	9.4±1.7	9.0	7.0-13.0	10.3±1.8	10.5	8.0-14.0	10.2±1.5	10.0	8.0-13.0	0.55	0.088	0.885
NEADL-mobility	10.8±5.0	11.0	4.0-18.0	12.3±5.1	12.5	5.0-18.0	9.6±5.1	8.5	3.0-19.0	10.7±5.3	8.5	4.0-19.0	<0.01*	<0.01*	0.763
NEADL-kitchen	7.1±3.5	8.0	1.0-14.0	8.81±4.42	9.0	1.0-15.0	6.44±3.63	6.50	1.0-15.00	6.94±4.34	6.5	1.0-15.0	<0.01*	0.08	0.065
NEADL-domestic	4.9±4.0	4.0	0.0-13.0	6.25±4.46	4.50	0.00-15.00	3.8±3.5	3.0	0.0-12.0	4.2±3.7	3.0	0.0-13.0	<0.01*	0.023*	0.029*
NEADL-leisure activities	6.7±3.5	8.0	0.0-11.0	7.8±4.3	9.0	0.0-16.0	5.2±4.56	4.0	0.0-18.0	5.75±4.80	3.50	1.0-18.0	0.026*	0.015*	0.373
NEADL-total	29.7±12.7	28.0	5.0-51.0	35.5±15.4	34.0	6.0-62.0	25.2±14.7	22.0	6.0-54.0	27.6±16.1	20.5	7.0-55.0	<0.01*	<0.01*	0.031*

SD: Standard deviation; Min: Minimum; Max: Maximum; HAD: Hospital Anxiety and Depression Scale; NEADL: Nottingham Extended Activities of Daily Living Scale; p1: Changes in group 1 over time; p2: Changes in group 2 over time; p3: Comparison of changes in groups over time; * p<0.05; Mann Whitney U test for independent groups; Wilcoxon Paired Sign Rank Sum Test for changes within groups.

depression scores within both groups ($p>0.05$). The comparison of the changes between the two groups showed no significant differences ($p>0.05$, Table 5).

Significant increases were found in the post-therapy mobility, domestic, leisure activity, and total scores of the NEADL within both groups ($p<0.05$). In the OT group, a significant increase was observed from pre- to post-treatment in the kitchen score only. The comparison of the changes between the groups revealed a significant increase in domestic and total scores in favor of the OT group ($p<0.05$, Table 5). No significant differences were observed between the groups in respect of the mobility, kitchen, and leisure activity scores ($p>0.05$, Table 5).

In the within group analyses of performance assessment of self-care skills, there was a significant increase in the independence, safety, and outcomes from functional mobility, personal self-care and instrumental ADL-physical items in both groups ($p<0.05$). A significant increase was observed in the independence and outcomes from instrumental ADL-cognitive items within the OT group ($p<0.05$), while there was no significant increase in the safety data ($p>0.05$, Table 6).

The analyses between the groups of performance assessment of self-care skills did not reveal any significant differences in functional mobility, personal self-care, and instrumental ADL-cognitive items ($p>0.05$). No significant difference was found between the groups in the changes of independent and safety data from instrumental ADL-physical items scores ($p>0.05$). However, a significant increase was observed in the outcomes in favor of the OT group ($p<0.05$, Table 6).

DISCUSSION

In the present study, we aimed to examine the effects of OT combined with SR on the ADL, quality of life, and psychological symptoms of hemiplegic patients. The main finding of the current study was the positive impact of OT on instrumental ADL and hand skills in subacute and chronic stroke patients. However, no positive effects were observed on quality of life and psychological symptoms.

While the positive improvement in the basic ADL was similar in both the OT and SR groups, the OT group showed a significant improvement in instrumental ADL compared to the SR group. In previous reviews and meta-analyses, improvements in

TABLE 6
Changes over time in the scores for performance assessment of self-care skills and comparison of differences between groups

	Occupational therapy + standard rehabilitation						Standard rehabilitation								
	Pre-treatment			Post-treatment week 8			Pre-treatment			Post-treatment week 8			p ³		
	Mean±SD	Median	Min-Max	Mean±SD	Median	Min-Max	Mean±SD	Median	Min-Max	Mean±SD	Median	Min-Max			
Functional mobility independence data	2.3±0.6	2.5	0.9-3.0	2.5±0.5	2.7	1.2-3.0	<0.01*	2.1±0.7	2.3	0.6-2.9	2.2±0.7	2.4	0.78-2.9	<0.01*	0.085
Functional mobility safety data	2.3±0.6	2.6	1.0-3.0	2.5±0.52	2.6	1.4-3.0	<0.01*	2.1±0.7	2.4	0.6-3.0	2.2±0.6	2.5	1.0-3.0	0.023*	0.289
Functional mobility outcome data	2.2±0.6	2.6	0.8-3.0	2.4±0.5	2.7	1.4-3.0	<0.01*	2.0±0.6	2.30	0.8-3.0	2.2±0.6	2.2	1.2-3.0	0.012*	0.287
Personal self care independence data	1.7±0.6	1.7	0.3-2.6	1.9±0.74	1.97	0.3-2.9	<0.01*	1.4±0.7	1.6	0.3-2.5	1.6±0.7	1.74	0.4-2.7	<0.01*	0.057
Personal self care safety data	1.8±0.5	2.0	0.6-2.6	2.0±0.6	2.0	0.6-3.0	<0.01*	1.5±0.6	1.6	0.3-2.6	1.6±0.6	1.8	0.6-2.6	0.015*	0.546
Personal self care outcome data	1.5±0.6	1.3	0.3-2.3	1.7±0.7	1.6	0.3-2.6	<0.01*	1.3±0.5	1.3	0.3-2.3	1.5±0.5	1.5	0.6-2.3	0.015*	0.325
Instrumental ADL (physical) independence data	2.1±0.6	2.4	0.7-3.0	2.2±0.6	2.50	0.9-3.0	<0.01*	1.8±0.7	2.1	0.2-2.9	1.9±0.8	2.2	0.2-2.9	<0.01*	0.099
Instrumental ADL (physical) safety data	2.2±0.6	2.5	1.2-3.0	2.4±0.6	2.5	1.2-3.0	0.015*	1.9±0.7	2.2	0.7-3.0	2.0±0.8	2.3	0.7-3.0	0.015*	0.970
Instrumental ADL (physical) outcome data	1.9±0.7	2.0	0.7-3.0	2.2±0.7	2.3	1.0-3.0	<0.01*	1.7±0.7	1.8	0.5-3.0	1.7±0.7	1.8	0.5-3.0	<0.01*	0.047*
Instrumental ADL (cognitive) independence data	1.9±0.8	2.3	0.2-2.8	2.0±0.8	2.5	0.2-2.9	<0.01*	1.6±0.8	2.1	0.3-2.8	1.7±0.9	2.1	0.3-2.8	<0.01*	0.282
Instrumental ADL (cognitive) safety data	1.6±0.6	1.7	0.4-2.6	1.7±0.7	1.8	0.2-2.6	0.655	1.5±0.7	1.6	0.4-2.8	1.5±0.8	1.6	0.2-2.8	0.515	0.715
Instrumental ADL (cognitive) outcome data	1.8±0.8	2.2	0.1-2.6	2.0±0.9	2.4	0.1-2.8	<0.01*	1.5±0.8	1.9	0.1-2.7	1.6±0.9	2.0	0.3-2.8	<0.01*	0.157

SD: Standard deviation; Min: Minimum; Max: Maximum; ADL: Activities of daily living; p1: Changes in group 1 over time; p2: Changes in group 2 over time; p3: Comparison of changes in groups over time; * p<0.05; Mann Whitney U test for independent groups; Wilcoxon Paired Sign Sum Test for changes within groups.

both basic and instrumental ADL were observed in OT groups.^[5,7,8,20,21] In a review of 39 studies published by Wolf et al.,^[7] the use of OT for improvement in ADL was supported by strong evidence. Although positive effects were observed in studies aimed at improving instrumental ADL, none of them produced a sufficient number of evidence for the use of OT in this manner. Similarly, in a Cochrane review investigating the impact of OT on the ADL of stroke patients, there were no sufficient data to reach a conclusive view on the effects of OT on the ADL.^[9] Basic ADLs include self-care tasks of dressing, transfers, walking, using stairs and bathing. The majority of these activities are closely associated with functionality and mobility of the lower extremity functional scale, rather than the upper extremity scale.^[1] Nevertheless, it has been also reported that general ADL and increased therapies for the lower extremities yielded more rapid results than those for the upper extremities.^[1] The OT used in the current study were mostly targeted the upper extremity functions. While there were improvements in the instrumental ADLs in the SR group of the current study, similar improvements in the basic ADL were also observed in the SR group, which can be attributed to the aforementioned reasons.

In our study, OT was not found to have any positive impact on the quality of life. In a systematic review, Dorstyn et al.^[22] investigated the effects of therapies aimed at leisure activities, a method of OT itself, on functional outcomes after stroke, and found that there was moderate evidence to support that there were beneficial effects on quality of life of OT based on leisure activities. These effects continued only during the course of disease and there was no evidence for long-term effects. The methodology of studies evaluating the effects of OT on participation in quality of life and leisure activities has mostly consisted of interventions based on social activities. Nonetheless, most of these therapies were not applied regularly and were applied over a long period, and some were conducted as group sessions.^[22,23] In the current study, however, most of the therapies were aimed at functional improvements. The therapy protocol used in this study was more intensive and personalized compared to most of the aforementioned studies. The improvement in physical function score rather than social, psychological, and emotional scores can be attributed to this aspect. The SF-36 is a generic quality of life assessment tool and does not contain questions related to stroke, which could explain why the changes in patients could not be fully reflected in the measurements, which might

eventually have prevented adequately good outcomes from being obtained.

In the current study, although a positive impact was observed in the hand skills of the patients receiving OT, no significant difference was found in the hand grip and pinch strength scores. In a systematic review including 18 RCTs by Steultjens et al.,^[5] hand and arm functions were assessed in two studies and it was concluded that OT did not have any significant effects on hand-arm functions. In contrast, in the group receiving OT in the current study, a more significant improvement was observed in the hand skill test performed using the Purdue Pegboard. However, in the review published by Steultjens et al.,^[5] there were two separate studies including stroke patients with apraxia, whereas these types of patients were excluded from the current study. The inclusion of those patients could have led to different outcomes in the current study. In a RCT by Bütefisch et al.^[24] of 27 subacute hemiplegic stroke patients, 2×15-min hand grip strength exercises, performed by squeezing the handles of a hand gripper, were applied to one group in addition to Bobath and OT, while sham transcutaneous electrical nerve stimulation therapy as well as Bobath and OT were applied to the other group. Significantly higher scores in the hand grip, extension strength, and acceleration rate were observed in the group receiving strength exercise by the end of the second week. Although there was significant recovery in pinch and grip strength in both groups in the current study, no significant difference was observed between the two groups. While a total of 30 min was allocated to strength exercises in the aforementioned study, this constituted only a relatively small section of the current study therapy. The discrepancy between the outcomes can be attributed to the difference in duration and intensity of the therapy.

Occupational therapy was not observed to have any positive effects on depression in the current study. In a study conducted on post-stroke depression, Salter et al.^[25] reported that selective serotonin reuptake inhibitors and related antidepressants were effective in the treatment of post-stroke depression, but activities such as non-pharmacological therapy, treadmill and aerobics did not have any proven efficiency. In another study including 185 patients, Walker et al.^[26] compared home-based OT with routine care services. At the end of six months, no significant improvements were found in depressive

symptoms. In a RCT including 94 chronic stage stroke patients, Wade et al.^[27] found no significant improvement in the HAD scores after three and six months of follow-up with an OT-based physiotherapy program. In a study in which lifestyle inclinations as well as physical activities were investigated in stroke patients, Lund et al.^[23] observed no significant improvement in the HAD scores at the end of a nine-month follow-up period compared to the control group. In a review on the effects of OT methods in stroke patients, Trombly and Ma^[21] analyzed four trials which assessed psychological symptoms. Recovery was not dependent on the content of therapy, since the participants exhibited improvement in depressive symptoms in both groups in one of the studies, and the control group were already less depressed at the beginning of the study in another study. The authors, therefore, concluded that positive effects of OT on depression were disputable and further studies were needed.

In the current study, the PASS test was used, which is a patient-centered, performance-based, criterion-referenced and observational measurement tool. The PASS is a tool which not only helps to assess performance objectively, but also to design OT methods suited to the patient. This tool is a scale which enables therapists to separately assess functional mobility, self-care skills, physical and cognitive instrumental ADL with regard to efficiency of independence, safety and outcome quality.^[13] In addition to the PASS test, the current study also used the Nottingham ADL Index, which is a global assessment scale, the hand and pinch grip strength measurement, which is a more specific criterion for the affected body side, and the Purdue Pegboard Test. According to the results obtained in the study, it can be inferred that the positive effect observed in ADL and independence scales was partly associated with the improvement of compensatory movements and behavior and partly related to the functional improvement of the affected body side. However, it was not possible to differentiate which mechanism was dominant for the improvements.

One of the strengths of the current study was the addition of the SR protocol to the OT group, which eliminated the risk of bias that would, otherwise, reduce the impact magnitude. In a systematic review by Dorstyn et al.,^[22] the preference of general care as the control group was indeed an element of bias in the assessment of the efficiency of OT in stroke patients. In contrast, the current study did not include a control

group that did not receive any therapy or only received general care. Although the OT group received the same SR protocol as the SR group, the ideal setting would be the inclusion of a control group not receiving any intervention at all. However, such a control group was not included in the study design for ethical reasons. Hence, there was no risk factor that could have reduced the impact magnitude. Nevertheless, it was possible to assess the combined effects of OT with a highly standardized rehabilitation program rather than its isolated effects.

Another strength of this study was the presence of a specified standardized design, therapy protocols and diagnostic tools, unlike many previous studies. In a review conducted by Chen and Winstein,^[28] an ideal scale assessing upper extremity participation had not yet been developed. The possible explanation for this can be that compensatory movements and behavior may influence the outcomes of these scales. Standardized post-stroke rehabilitative assessment criteria are still a matter of debate.^[25] Although there is no consensus concerning duration and intensity of the rehabilitation programs after stroke, many studies and meta-analyses have attempted to shed light on this subject.^[29-31] In a guide published on evidence-based stroke rehabilitation, Quinn et al.^[32] reported that present evidence was not adequate enough to describe minimum or maximum durations of therapy. In a meta-analysis including 20 RCTs, Kwakkel et al.^[1] investigated the effects of increased rehabilitation periods on the efficiency of the therapy and reported that a 16-h increase in the duration of therapy was necessary to produce a significant difference in the outcomes. The length of therapy per workday was planned as 72 min for the OT group and 45 min for the control group and, thus, the OT group received a total of 18-h additional rehabilitation during the eight-week therapy period. This seems to be consistent with the phrase "minimum additional time needed to obtain a significant difference in rehabilitation" mentioned in the meta-analysis conducted by Kwakkel et al.^[1]

Patients in subacute and chronic phases were included in the current study. There is a limited number of studies on the efficiency of rehabilitation in these phases.^[32,33] Patients with a history of stroke from six months to two years were included to obtain results irrespective of the impacts of the spontaneous neurological recovery observed in the first six months and to observe the positive impacts which could be achieved through OT modalities in addition to the rehabilitation periods of patients after the acute phase.

Nonetheless, there are some limitations to the study. It is not possible to generalize the results due to the small number of patients included in the study. Therefore, it was not possible to conduct subgroup examinations according to type of stroke, risk factors, and demographic data of the patients. As the follow-up period was limited to two months, it is unknown whether the benefits gained through therapy would continue for a long period of time. The fact that there was no group not receiving any therapy can be also considered a limitation of the study. Moreover, due to the fact that the Brunnstrom stages of the patients included in the study were relatively good, the effects of OT modalities on hemiplegic stroke patients with more severe disability could not be assessed.

In conclusion, our study results suggest that a personalized, patient-specific and task-based OT administered after hemiplegia has a positive impact on basic and instrumental ADL.

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