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The effects of task-oriented training combined with Bobath program and task-oriented training alone on upper-limb function in stroke patients

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Abstract

Background: Paralysis of the hand occurs acutely in up to 87% of all stroke survivors. Common rehabilitation approaches specifically developed for hemiparesis after stroke include Task Oriented Training (TOT) and Bobath program. The objective of this study was to compare the effects of Task-Oriented Training combined with Bobath program and Task-Oriented Training alone on the function of upper extremity in post-stroke hemiparesis patients.

Methods: In a Randomized Clinical Trial 16 participants with stroke allocated to either an intervention Task Oriented Training and Bobath program (A) or Task-Oriented Training alone (B) groups. Main outcome measures were the Fugl Meyer Assessment (FMA), Wolf Motor Function Test (WMFT), and the secondary outcome measures were the Barthel Index, and Grip Strength Test. Six participants received combination of Task-Oriented Training with Bobath program and 8 people received Task-Oriented Training alone for five weeks, three days a week.

Results: We used the independent Sample t-test and repeated measures ANOVA to compare functional measures of upper limb within and between groups. Our results indicated that although each of combination and TOT programs showed comparable improvements in functional measures of the affected upper limb, no one of them had priority over another.

Conclusion: Since stroke patients vary vastly on factors such as severity of impairments, learning styles and motivation it cannot be assumed that one approach will be more operative than others for all individuals at every stage of their recovery. Further research needs to find difference between rehabilitation approaches.

Keywords: Stroke, Hemiparesis, Upper extremity, Task-Oriented training, Bobath program, Combination therapy

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Introduction

Stroke is the largest cause of complex disability. Half of all stroke survivors are left with a disability. It has a greater disability impact on an individual than any other chronic disease (1). Most stroke survivors will regain the ability to walk independently, but only less than 50% will recover arm function. The recovery process of upper extremity function is often slower than the recovery process of lower extremity function (2). Paralysis of the hand occurs acutely in up to 87% of all stroke survivors (3). 55% to 75% of stroke survivors having significant constant deficits in performing activities of daily living (ADLs) (4). Loss of independence of upper limb function leads to functional disability significantly, affecting the quality of life and independence in activity of daily living (washing,

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↑What is "already known" in this topic:
At present, several studies have reported that rehabilitation Interventions can be combined in order to achieve the maximal motor function recovery for each stroke patient. However, it is not clear that a special kind of which combination is better than any other.

→What this article adds:
This study provides support for the use of task -oriented training rather than combination of Bobath and Task- oriented training for improving upper limb function in chronic stroke individuals.

feeding, dressing, shopping, etc.)(5). Three months after stroke, 5% to 20% of survivors have normal upper limb function (6). Various rehabilitation approaches from several philosophical backgrounds such as Task-oriented Training (TOT) (7), Bobath Approach (8) are used in Neurological Rehabilitation. However, the best approach to improve upper limb function is still not evident and there is no evidence to show that one of the above-mentioned physiotherapy approaches gives better outcomes than the others (9).

Task-oriented Training (TOT) developed by Carr and Shepherd in 1987 motivates active participation and focus on functional tasks rather than simple, repetitive training of natural movement patterns (10). It is one of the promising rehabilitative strategies that has emphasized on relearning of movements with the assistance of task-specific activities (11). This approach believes that rehabilitation should begin as soon as possible after injury. TOT motivates the brain to take on and reorganize popularization and transfer training from the rehabilitation setting into everyday life (12). Several studies support the choice of task-oriented training. Neuroimaging studies in animals and humans have presented strong evidence for changed activation patterns in many parts of the affected brain (13). Although the role of task practice is important in improving general motor performance, but the evidence is insufficient and has based on small clinical trials and observational studies (14).

Bobath approach is neurodevelopment model based on reflex hierarchical model of motor control. It is believed that the patient must be active while the therapist assists the patient to move using key points of control and reflex inhibiting patterns. The Bobath Concept has evolved into its current form as a result of the progressive accumulation of scientific knowledge. The current Bobath Concept is a problem solving approach to the assessment and treatment of individuals with disturbances of function, movement, and postural control due to a lesion of the central nervous system; it can be applied to individuals of all ages and all degrees of physical and functional disability (15). Despite wide use of Bobath in post-stroke therapy, there is insufficient evidence to show that Bobath approach compared with other therapy approaches is more effective for improving upper limb function in stroke patients (16).

Several studies have reported that physiotherapy interventions using a combination of different approaches, are more effective in motor function instroke patients than in a control group, however, duration of exercises and which combination therapy is better than others is not clear (17). Consequently, the main objective of this study is to compare the effectiveness of combination of TOT and Bobath program with TOT alone on function of upper extremity in sub-acute and chronic post-stroke hemiparesis patients.

Methods

16 Patients were selected from the college clinic of physiotherapy which was located at School of Rehabilitation Sciences in Tehran from August 2016to April 2017. Among them, two patients did not complete our study because their houses were far from our clinic, therefore we exclude them (Fig.1).

The study was a randomized controlled trial (IRCT2017051316680N4), and the subjects were randomly divided into two groups. In intervention A group (n=6) participants received TOT combined with Bobath program and in intervention B group (n=8) participants received TOT only.

Inclusion criteria- Individuals participated in this study if they had first unilateral hemiparesis following stroke ranging between 2-12 months (subacute and chronic stage) which had been confirmed by computerized tomography (CT) or Magnetic Resonance Imaging (MRI), ability to comprehend simple instructions (Mini-Mental State Examination with a minimum score of 20), Motor recovery offhand Brunnstrom stages ≥ 3, and score of spasticity of the elbow flexors below and equal 3 based on the Modified Ashworth Scale (MAS). In addition, they must have had 45-70 years of age, score of depression based on the Geriatric Depression Scale (GDS)≤ 8, and they not submitted to other upper-limb rehabilitation programs during the participation in this study.

Exclusion criteria- Patients were excluded if they had previous injury, disease, or contracture of the upper extremity and no sitting balance, any comorbid neurological disease or condition such as multiple sclerosis, Parkinson disease, spinal cord injury, traumatic brain lesions, brain tumor, epilepsy, or dementia, and they had Hemineglect phenomena. The Committee of Ethics of Iran University of Medical Sciences approved the study protocol (IR.IUMS.REC.1395.9323699003). Informed consent was obtained from all participants.

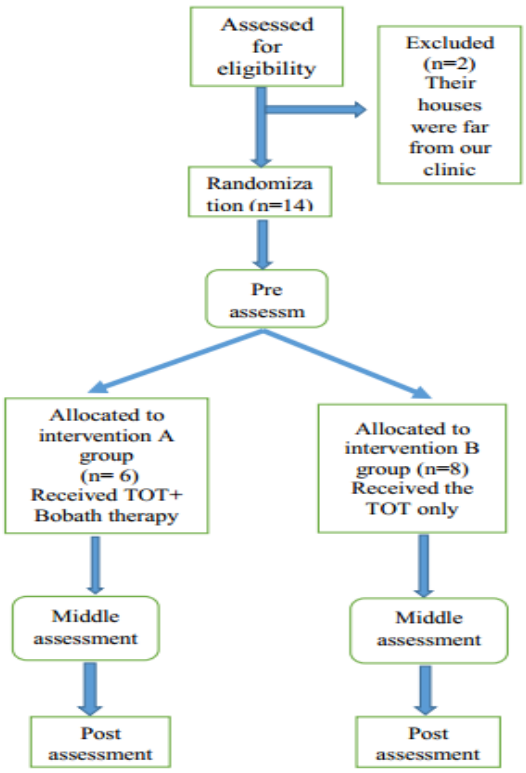

Fig. 1. Flow chart of the study

Outcome measures: The primary outcome measures used in this study were the Fugl Meyer Assessment, Wolf Motor Function Test, and the secondary outcome measures were Barthel ADL Index, and Grip Strength Test. The FMA assesses voluntary movement, reflex activity, grasp, and coordination. Performance is measured on 33 tasks with a 3-point ordinal scale (0to 2), with a maximum score of 66 with subscore for upper arm 36, for the wrist 10 for the hand 14, and 6for coordination and speed of movement. Scores were grouped according to the various levels of impairment which were as follows: 10-29: sever, 30-49: moderate, ≥ 50: mild. This scale has been found to have excellent intra-rater and inter-rater reliability(Intra-rater ICC = 0.95, Inter- rater: r = 0.97 to 0.99)and have excellent validity (Construct: r =0.63 to 0.89)(18). The WMFT is a quantitative measure of upper extremity motor ability through timed and functional tasks. It includes 15 function-based tasks and 2strength based tasks. Maximum score is 75. Lower scores are indicative of lower functioning levels. Time required to administer is 15-20 minutes depending on the individual.

This scale has been found to have High reliability (Test-retest: r = 0.90 to 0.95, Inter-rater: ICC = 0.93 to0.99, Internal Consistency: α = 0.92). In addition, it showed acceptable criterion validity with FMA (Criterion: r = 0.57 to 0.88) (19).

Barthel ADL Index covers the information obtained from the patient's self-report, or from one of his relatives. This information includes 10activities of daily life: feeding, transferring from wheelchair to bed and back, personal hygiene, getting on and off toilet, bathing, walking on level surface/propelling wheelchair, ascending and descending stairs, dressing, controlling bowels, and controlling bladder. The items are weighted differently. This scale has been found to have excellent internal consistency (alpha = 0.89 to 0.90) and excellent correlation between the FIM motor and10 item BI at both admission and discharge (r> 0.92) (20).

Grip strength test is measured by PCE-FM1000force tester (force gauge load cell). The purpose of this test is to measure the maximum isometric strength of the hand and forearm muscles (21).

The outcome measures were administered within three days' interval before the first treatment phase, and in the middle (after 6 treatment sessions) and post treatment. In order to create blindness between assessor and therapist, the evaluations and treatments were done by two physiotherapists. The patients were also blinded. All the tests and exercises conducted randomly in the morning between the hours of 8 am and 12 am in the same room and under the same illumination and thermal conditions.

The intervention A group received 30 minutes/day TOT therapy and 30 minutes/day Bobath therapy for3 days/week for a period of 5 weeks. The intervention B group received 60 minutes/day TOT therapy alone for 3 days/week for a period of 5weeks. The TOT and Bobath protocol used in the study is shown in Box 1 and 2.

The results were analyzed in a SPSS program version22. Normality analysis was carried out through the Shapiro-

Box 1. Bobath protocol

The Bobath protocol

- Weight bearing in sitting position
- Self-overhead movements by hands clasped
- Reach forward and overhead in sitting position while arms held the gymnastic ball
- Weight bearing in quadruped and modified plantigrade positions
- Slow rocking movement in quadruped and modified plantigrade positions
- Functional movements such as lying to sit from the affected side and sit to lie, sit to stand and vice versa
- Moving a ball in the direction of foreword-backward and side to side while standing or sitting.

*Box 2.*TOT protocol

The TOT protocol

- Table-top polishing.
- Arm cradling.
- Supinate & pronate Patient cylindrical object.
- Extend the wrist while pushing a cylindrical object.
- Reaching forward to pick up or touch an object.
- Reaching sideways to pick up an object from a table and transferring it to a table in front.
- Pouring ½ cup of water from measuring pot to wide mouth glass held in opposite hand.
- Bouncing ball.
- Lifting the basket and placing it on the table.
- Lifting the can and bringing it close to lips.
- Flipping the card over from side to side.
- Picking up the pen using thumb and first two fingers.
- Stacking checkers.
- Throwing a ball into a basket.
- Pushing the ball on the wall from the front and side.

Wilk test. Data that presented parametric patterns were described in mean ± standard deviation.

The effectiveness of interventions on variables calculated as follows: a- Treatment effect (TE) =final observation – initial observation, b- % Therapy Effect = (X final – X initial) *100/ X initial.

Analysis were done at three stages: i. Independent Sample t-test was used to compare two groups in first and final evaluation as an overall assessment, ii. Repeated measures ANOVA was used to test 3 evaluations for two independent experimental and control groups, and iii. Repeated measure ANOVA for each group separately.

Results

Demographic and clinical characteristics of 14participants in Table 1. Due to the normal distribution of variables (evaluated via the Shapiro-Wilk test), we used parametric analyses for all comparisons. The mean and standard deviation of all tests before, middle and after treatment are shown in Table 2. There were no significant differences in FMA, WMFT, Barthel ADL Index, or Grip Strength between the two groups. Result analysis among three evaluation times of intervention B group showed significant improvements for FMA, WMFT quality of movement, WMFT force Grip, WMFT force weight cuff, Grip Strength($p \leq 0.005$) but WMFT time for only middle and after mean ($p=0.053$). Additionally, Barthel ADL Index improved significantly after treatment ($p=0.049$). Result analysis among three evaluation times of intervention A group showed significant improvement just in the FMA for evaluation ($p=0.022$). Table 3 has specified the mean and standard deviation of treatment effect &percentage change of all tests in 14 participants' post-stroke.

Discussion

Although combination and TOT programs showed comparable improvements in functional measures of upper limb, no one has priority over another in improving upper limb function. These results could be due to having task-oriented training part in both groups. Motivation, cooperation and participation of patients can be attracted through theTOT program because TOT exercises are goal-directed and meaningful; some researchers have shown that treatments are more successful if the patients feel they are important and meaningful (22).Since in the TOT group the whole time was allocated to functional exercises the affected upper limb function showed significant improvement in different dimensions of motor function such as motor control, the time and quality of movement, grip strength and the ADL, while the affected upper limb function in combination group indicated significant improvement only in motor control that was measured by the FMA test. Several studies have reported that repetitive TOT treatment plays a main role in inducing and maintaining brain changes for the overall limbs performance. Repetition of a task in the absence of new significant skill learning is questionable. It was concluded that less intense task-specific training regimens with the affected limb can produce cortical reorganization and

Table 1. Demographic and clinical characteristics of participants

Characteristics	Bobath-TOT	TOT	P
Age(Year)	56.5 ± 10.13	61.13 ± 11.04	0.438
Weight(Kg)	69.83± 5.84	75.13 ± 12.64	0.363
Height(Cm)	168.33 ± 5.89	161.88 ± 8.63	0.142
MMSE	27 ± 1.26	26.38 ± 0.52	0.23
Duration Post Stroke (Month)	7.17 ± 3.37	6.50 ± 2.27	0.67

Table 2. The mean and standard deviation of all tests before, middle and after treatment for 14 participants' post-stroke

Treatment	Group A			Group B		
	Before	Middle	After	Before	Middle	After
FMA	42.83(7.70)	48.67(9.67)	45.67(6.38)	38.13(6.08)	45.88(8.37)	49(8.19)
WMFT Quality of movement	3.23(1.42)	3.84(0.79)	4.42(0.53)	2.78(0.70)	3.47(0.83)	4.07(0.70)
WMFT Time (second)	31.18(15.69)	33.26(15.04)	36.34(22.45)	18.29(6.01)	27.41(13.66)	39.15(23.64)
WMFT Force Grip (N)	45.44(36.74)	48.02(35.28)	54.52(36.75)	40.58(24.31)	48.56(23.35)	57.09(28.69)
WMFT Force Cuff Weight (Kg)	1.85(0.95)	2.52(1.18)	3.25(1.54)	0.59(0.60)	1.29(0.98)	1.61(1.21)
Barthel ADL	85.00(13.42)	----------	86.67(12.52)	85.71(9.76)	----------	92.14(10.35)
Gripe Strength (N)	48.90(38.31)	50.53(39.95)	56.33(44.30)	44.08(29.13)	54.84(31.21)	56.35(29.35)

SD: Standard deviation, FMA: Fugl-Meyer assessment, WMFT: wolf motor function test, ADL: activity of daily living

Table 3. The mean and standard deviation of Treatment effect & percentage change of all tests in 14 participants' post stroke (Sample-T-test)

	Group A		Group B		
	%TE M(SD)	TE M(SD)	%TE M(SD)	TE M(SD)	P
FMA	2.17(3.39)	1.67(2.58)	7.77(8.55)	6.43(6.90)	0.162
WMFT Quality of movement	150.81(318.11)	1.19(1.01)	51.76(35.24)	1.28(0.45)	0.393
WMFT Time	212.15(504.27)	5.15(17.29)	127.80(126.92)	20.86(22.15)	0.654
WMFT Force Grip	75.41(114.72)	9.08(10.30)	52.89(34.15)	16.51(9.52)	0.605
WMFT Force Cuff Weight	133.33(140.24)	1.40(1.13)	256.25(289.63)	1.02(0.74)	0.360
Barthel ADL	2.17(3.39)	1.67(2.58)	7.77(8.55)	6.43(6.90)	0.162
Gripe Strength	47.44(71.16)	7.43(10.71)	42.00(41.77)	12.27(11.20)	0.86

TE: treatment effect, FMA: fugl-Meyer assessment, WMFT: wolf motor function test, ADL: activity of daily living

correlated meaningful functional improvements (23). Likewise, Bayona et.al emphasized the prominence of task-oriented therapy. The authors stated that the preferable way to relearn a given task is to train specifically for that task. Repetition alone, without utility or meaning in terms of function, is not enough to produce increased motorcortical representations (22). Meanwhile, neural plastic changes in the human brain have been proved after performing task-oriented training in post stroke hemiparesis (24). Jang et.al noted a decrease in the unaffected and an increase in the affected primary sensorimotor cortex activities along with functional recovery in stroke patients who received TOT (25). Additionally, Langhammer et.al indicated that motor relearning program (MRP) is preferable than the Bobath program in the rehabilitation of stroke patients (26).

However, our result is in contrast to the findings of the Khandare, Sneha S et.al as they regarded the significant effect of combination program over another program. Causes of difference could be due to using various approaches (mirror therapy+ task oriented training), methodology, outcome measures and sample size. Moreover, duration of the treatment for two groups was not the same (27). In addition, McDonnell et.al showed a different result. They used the combination therapy of afferent stimulation and Task-Specific Training, and found that their combination treatment was more effective than Task-Specific Training alone (28). Their inclusion criteria were different from our criteria. For example, they registered patients who had active range of antigravity motion of the affected side of at least 60 degrees' shoulder elevation and 10degrees wrist extension and passive range of motion of the affected side of at least 75% normal in the shoulder, elbow, wrist, and hand with minimal or no pain.

Van Vliet et al. showed that Bobath-based therapy was not more effective than movement science-based intervention. They stated that the cause for their results could be insufficient experience of the physiotherapist, lack of program details and insufficient duration and intensity of treatment (29). Da Silva et.al showed that TOT-strength training, and TOT alone can improve motor control and function (30). Arya et al. showed highly significant improvement in Meaningful Task-Specific Training (MTST) compared to Brunnstrom movement therapy and Bobath neurodevelopmental therapy on FMA test (31). Peter S. Lum, et.al showed that the robot group had significantly greater improvements in the FMA compared with the neurodevelopmental therapy after 1and 2 months of treatment, but at the 6-month follow-up, the groups no longer differed in terms of the FMA test (32).

Immadi et.al noted that MRP is more effective on time and quality of movement than conventional physical therapy program (33). Baskett et al. also showed that grip strength in functional training will improve better than conventional therapy (34). The study done by Chanuk Yoo et.al agreed with the current study so that ADL in stroke patients could be improved significantly by task-oriented training (35).

We recommend more studies on using different combination exercises which should be applied in long duration in sub-acute and chronic phase of stroke. There was no follow-up test with which to evaluate the long-term effect. In addition, future studies should include larger sample sizes so that we can generalize the results of these studies to stroke population.

Conclusion

This study demonstrated that combining Bobath therapy along with Task-Oriented Training for improving upper limb function in chronic stroke patients is not better than Task-Oriented Training alone as stroke patients vary vastly on factors such as physical, cognitive, speech, and severity of impairments. Also, due to individual differences and difference in learning styles, it cannot be assumed that one approach will be more operative than others for all individuals at every stage of their recovery.

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Conflict of Interests

The authors declare that they have no competing interests.

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مقایسه روش تلفیقی آموزش وظیفه گرا همراه با بوبت و آموزش وظیفه گرا به تنهایی بر عملکرد اندام فوقانی بیماران همی پارزی ناشی از سکته مغزی

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چکیده

زمینه: فلج دست به صورت حاد در۸۷٪ از تمام بازماندگان سکته مغزی اتفاق می افتد. شایع‌ترین نگرش‌های توانبخشی که برای درمان فلج نیمه بدن بعد از سکته مغزی مورد استفاده قرار می‌گیرند، نگرش‌های آموزش وظیفه گرا و بوبت هستند.

هدف: مقایسه روش تلفیقی با آموزش وظیفه گرا بر عملکرد اندام فوقانی بیماران همی پارزی ناشی از سکته مغزی.

روش‌ها: در یک کارآزمایی بالینی، ۱۶ بیمار همی پارزی بعد از سکته مغزی بطور تصادفی در دو گروه A (آموزش وظیفه گرا و بوبت) و B (آموزش وظیفه گرا) قرار گرفتند. معیارهای اصلی سنجش در این تحقیق، آزمون فوگل میر، آزمون عملکرد حرکتی ولف و معیارهای ثانویه سنجش، شاخص بارتل و آزمون قدرت گریپ بود. ۶ نفر از مشارکت کنندگان تلفیقی از برنامه درمانی تکلیف محور با برنامه بوبت را دریافت کردند و ۸ نفر فقط برنامه درمانی تکلیف محور را به مدت ۵ هفته، هفته ای ۳ روز، هر جلسه ۶۰ دقیقه دریافت کردند.

یافته‌ها: در این تحقیق از آزمون تی ساده و آزمون تکرار مشاهدات برای مقایسه پیامدهای عملکرد اندام فوقانی درون و بین گروه ها استفاده شد. نتایج تحقیق حاضر نشان داد که اگرچه هر یک از این برنامه های تلفیقی و تکلیف محور باعث بهبودی در عملکرد اندام فوقانی سمت مبتلا شدند. اما در مقایسه با یکدیگر هیچ الویتی نسبت به هم نداشتند.

نتیجه‌گیری: از آنجا که بیماران سکته مغزی تفاوت‌های زیادی از نظر جسمانی، شناختی، گفتاری و شدت اختلالات با یکدیگر از نظر سبک یادگیری دارند، یک نگرش یا برنامه تنهایی نمی‌توانند برای همه افراد در هر مرحله از بهبودی سکته موثر باشد.

کلیدواژه ها: سکته مغزی، همی پارزی اندام فوقانی، آموزش تکلیف محور و نگرش بوبت، درمان تلفیقی

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