

## Aquatic versus Land Based Dual Task Training on Postural Stability in Stroke Patients

Nawal Abd El- Raouf Abou- Shady<sup>1</sup>; Tamer Emara<sup>2</sup>; Ahmed El Bokl<sup>2</sup> and Maged Moris Beshay Rezk<sup>1</sup>

<sup>1</sup>Department of Neuromuscular Disorder and its Surgery, Faculty of Physical Therapy, Cairo University, Cairo, Egypt

<sup>2</sup>Neurology Department, Faculty of Medicine, Ain Shams University, Cairo, Egypt

Email: [magedmoris88@yahoo.com](mailto:magedmoris88@yahoo.com)

**Abstract: Background:** For activities of daily life, person should be able to maintain and adopt various postures, react to external disturbances and use automatic postural responses. After stroke some or all of these tasks become more difficult. Daily living requires balance and walking ability while performing other tasks. **Purpose:** was to Investigate the difference between the effect of aquatic dual task training and land based dual task training for improving postural stability in stroke patients. **Methods:-** thirty stroke hemiparetic male patients, their age ranged from 45 to 60 years. They were assigned into two equal groups (Group A and B): group A received land based dual task training while group B received aquatic dual task training. The duration of treatment was 4 weeks, 3 session per week, 1 hour per session. Patients were assessed using Biodex balance system (bilateral postural stability test) and clinical tests (time up and go, functional reach test). **Results:** The study showed significant improvement of postural stability in stroke patients in both groups with greater improvement of group B (aquatic training) than group A (land based training), in all measured variables. **Conclusion:** The use of Aquatic dual task training, land based dual task training can effectively improve postural stability in stroke patients. Aquatic dual task training offered a greater improvement of postural stability in comparison to land based dual task training.

[Nawal Abd El- Raouf Abou- Shady; Tamer Emara; Ahmed El Bokl and Maged Moris Beshay Rezk. **Aquatic versus Land Based Dual Task Training on Postural Stability in Stroke Patients.** *N Y Sci J* 2018;11(4):11-20]. ISSN 1554-0200 (print); ISSN 2375-723X (online). <http://www.sciencepub.net/newyork>. 2. doi:[10.7537/marsnys110418.02](https://doi.org/10.7537/marsnys110418.02).

**Keywords:** Stroke- Postural Stability- Aquatic Dual Task Training- Land Based Dual Task Training.

### 1. Introduction

A stroke arising from the necrosis of nerve cells in specific brain areas, caused by the interruption of blood supply to brain cells due to the blockage or rupture of blood vessels transporting oxygen and glucose to the brain (Cauraugh and Kim, 2002). Stroke is one the leading causes of severe handicap in the world, the effects of stroke are variable and include impairments in motor and sensory systems, emotion, language, perception and cognitive function. (Marsden et. al., 2005). Balance impairment is common in stroke survivors. A person with stroke typically has decreased trunk control, poor bilateral integration and impaired automatic postural control (Radomski and Lathan, 2008). For activities of daily life, person should be able to maintain and adopt various postures, react to external disturbances and use automatic postural responses. After stroke some or all of these tasks become more difficult. Daily living requires balance and walking ability while performing other tasks. Thus, balancing and gait training for hemiplegic stroke patients should reflect the motor skills and cognitive function required in daily living dual tasks (Bowen et al., 2001). Aquatic exercise involves low workload on the lower limbs and has been shown to improve muscle strength, muscle endurance, balance, gait, and cardiovascular endurance

(Kelly et al., 2003). Compared with exercises performed on the ground, aquatic exercise can help patients exercise more consistently and positively affect their emotional state (Matsumoto et al., 1999). Training in dual-task situations resulted in more positive results, such as an increase in cerebral blood flow, than training in single-task situations (Erickson et al., 2007).

So the purpose of this study was to compare between the effect of aquatic and land based dual task training on postural stability in stroke patients.

### 2. Subjects and Methods

This study was conducted on thirty male patients suffering from unilateral first ever stroke. all patients were recruited to this study from outpatient clinic faculty of physical therapy, Cairo university and out patients clinic of al wafa & al amal. Their ages were ranged from 45:60, the diagnosis performed radiologically and clinically by physician. The patients with unilateral first ever stroke, duration of illness more than 6 months post stroke. Patients with other neurological disorder, orthopedic deformity, and visual impairments or handicap were excluded from the study.

All patients were given a full explanation of the treatment protocol and a written informed consent

form giving agreement to participation and publication of results was signed by all patients.

### Study design and randomization

30 unilateral first ever stroke patients were assigned randomly into two groups, (group A and group B).

Randomization was used to eliminate the researches bias and was carried out by sealed envelope randomization method to assigned the patient randomly.

### Intervention

Patients who met the selection criteria were divided randomly into two equal groups (15 patients for each group) Group A (received land based dual task training group), Group B (received aquatic dual task training group).

**For group A:** Land based dual task training on the therapy room floor for 40 minutes a day, 3 days a week, for 4 weeks. The training program consisted of a stability exercise (standing with eyes closed, raising and lowering two ankles). Stability exercise while conducting an assignment by using the hands (standing and try to touch object on the therapist hand how adjust its position, receiving and returning a cup of water), movement exercise (walking 10 m at a comfortable speed), and movement exercise while conducting an assignment by using the hands (walking 10 m at a comfortable speed while holding a 200-mL cup of water without spilling).

**For group B:** Aquatic dual-task training in water with a temperature of 32–34 °C and a depth of 100 cm for 40 minutes a day, 3 days a week, for 4 weeks. Aquatic dual-task training consisted of a stability exercise (standing with eyes closed, raising and lowering two ankles), stability exercise while conducting an assignment by using the hands (standing and try to touch object with the therapist, receiving and returning a cup of water), movement exercise (walking 10 m at a comfortable speed), and movement exercise while conducting an assignment by using the hands (walking 10 m at a comfortable speed while holding a 200-mL cup of water without spilling), (Kyoung et al., 2016), (An et al., 2014).

### Outcome measures

The first step, a detailed medical history, weight and height were taken from each patient in the clinical evaluation sheet and diagnosed as unilateral first ever stroke in chronic stage is confirmed

The second step patients randomly assigned into two groups group A received land based dual task training, group B received aquatic dual task training.

Treatment was done three sessions per week for four weeks.

Patients were evaluated for postural stability by Biodex balance system (bilateral postural stability test) and clinically by (functional reach test) and (time up

and go test). The first evaluation was conducted before treatment (pretreatment), the second one was done after four weeks of treatment program (post-1) and the third one 2 weeks later as a follow up (post-2).

### Statistical analysis

Data were collected and analyzed through two types of statistics by using SPSS program version 17 as follows:

#### Descriptive statistics:

In this study, the descriptive statistics inform of mean and standard deviation was calculated for all patients to determine homogeneity and central deviation.

#### Analytic statistics:

1. Comparing mean values between pre, post-treatment (post-1) and follow up (post-2) were done by analysis of variance (ANOVA).

2. Comparing mean values between (pre and post-1) and (pre and post-2) were done by paired t-test.

3. Comparing mean values between pre, post-1 and post-2 for groups A and B were done by unpaired t-test.

4. P-values less than 0.05 were considered statistically significant.

### 3. Results

Our study results showed significant improved result for time up and go test in both group with greater % of improvement for group B, when comparing (pre and post-1) and (pre and post-2), were 47.19% and 40.45% respectively, and for group A, were 36.64% and 28.97% respectively.

Functional reach test results shown significant improved in both groups with greater % of improvement for group B, when comparing (pre and post-1) and (pre and post-2), were 89.26% and 47.59% respectively, and for group A, were 49.67% and 12.99% respectively.

Overall stability index results shown significant improved in both group with greater % of improvement for group B, when compared (pre and Post-1) and (pre and post-2), were 39.39% and 35.66% respectively, and for group A, 38.77% and 26.08% respectively.

Anterior / posterior stability index results show significant improved of both groups with greater % of improvement for group B, when compared (pre and post-1) and (pre and post-2) were 50.29% and 46.76% respectively and for group A, were 44.56% and 37.88% respectively.

Medial/ lateral stability index our study results shown significant improved for both groups with greater % of improvement for group B, when compared (pre and post-1) and (pre and post-2) were

32.75% and 22.75% respectively, and for group A, were 23.76% and 16.50% respectively.

Table (1): Statistical analysis of the age (years), weight (kg) and height (cm).

Items	Groups	Mean $\pm$ SD	t-value	p-value	Level of significance
Age (years)	Group (A)	53.27 $\pm$ 3.88	0.53	0.598	NS
	Group (B)	52.33 $\pm$ 5.54			
Height (cm)	Group (A)	171.33 $\pm$ 5.02	0.31	0.756	NS
	Group (B)	170.73 $\pm$ 5.44			
Weight (kg)	Group (A)	71.07 $\pm$ 3.53	1.51	0.145	NS
	Group (B)	73.4 $\pm$ 4.85			

SD: Standard Deviation. NS: Non Significant.

T-value: Unpaired t- test value. P-value: Probability value.

Table (2): Comparing pre, post-1 and post-2 treatment mean values of timed up and go test (sec) for each group (A and B).

Items	Timed up and go test (sec)					
	Group (A)			Group (B)		
	Pre treatment	Post-1 treatment	Post-2 Treatment	Pre Treatment	Post-1 treatment	Post-2 treatment
Mean	23.47	14.87	16.67	23.73	12.53	14.13
$\pm$ SD	$\pm$ 3.7	$\pm$ 2.88	$\pm$ 3.66	$\pm$ 3.41	$\pm$ 2.29	$\pm$ 2.1
f-value	26.19			77.47		
p-value	0.000			0.000		
Level of significance	S			S		

Pre: Before treatment. Post-1: After four weeks of treatment.

Post-2: After two weeks follow up. SD: Standard Deviation.

F-value: ANOVA t- test value. P-value: Probability value. S: Significant.

Table (3): Comparing different times treatment mean values between (pre and post-1) and (pre and post-2) of timed up and go test (sec) for group (A)

Items	Timed up and go test (sec)			
	Group (A)		Group (B)	
	Pre treatment	Post-1 treatment	Pre treatment	Post-2 treatment
Mean	23.47	14.87	23.47	16.67
$\pm$ SD	$\pm$ 3.7	$\pm$ 2.88	$\pm$ 3.7	$\pm$ 3.66
MD	8.6		6.8	
% of improvement	36.64 %		28.97 %	
t-value	10.7		7.14	
p-value	0.000		0.000	
Level of significance	S		S	

Pre: Before treatment. Post-1: After four weeks of treatment application.

Post-2: After two weeks follow up. MD: Mean Difference. T-value: Paired t- test value. P-value: Probability value.

% of improvement: Percentage of improvement. S.: Significant.

Table (4): Comparing different times treatment mean values between (pre and post-1) and (pre and post-2) of timed up and go test (sec) for group (B)

Items	Timed up and go test (sec)			
	Group (B)			
	Pre treatment	Post-1 treatment	Pre treatment	Post-2 Treatment
Mean	23.73	12.53	23.73	14.13
$\pm$ SD	$\pm$ 3.41	$\pm$ 2.29	$\pm$ 3.41	$\pm$ 2.1
MD	9.6			
% of Improvement	40.45 %			
t-value	17.46			
p-value	0.000			
Level of Significance	S			

Pre: Before treatment. Post-1: After four weeks of treatment application.

Post-2: After two weeks follow up. MD: Mean Difference.

T-value: Paired t- test value. P-value: Probability value.

% of improvement: Percentage of improvement. S.: Significant.

Table (5): Comparing pre, post-1 and post-2 treatment mean values of timed up and go test (sec) between groups (A and B)

Items	Timed up and go test (sec)					
	Pre-treatment		Post-1 treatment		Post-2 treatment	
	Group (A)	Group (B)	Group (A)	Group (B)	Group (A)	Group (B)
Mean	23.47	23.73	14.87	12.53	16.67	14.13
± SD	± 3.7	± 3.41	± 2.88	± 2.29	± 3.66	± 2.1
MD	0.26		2.34		2.54	
t-value	0.21		2.46		2.33	
p-value	0.839		0.021		0.03	
Level of significance	NS		S		S	

Pre: Before treatment. Post-1: After four weeks of treatment application.

Post-2: After two weeks follow up. MD: Mean Difference.

T-value: Paired t- test value. P-value: Probability value.

% of improvement: Percentage of improvement. S.: Significant.

NS.: Non Significant.

Table (6): Comparing pre, post-1 and post-2 treatment mean values of functional reach test (cm) for each group (A and B).

Items	Functional reach test (cm)					
	Group (A)			Group (B)		
	Pre treatment	Post-1 Treatment	Post-2 Treatment	Pre Treatment	Post-1 treatment	Post-2 treatment
Mean	19.47	29.13	22	18.07	34.2	26.67
± SD	± 2.9	± 4.61	± 2.17	± 5.55	± 5.29	± 3.54
f-value	32.88			43.26		
p-value	0.000			0.000		
Level of significance	S			S		

Pre: Before treatment. Post-1: After four weeks of treatment.

Post-2: After two weeks follow up. SD: Standard Deviation.

F-value: ANOVA t- test value. P-value: Probability value. S: Significant.

Table (7): Comparing different times treatment mean values between (pre and post-1) and (pre and post-2) of functional reach test (cm) for group (A)

Items	Functional reach test (cm)			
	Group (A)			
	Pre treatment	Post-1 treatment	Pre treatment	Post-2 treatment
Mean	19.47	29.13	19.47	22
± SD	± 2.9	± 4.61	± 2.9	± 2.17
MD	9.67		2.53	
% of Improvement	49.67 %		12.99 %	
t-value	9.09		2.6	
p-value	0.000		0.021	
Level of Significance	S		S	

Pre: Before treatment. Post-1: After four weeks of treatment application.

Post-2: After two weeks follow up. MD: Mean Difference.

T-value: Paired t- test value. P-value: Probability value.

% of improvement: Percentage of improvement. S.: Significant.

Table (8): Comparing different times treatment mean values between (pre and post-1) and (pre and post-2) of functional reach test (cm) for group (B)

Items	Functional reach test (cm) Group (B)			
	Pre treatment	Post-1 treatment	Pre treatment	Post-2 Treatment
Mean	18.07	34.2	18.07	26.67
± SD	± 5.55	± 5.29	± 5.55	± 3.54
MD	16.13		8.6	
% of Improvement	89.26 %		47.59 %	
t-value	15.36		4.73	
p-value	0.000		0.000	
Level of Significance	S		S	

Pre: Before treatment. Post-1: After four weeks of treatment application.

Post-2: After two weeks follow up. MD: Mean Difference. T-value: Paired t- test value.

P-value: Probability value. % of improvement: Percentage of improvement. S.: Significant.

Table (9): Comparing pre, post-1 and post-2 treatment mean values of functional reach test (cm) between groups (A and B)

Items	Functional reach test (cm)					
	Pre-treatment		Post-1 treatment		Post-2 treatment	
	Group (A)	Group (B)	Group (A)	Group (B)	Group (A)	Group (B)
Mean	19.47	18.07	29.13	34.2	22	26.67
± SD	± 2.9	± 5.55	± 4.61	± 5.29	± 2.17	± 3.54
MD	1.4		5.07		4.67	
t-value	0.87		2.79		4.35	
p-value	0.396		0.009		0.000	
Level of significance	NS		S		S	

Pre: Before treatment. Post-1: After four weeks of treatment application.

Post-2: After two weeks follow up. MD: Mean Difference.

T-value: Paired t- test value. P-value: Probability value.

% of improvement: Percentage of improvement. S.: Significant.

NS.: Non Significant.

Table (10): Comparing pre, post-1 and post-2 treatment mean values of overall stability index for each group (A and B).

Items	Overall stability index					
	Group (A)			Group (B)		
	Pre treatment	Post-1 treatment	Post-2 Treatment	Pre Treatment	Post-1 treatment	Post-2 treatment
Mean	4.41	2.7	3.26	4.29	2.6	2.75
± SD	± 0.9	± 0.81	± 0.76	± 0.94	± 0.54	± 0.55
f-value	16.79			28.5		
p-value	0.000			0.000		
Level of significance	S			S		

Pre: Before treatment. Post-1: After four weeks of treatment.

Post-2: After two weeks follow up. SD: Standard Deviation.

F-value: ANOVA t- test value. P-value: Probability value.

S: Significant.

Table (11): Comparing different times treatment mean values between (pre and post-1) and (pre and post-2) of overall stability index for group (A)

Items	Overall stability index Group (A)			
	Pre treatment	Post-1 Treatment	Pre treatment	Post-2 Treatment
Mean	4.41	2.7	4.41	3.26
± SD	± 0.9	± 0.81	± 0.9	± 0.76
MD	1.71		1.15	
% of Improvement	38.77 %		26.08 %	
t-value	11.61		6.85	
p-value	0.000		0.000	
Level of significance	S		S	

Pre: Before treatment. Post-1: After four weeks of treatment application.

Post-2: After two weeks follow up. MD: Mean Difference.

T-value: Paired t- test value. P-value: Probability value.

% of improvement: Percentage of improvement. S.: Significant.

Table (12): Comparing different times treatment mean values between (pre and post-1) and (pre and post-2) of overall stability index for group (B)

Items	Overall stability index Group (B)			
	Pre treatment	Post-1 treatment	Pre treatment	Post-2 treatment
Mean	4.29	2.6	4.29	2.75
± SD	± 0.94	± 0.54	± 0.94	± 0.55
MD	1.69		1.53	
% of Improvement	39.39 %		35.66 %	
t-value	10.29		9.25	
p-value	0.000		0.000	
Level of Significance	S		S	

Pre: Before treatment. Post-1: After four weeks of treatment application. Post-2: After two weeks follow up.

MD: Mean Difference. T-value: Paired t- test value. P-value: Probability value.

% of improvement: Percentage of improvement. S.: Significant.

Table (13): Comparing pre, post-1 and post-2 treatment mean values of overall stability index between groups (A and B)

Items	Overall stability index					
	Pre- treatment		Post-1 treatment		Post-2 treatment	
	Group (A)	Group (B)	Group (A)	Group (B)	Group (A)	Group (B)
Mean	4.41	4.29	2.7	2.6	3.26	2.75
± SD	± 0.9	± 0.94	± 0.81	± 0.54	± 0.76	± 0.55
MD	0.14		1		0.51	
t-value	0.38		0.4		2.12	
p-value	0.71		0.04		0.034	
Level of Significance	NS		S		S	

Pre: Before treatment. Post-1: After four weeks of treatment application.

Post-2: After two weeks follow up. MD: Mean Difference. T-value: Paired t- test value.

P-value: Probability value. % of improvement: Percentage of improvement.

S.: Significant.

NS.: Non Significant.

Table (14): Comparing pre, post-1 and post-2 treatment mean values of anterior / posterior stability index for each group (A and B).

Items	Anterior / posterior stability index					
	Group (A)			Group (B)		
	Pre treatment	Post-1 treatment	Post-2 Treatment	Pre Treatment	Post-1 treatment	Post-2 treatment
Mean	3.59	2.23	2.43	3.4	1.69	1.81
± SD	± 0.79	± 0.76	± 1.02	± 0.9	± 0.57	± 0.49
f-value	10.85			29.97		
p-value	0.000			0.000		
Level of significance	S			S		

Pre: Before treatment. Post-1: After four weeks of treatment.

Post-2: After two weeks follow up. SD: Standard Deviation.

F-value: ANOVA t- test value. P-value: Probability value.

S: Significant.

Table (15): Comparing different times treatment mean values between (pre and post-1) and (pre and post-2) of anterior / posterior stability index for group (A)

Items	Anterior / posterior stability index			
	Group (A)		Group (B)	
	Pre treatment	Post-1 Treatment	Pre treatment	Post-2 Treatment
Mean	3.59	2.23	3.59	2.43
± SD	± 0.79	± 0.76	± 0.79	± 1.02
MD	1.36		1.16	
% of improvement	44.56 %		37.88%	
t-value	9.15		5.6	
p-value	0.000		0.000	
Level of significance	S		S	

Pre: Before treatment. Post-1: After four weeks of treatment application. Post-2: After two weeks follow up.

MD: Mean Difference. T-value: Paired t- test value. P-value: Probability value.

% of improvement: Percentage of improvement. S.: Significant.

Table (16): Comparing different times treatment mean values between (pre and post-1) and (pre and post-2) of anterior / posterior stability index for group (B)

Items	Anterior / posterior stability index			
	Group (B)		Group (A)	
	Pre treatment	Post-1 treatment	Pre treatment	Post-2 Treatment
Mean	3.4	1.69	3.4	1.81
± SD	± 0.9	± 0.57	± 0.9	± 0.49
MD	1.71		1.59	
% of Improvement	50.29 %		46.76 %	
t-value	12.33		10.49	
p-value	0.000		0.000	
Level of Significance	S		S	

Pre: Before treatment. Post-1: After four weeks of treatment application.

Post-2: After two weeks follow up. MD: Mean Difference. T-value: Paired t- test value.

P-value: Probability value. % of improvement: Percentage of improvement. S.: Significant.

Table (17): Comparing pre, post-1 and post-2 treatment mean values of anterior / posterior stability index between groups (A and B)

Items	Anterior / posterior stability index					
	Pre-treatment		Post-1 treatment		Post-2 treatment	
	Group (A)	Group (B)	Group (A)	Group (B)	Group (A)	Group (B)
Mean	3.59	3.4	2.23	1.69	2.43	1.81
± SD	± 0.79	± 0.9	± 0.76	± 0.57	± 1.02	± 0.49
MD	0.19		0.54		0.62	
t-value	0.63		2.22		2.12	
p-value	0.537		0.035		0.04	
Level of significance	NS		S		S	

Pre: Before treatment. Post-1: After four weeks of treatment application.

Post-2: After two weeks follow up. MD: Mean Difference.

T-value: Paired t- test value. P-value: Probability value.

% of improvement: Percentage of improvement. S.: Significant.

NS.: Non Significant.

Table (18): Comparing pre, post-1 and post-2 treatment mean values of medial / lateral stability index for each group (A and B).

Items	Medial / lateral stability index					
	Group (A)			Group (B)		
	Pre treatment	Post-1 treatment	Post-2 Treatment	Pre Treatment	Post-1 treatment	Post-2 treatment
Mean	3.03	2.31	2.53	2.9	1.95	2.24
± SD	± 0.42	± 0.4	± 0.32	± 0.31	± 0.35	± 0.29
f-value	13.77			34.74		
p-value	0.000			0.000		
Level of significance	S			S		

Pre: Before treatment. Post-1: After four weeks of treatment.

Post-2: After two weeks follow up. SD: Standard Deviation.

F-value: ANOVA t- test value. P-value: Probability value. S: Significant.

Table (19): Comparing different times treatment mean values between (pre and post-1) and (pre and post-2) of medial / lateral stability index for group (A)

Items	Medial / lateral stability index			
	Group (A)			
	Pre treatment	Post-1 Treatment	Pre treatment	Post-2 treatment
Mean	3.03	2.31	3.03	2.53
± SD	± 0.42	± 0.4	± 0.42	± 0.32
MD	0.72		0.5	
% of Improvement	23.76 %		16.5 %	
t-value	6.65		4.53	
p-value	0.000		0.000	
Level of Significance	S		S	

Pre: Before treatment. Post-1: After four weeks of treatment application. Post-2: After two weeks follow up.

MD: Mean Difference. T-value: Paired t- test value. P-value: Probability value.

% of improvement: Percentage of improvement. S.: Significant.



Table (20): Comparing different times treatment mean values between (pre and post-1) and (pre and post-2) of medial / lateral stability index for group (B)

Items	Medial / lateral stability index Group (B)			
	Pre treatment	Post-1 treatment	Pre treatment	Post-2 Treatment
Mean	2.9	1.95	2.9	2.24
± SD	± 0.31	± 0.35	± 0.31	± 0.29
MD	0.95		0.66	
% of Improvement	32.75 %		22.75 %	
t-value	8.75		6.51	
p-value	0.000		0.000	
Level of Significance	S		S	

Pre: Before treatment. Post-1: After four weeks of treatment application.

Post-2: After two weeks follow up. MD: Mean Difference. T-value: Paired t- test value.

P-value: Probability value. % of improvement: Percentage of improvement. S.: Significant.

Table (21): Comparing pre, post-1 and post-2 treatment mean values of medial / lateral stability index between groups (A and B)

Items	Medial / lateral stability index					
	Pre- treatment		Post-1 treatment		Post-2 treatment	
	Group (A)	Group (B)	Group (A)	Group (B)	Group (A)	Group (B)
Mean	3.03	2.9	2.31	1.95	2.53	2.24
± SD	± 0.42	± 0.31	± 0.4	± 0.35	± 0.32	± 0.29
MD	0.13		0.36		0.29	
t-value	0.93		2.56		2.55	
p-value	0.36		0.016		0.017	
Level of significance	NS		S		S	

Pre: Before treatment. Post-1: After four weeks of treatment application.

Post-2: After two weeks follow up. MD: Mean Difference. T-value: Paired t- test value.

P-value: Probability value. % of improvement: Percentage of improvement.

S.: Significant. NS.: Non Significant.

#### 4. Discussion

The main aim of this study was to investigate the difference between the effect of aquatic dual task training and land based dual task training on postural stability in stroke patients. How various exercise environment of dual task training for 4 week influenced postural stability in stroke patients.

Thirty subjects with first ever unilateral stroke diagnosed clinically and radiologically, assigned randomly into 2 equal group, Group A received land based dual task training, and Group B received aquatic dual task training, differences between pre treatment, post treatment (post-1) and follow up (post-2) were assessed by Biodex balance system (bilateral postural stability test ) and clinically by (time up and go test) and (functional reach test), for both groups.

The present study showed significant improvement of all variables that were investigated in both groups with percent of improvement in favor of

group B (aquatic dual task training ) in all measured variables as results shown.

This result agreed with **Han et al., (2013)** whom concluded that under water exercises is more effective than land exercises at improving the joint sense and balance of stroke patients. The researchers used 6weeks proprioceptive exercise to compare changes in balance ability of land exercise and underwater exercise on chronic stroke, result showed significant improvements in both groups, with more improvement in underwater exercise group.

in addition, the result of this study supported by **Simmons and Hasen, (1996)** concluded that postural control improve greater in aquatic group as compared to land based group.

**Wanees and Mohamed (2016)** revealed that both aquatic and land based training may benefit children with by improving balance and locomotion in short term.

the results of this study demonstrated that there was significant improvement in both aquatic and land based dual task training groups. with greater improvement of postural control using aquatic dual task training.

### Conclusion

From previous obtained result data we can concluded that there was significant improvement in both aquatic and land based dual task training groups. with superiority improvement of postural stability using aquatic dual task training. It appear to be that the aquatic dual task training offered a greater improvement of postural stability in comparison to land based dual task training.

### References

1. Cauraugh JH, Kim S (2002): Two coupled motor recovery protocols are better than one: electromyogram-triggered neuromuscular stimulation and bilateral movements. *Stroke*, 33: 1589–1594.
2. Marsden J F, Playfor D, E, Day B.L. (2005): The vestibular control of balance after stroke *Journal of Neurology Neurosurgery and Psychiatry* 76: 670-679.
3. Radomski MV and Lathan CA (2008): *Occupational therapy for physical dysfunction*, 6<sup>th</sup> ed. Philadelphia: Wolters Kluwer Health/ Lippincott Williams and Wilkins. P.p 621.
4. Bowen A, Wenman R, Mickelborough J, et al. (2001): Dual-task effects of talking while walking on velocity and balance following a stroke. *Age Ageing*, 30: 319–323.
5. Kelly JO, Kilbreath SL, Davis GM, et al. (2003): Cardiorespiratory fitness and walking ability in subacute stroke patients. *Arch Phys Med Rehabil*, 2003, 84: 1780– 1785.
6. Matsumoto I, Araki H, Tsuda K, et al. (1999): Effects of swimming training on aerobic capacity and exercise induced bronchoconstriction in children with bronchial asthma. *Thorax*, 54: 196–201.
7. Erickson KI, Colcombe SJ, Wadhwa R, et al. (2007): Training-induced functional activation changes in dual-task processing: an FMRI study. *Cereb Cortex*, 2007, 17: 192–204. [Medline] [CrossRef].
8. Kyoung K, Dong-Kyu L and Eun-Kyung K (2016): Effect of aquatic dual task training on balance and gait in stroke patients. *J. Phys. Ther. Sci.*, 28: 2044-2047.
9. An HJ, Kim JI, Kim YR, et al. (2014): The effect of various dual task training methods with gait on the balance and gait of patients with chronic stroke. *J Phys Ther Sci*, 26: 1287–1291.
10. Han SK, Kim MC, An CS (2013): Comparison of effects of a proprioceptive exercise program in water and on land the balance of chronic stroke patients. *J Phys Ther Sci*, 2013, 25: 1219–1222.
11. Simmons V. and Hasen PD. (1996): Effectiveness of water exercise on postural mobility in well elderly. *J. Gerontol A. Biol. Sci. Med Sci.*
12. Wanees B and Mohamed B (2016): Comparing the effect of aquatic and land based exercises on balance and walking in spastic diplegic cerebral palsy children. *Med. J. Cairo Univ.*, Vol. 84 No. 1, March: 1-8.

3/31/2018