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Review Article

Dual Task Training in Patients with Stroke for Improving Balance and Gait: A Systematic Review

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ABSTRACT

Introduction: Walking while performing a cognitive task (i.e. dual-task) disturbs the control of balance and hence interfere with gait in stroke individuals. Dual Task training is said to improve the same. However, it is necessary to establish this fact through the in depth study of available literature.

Methodology: A literature search was performed with help of PubMed to select the studies related to dual task training on balance and gait. The inclusion criteria were prospective or retrospective cohort studies, studies that included only participants with stroke leading to hemiparesis and/or along with healthy participants as control group and studies that include dual task training on balance and gait. Two independent investigators assessed the studies based on inclusion and exclusion criteria. The studies were thoroughly evaluated with respect to dual task training on balance and gait.

Results: With the help of given keywords, abstracts of 25 studies were retrieved. After initial screening 12 studies were selected for in depth analysis. Dual task training along with different treatment approaches was investigated and outcome measures like Berg Balance Scale, Gait Variables, Functional Reach Test, Time Up and Go Test and 10 Meters Walk Test was measured.

Conclusion: From this study it can be concluded that dual task training was found to be effective in improving functional performance of the stroke patients.

Key words: dual task training, balance, gait and stroke.

BACKGROUND

Stroke is a disease caused by a lack of blood supply to the brain following ischemia or hemorrhage. The reduced motility following stroke results in a body imbalance that appears as asymmetric posture. proprioception disorder. and abnormal muscle tone that lead to the degeneration of balancing ability.^[1] It causes loss of positional control that leads to instability, which in turn brings about reduced balancing ability, concentration difficulty, and decreased independence in activities of daily living (ADLs).^[2]

Cerebrovascular disease-related mortality rates have been increasing, and 1 out of every 4 cerebrovascular disease patients dies within a month after the onset of disease1). Among the surviving patients, 15–30% becomes severely handicapped, and 40% are left with functional deficits resulting in problems with the major components of functional independence: motor, sensory, and cognitive functions. ^[3] 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. ^[4]

Dual-task training is a training in which two or more tasks are performed at the same time continuously. However, dualtask training allows coordination of various tasks, as one can perform more than two tasks at the same time².Dual tasks fall into

two main groups: motor dual tasks, which require performance of a motor task and a postural control task at the same time; and cognition dual task which require performance of a cognition task and postural control task at the same time. Both types of dual task are noted as ways of training patients with neurological damage to recover their motor control ability.^[4]

Cognitive-motor and motor dual tasks play important roles in daily life: walking while talking, using a mobile phone, carrying a bag or watching traffic. Previous studies have indicated, however, that performing two tasks simultaneously may negatively impact gait performance. Dual task interference impacting gait performance has been observed not only in healthy subjects, but also in subjects with neurological disorders.^[5]

RESEARCH QUESTION – Is Dual Task Training best treatment intervention available in the literature for balance and gait rehabilitation in patients with stroke?

AIM: To provide best possible evidence for most effective dual task training approach for balance and gait rehabilitation in patients with Stroke.

OBJECTIVES:

- 1. To explore the literature related to Dual Task Training for Balance and Gait Rehabilitation, available in last 10 years.
- 2. To describe the Dual Task Training approaches used in various research studies.
- 3. To describe the outcome measures used in various studies for measuring the effectiveness of an intervention.
- 4. To analyze the studies for details about the intervention and its effectiveness.

METHODOLOGY

All studies related to Dual Task Training in patients with stroke were sought. To achieve this, a systematic literature search was conducted in March 2018 through the most commonly used search engine Pubmed. Full text articles from peer-reviewed journals were included. Intervention based studies in the form of Clinical Trials, Experimental Studies, Quasi experimental studies, RCTs were included. Due to Language and appropriate translation issue, only studies published in English language were considered. A combination of the following keywords and MeSH terms were used: Dual Task Training, Balance, Gait, and Stroke.

Study selection and data extraction:

The Inclusion criteria were 1) Prospective or retrospective cohort studies, 2) studies that included only participants with stroke leading to hemiparesis and/or along with healthy participants as control group and 3) studies that include Dual Task Training. The exclusion criteria were if their population of interest also included patients with other neurological conditions and studies in any language other than English. To begin with, two reviewers (SR, SG) independently read the titles and/or abstracts of the identified studies with respect to the inclusion and exclusion criteria. Irrelevant studies were removed from the list. Potentially eligible studies were read fully by both reviewers and their suitability for inclusion was independently determined by both SR and SG. Disagreement was resolved by consensus.

Types of outcome: The outcomes were Auditory Stroop test, Stepping down test, Cadence, Stride time, Stride length, Berg balance scale, Five Times Sit-to Stand Test, Functional Reach Test, 10-Meter Walk Test, Timed Up and Go Test, . Figure-of-8 Walk Test (F8WT) and Functional Gait Assessment.

List of abbreviations: BMI-Body Mass Index, MMSE- Mini Mental State Examination, BBS- Berg Balance Scale, TUG- Time Up And Go Test, FGAS – Functional Gait Assessment Scale, FRT-Functional Reach Test, DTT- Dual Task Training, ADL- Activities of daily living, COP- Center Of Pressure, 10MWT- 10-Meter Walk Test, and F8WT-Figure-of-8 Walk Test.

Data Extraction:

Preliminary information was extracted from the each eligible study which included: study type and setting, patient demographics (age, gender) and clinical characteristics including relevant inclusion and exclusion criteria, dual task training , and the task given to the participants was noted. In case of a query about the study, authors were contacted by email for clarification. Each study was read in details by both authors separately.

RESULTS

Flow of the studies through the review

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(2007) experimental group (n=13). Experimental group underwent a 4-week ball exercise	r ang	Duration: 1 year	randomized into a control group $(n=12)$ or	Terrent and the second se
	(2007)		experimental group (n=15).	program

Study	Eligibili	Rando	Conceal	Group	Participa	Therapi	Assess	<15	Intentio	Betwee	Point	PEDr	Grad
	ty	m	ed	s	nt	st	or	%	n- to-	n group	estimate	0	e
	criteria	allocati	Allocati	Simila	blinding	blindin	blindin	drop	treat	differen	s and	score	
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				ne							reported		
1. Wing-	Y	Y	N	N	N	N	Y	Y	Y	Y	Y	7	high
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(2017)													у
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3.Kyoung	N	N	N	Y	N	N	N	Y	Ŷ	Ŷ	Ŷ	5	tair
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(2016)	37	X7	N	¥7	NY.	Ŋ	N	\$7	37	37	37	7	y
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(2007)	1	1	1	1	1	1	1	1	1	1	1	1	y y

Table 2: Quality of Study included in review according to PEDro.

The total numbers of records identified by the search of PubMed were 23. After initial screening of titles and abstracts,4 studies were excluded (2 because – it was a observational study, 1 because – patients with Parkinsonism were included, 1 because- it was a case series). After full text review, of the remaining 18 studies, 6 studies were excluded because they were not related to Balance and Gait Function. Therefore, 12 studies were included in the review.

Table 3: Effects of Dual Task Training in Patients with Stroke.

Study	No Of Stroke Patient s	Outcome Measure	Mean±SD							Conclusion
1. Wing- Nga Chan (2017)	26 subjects	1. Berg Balance Scale		Tai Chi $(n = 9)$	Con exer	ventional cise	Control $(n = 9)$	p	value	These results suggest a beneficial effect of Tai
		2.Functiona 1 Reach Test	BBS score Functional reach (cm)	51.0 ± 2 23.9 ± 3	2.9 50.3 3.7 23.9	$\frac{1}{2} \pm 3.2$ ± 8.3	54.2 ± 1 32.1 ± 9	1.7 0 0.0 0	0.074	Chi training on cognition among stroke survivors without compromising
		3.Time Up And Go Test	TUGT (sec)	14.5 ± 4	4.6 12.2	± 2.1	12.3 ± 5	5.1 0	.661	physical task performanc e in dual-tasking. The effect was better than the conventional exercise group
2. Yan-Ci Liu	28 subjects	1. Gait Speed	1. Cognitive dua	l task gait	performand	e after diff	erent trainii	ng protoco	ols.	It seems that CDTT
(2017)		2.Cadence 3.Stride		CPT gr 10)	oup (n =	CDTT = 9)	group (n	MDTT (n = 9)	group	improved cognitive dual task gait
		Length 4. Stride Time	Speed (cm/sec) Change value Cadence	pre 62.1 ±19.9 83.6 ±	Post 60.1 ±20.7 -2.0 ± 9.4 83.7 ±	Pre 56.4 ±18.0 81.2 ±	$\begin{array}{r} \text{post} \\ 63.4 \ \pm \\ 20.6 \\ \hline 6.9 \ \pm \\ 11.1 \\ \hline 86.1 \ \pm \end{array}$	pre 62.4 ± 13.8 93.7	Post $63.8 \pm$ 13.7 $1.4 \pm$ 4.0 $93.9 \pm$	performance and MDTT improved motor dual task gait performance although such improvements did not reach significant group difference

Sana Rai	et.al.	Dual	Task	Training	in	Patients	with	Stroke	for	Improving	Balance	and	Gait:	A	Systematic
Review															

			(step/min)	14.6	14.6	13.5	12.9	±	10.8	Therefore, different
			Change	1 r	0.1 ±		4.8 ±	11.7	0.2 ±	types of dual
			value		3.9		10.5		3.2	task gait training can be
			Stride time	147 +	1.42	1.52 +	143 +	- 1.30	1 29 +	adopted to enhance
			(sec)	0.25	+0.19	0.27	0.22	+	0.14	different dual task gait
			Change	0.20	-0.05	0.27	-0.00	0.16	-0.01	performance in stroke.
			valua		+0.15		± 0.00	0.10	+ 0.06	1
			Value Striida	027	20.15	01 1	0.20	<u>00 2</u>	22.2	
			Stride	83.7	85.3 ±	82.2	88.2	80.2	83.3 ±	
			length (cm)	±18.7	17.6	± 20.2	• ±	±	17.5	
							21.4*	17.2		
			Change		1.6		5.9 •±	±	3.1 ±	
			value		±6.3		5.9		3.7	
			2. Motor dual ta	sk gait perf	ormance af	ter differe	ent training	g protocols		
				CPT gro	up(n =	CDTT	group (n	MDTT 1	group (n	
				10)	~ r <	= 9)	8 · · · I · ·	= 9)		
				nre	Post	Pre	nost	nre	Post	
			Speed	59.4	687 +	55.6	61.8 +	57.1 +	62.7 +	
			(cm/sec)	- -	24.5	+	21.8	12.0	12.5	
			(chi/sec)	24.5	0.2	147	62 +	12.0	5.6 ±	
			Change	24.3	9.5	14.7	0.2 ±		3.0 ± 2.6	
			value	04.0	±10.5	01.0	10.5	01.4	2.0	
			Cadence	84.9	89.9 ±	84.9	83.5±	91.4 ±	92.1 ±	
			(step/min)	±	15.9	±	21.8	9.5	9.1	
			Change	15.9	5.0 ±	12.1	$-1.4 \pm$		0.7 ± 1.0	
			value		0.8		16.0		1.9	
			Stride time	1.46	$1.37 \pm$	1.43	1.40 ±	$1.33 \pm$	1.31 ±	
			(sec)	±	0.25	±	0.24	0.13	0.13	
			Change	0.27	-0.09	0.21	-0.03		-0.01	
			value		± 0.14		± 0.15		± 0.03	
			Stride	82.0	91.0 ±	80.8	83.7 ±	76.5±	82.7 ±	
			length (cm)	±	19.7	±	17.8	17.0	16.9	
			Change	20.1	9.1 ±	14.8	3.0 ±		6.2 ±	
			value		11.7		6.4		2.8	
				1				1		
			3 Single walkir	o gait perfo	rmance afte	er differe	nt training	protocols		
			5. Shigie warki	CPT are	manee and		F group		T group	
					Jup (n –	- 0)	r group	(n - 0)	1 group	
				10)	Poet	- 9) Dro	post	(11 - 9	Post	
			Cara I	71.1 ·	POSt	70.6		71.9	POSt 72.9	
			Speed	/1.1 ±	/3./ ±	/0.6	± /4.9	± /1.8	72.8	
			(cm/sec)	20.8	23.8	17.7	20.7	±	± 9.8	
			Change		2.7 ±		4.3	± 10.6	0.9	
			value		6.1		6.6		±2.3	
			Cadence	90.9 ±	89.7 ±	90.31	94.6	± 96.3	93.8	
			(step/min)	13.3	15.2	± 10.9	10.9	± 8.4	± 6.6	
			Change		-1.1 ±		4.3	±	-2.5	
			value		3.2		6.1		± 3.1	
			Stride time	1.35 ±	1.27 ±	1.35	± 1.29	± 1.25	1.28	
			(sec)	0.22	0.20	0.17	0.16	±	±	
								0.10	0.10	
			Change		$-0.08\pm$		-0.06	5	0.03	
			value		0.27		± 0.1	1	+	
									0.03	
			Stride	93.5	97.6 +	94.1	+ 95.1	+ 90.6	94.4	
			length (cm)	+16.29	19.1	17.8	20.1		+	
			iongui (em)	10.27	17.1	17.0	20.1	14.8	13.6	
			Change		4.1	-	1.0	+ 14.0	28 +	
			value		4.1 +7.4	1	1.0	-	3.0 ±	
2 1/	20	1.D	value	I	±/.4	<u> </u>	3.3		3.0	<u> </u>
5.Kyoung	20	1.Berg								
(2016)	subjects	вагапсе		Group	Pre	Post		D-Value		our results showed that
1 (2010)	1	Scola		EC	41.0 . 1	C 44.4	+1.4 (2.6 ± 1.5		aquatic dual task training
(====)		Scale	BBS(score)	EU	41.8 ± 1.0	0 44.4	± 1.4			has a positive effect on
()		Scale 2.	BBS(score)	CG	41.8 ± 1.0 39.4 ± 2.0	2 40.2	± 1.4 (± 1.9 (0.8 ± 1.1		halongo and goit in
()		Scale 2. Functional	BBS(score) FRT(cm)	CG	41.8 ± 1.0 39.4 ± 2.0 19.5 ± 1.0	6 44.4 2 40.2 7 22.0	± 1.4 ± 1.9 (± 1.3)	0.8 ± 1.1 2.5 ± 1.5		balance and gait in
()		Scale 2. Functional Reach Test	BBS(score) FRT(cm)	EG CG EG CG	41.8 ± 1.0 39.4 ± 2.0 19.5 ± 1.0 19.7 ± 1.0	$ \begin{array}{c} 6 & 44.4 \\ 2 & 40.2 \\ 7 & 22.0 \\ 2 & 20.1 \\ \end{array} $	± 1.4 ± 1.9 (± 1.3 (± 0.9 (0.8 ± 1.1 2.5 ± 1.5 0.4 ± 0.9		balance and gait in stroke patients.
()		Scale 2. Functional Reach Test 3.10 Meter Walk Test	BBS(score) FRT(cm)	EG CG EG CG EG	41.8 ± 1.0 39.4 ± 2.0 19.5 ± 1.0 19.7 ± 1.0 15.9 ± 1.0	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} \pm 1.4 \\ \pm 1.9 \\ \pm 1.3 \\ \pm 0.9 \\ 0 \pm 1.3 \\ \pm 0.9 \\ 0 \pm 1.9 \end{array}$	$ \begin{array}{r} 0.8 \pm 1.1 \\ 2.5 \pm 1.5 \\ 0.4 \pm 0.9 \\ -3.0 \pm 1.4 \end{array} $		balance and gait in stroke patients.
		Scale 2. Functional Reach Test 3.10 Meter Walk Test 4 Time Un	BBS(score) FRT(cm) 10MWT(sec)	EG CG EG CG EG CG	41.8 ± 1.3 39.4 ± 2.3 19.5 ± 1.3 19.7 ± 1.3 15.9 ± 1.4 15.6 ± 1.3	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} \pm 1.4 \\ 2 \pm 1.9 \\ 0 \pm 1.3 \\ \pm 0.9 \\ 0 \pm 1.9 \\ - \pm 1.9 \\ - \pm 1.9 \\ - \pm 1.9 \\ - \end{array}$	$\begin{array}{c} 0.8 \pm 1.1 \\ 2.5 \pm 1.5 \\ 0.4 \pm 0.9 \\ \hline -3.0 \pm 1.4 \\ \hline -0.5 \pm 0.8 \end{array}$		balance and gait in stroke patients.
		Scale 2. Functional Reach Test 3.10 Meter Walk Test 4.Time Up	BBS(score) FRT(cm) 10MWT(sec)	EG CG EG CG EG CG EG	41.8 ± 1.1 39.4 ± 2.1 19.5 ± 1.1 19.7 ± 1.1 15.9 ± 1.2 15.6 ± 1.1 22.9 ± 1.2	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} \pm 1.4 \\ \pm 1.9 \\ \pm 1.9 \\ \pm 0.9 \\ \pm 1.3 \\ \pm 0.9 \\ \pm 1.1 \\ \pm 1.1 \\ \pm 1.9 \end{array}$	$\begin{array}{c} 0.8 \pm 1.1 \\ 2.5 \pm 1.5 \\ 0.4 \pm 0.9 \\ \hline -3.0 \pm 1.4 \\ \hline -0.5 \pm 0.8 \\ \hline -2.8 \pm 1.3 \end{array}$		balance and gait in stroke patients.
		Scale 2. Functional Reach Test 3.10 Meter Walk Test 4.Time Up And Go	BBS(score) FRT(cm) 10MWT(sec) TUGT(sec)	EG CG EG CG EG CG EG CG	41.8 ± 1.1 39.4 ± 2.1 19.5 ± 1.1 19.7 ± 1.1 15.9 ± 1.2 15.6 ± 1.1 22.9 ± 1.1 20.4 ± 1.1	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} \pm 1.4 \\ \pm 1.9 \\ \pm 1.9 \\ \pm 0.9 \\ \pm 1.9 \\ \pm 1.1 \\ \end{array}$	$\begin{array}{c} 0.8 \pm 1.1 \\ 2.5 \pm 1.5 \\ 0.4 \pm 0.9 \\ -3.0 \pm 1.4 \\ -0.5 \pm 0.8 \\ -2.8 \pm 1.3 \\ -0.3 \pm 0.9 \end{array}$		balance and gait in stroke patients.
4 Umma	40	Scale 2. Functional Reach Test 3.10 Meter Walk Test 4.Time Up And Go Test	BBS(score) FRT(cm) 10MWT(sec) TUGT(sec)	EG CG EG CG EG CG EG CG	$\begin{array}{c} 41.8 \pm 1.3 \\ 39.4 \pm 2.3 \\ 19.5 \pm 1.3 \\ 19.7 \pm 1.3 \\ 15.9 \pm 1.4 \\ 15.6 \pm 1.3 \\ 22.9 \pm 1.3 \\ 20.4 \pm 1.4 \end{array}$	6 44.4 2 40.2 7 22.0 2 20.1 4 12.9 5 15.1 3 20.1 0 20.1	$\begin{array}{c} \pm 1.4 \\ \pm 1.9 \\ \pm 1.9 \\ \pm 0.9 \\ \pm 0.9 \\ \pm 1.1 \\ \pm 1.1 \\ \pm 1.9 \\ \pm 1.1 \\ \end{array}$	$\begin{array}{c} 0.8 \pm 1.1 \\ 2.5 \pm 1.5 \\ 0.4 \pm 0.9 \\ -3.0 \pm 1.4 \\ -0.5 \pm 0.8 \\ -2.8 \pm 1.3 \\ -0.3 \pm 0.9 \end{array}$		balance and gait in stroke patients.
4.Hyunseun	40 mki ti	Scale 2. Functional Reach Test 3.10 Meter Walk Test 4.Time Up And Go Test 1. Gait	BBS(score) FRT(cm) 10MWT(sec) TUGT(sec)	EG CG EG CG EG CG EG CG	$\begin{array}{c} 41.8 \pm 1.1 \\ 39.4 \pm 2.2 \\ 19.5 \pm 1.2 \\ 19.7 \pm 1.2 \\ 15.9 \pm 1.2 \\ 15.6 \pm 1.2 \\ 22.9 \pm 1.2 \\ 20.4 \pm 1.2 \end{array}$	6 44.4 2 40.2 7 22.0 2 20.1 4 12.9 5 15.1 3 20.1 0 20.1	$\begin{array}{c} \pm 1.4 \\ 2 \pm 1.9 \\ \pm 1.3 \\ \pm 0.9 \\ 0 \pm 1.3 \\ \pm 1.9 \\ \pm 1.1 \\ \pm 1.9 \\ \pm 1.1 \\ \pm 1.1 \\ \end{array}$	$\begin{array}{c} 0.8 \pm 1.1 \\ 2.5 \pm 1.5 \\ 0.4 \pm 0.9 \\ -3.0 \pm 1.4 \\ -0.5 \pm 0.8 \\ -2.8 \pm 1.3 \\ -0.3 \pm 0.9 \end{array}$		balance and gait in stroke patients.
4.Hyunseun g Kim	40 subjects	Scale 2. Functional Reach Test 3.10 Meter Walk Test 4.Time Up And Go Test 1. Gait Speed 2.Coden u	BBS(score) FRT(cm) 10MWT(sec) TUGT(sec)	EG CG EG CG EG CG EG CG	$\begin{array}{c} 41.8 \pm 1.1 \\ 39.4 \pm 2.1 \\ 19.5 \pm 1.1 \\ 19.7 \pm 1.1 \\ 15.9 \pm 1.1 \\ 15.6 \pm 1.1 \\ 22.9 \pm 1.1 \\ 20.4 \pm 1.1 \end{array}$	6 44.4 2 40.2 7 22.0 2 20.1 4 12.9 5 15.1 3 20.1 0 20.1	$\begin{array}{c} \pm 1.4 \\ \pm 1.9 \\ \pm 1.3 \\ \pm 0.9 \\ \pm 1.3 \\ \pm 0.9 \\ \pm 1.1 \\ \pm 1.1 \\ \pm 1.1 \\ \pm 1.1 \\ \end{array}$	$\begin{array}{c} & 1.0 \\ & 0.8 \pm 1.1 \\ 2.5 \pm 1.5 \\ 0.4 \pm 0.9 \\ \hline -3.0 \pm 1.4 \\ \hline -0.5 \pm 0.8 \\ \hline -2.8 \pm 1.3 \\ \hline -0.3 \pm 0.9 \end{array}$		Our findings suggest that
4.Hyunseun g Kim (2015)	40 subjects	Scale 2. Functional Reach Test 3.10 Meter Walk Test 4.Time Up And Go Test 1. Gait Speed 2.Cadence 3. Surial	BBS(score) FRT(cm) 10MWT(sec) TUGT(sec)	EG CG EG CG EG CG CG	$\begin{array}{c} 41.8 \pm 1.1 \\ 39.4 \pm 2.1 \\ 19.5 \pm 1.1 \\ 19.7 \pm 1.1 \\ 15.9 \pm 1.1 \\ 15.6 \pm 1.1 \\ 22.9 \pm 1.1 \\ 20.4 \pm 1.1 \end{array}$	6 44.4 2 40.2 7 22.0 2 20.1 4 12.9 5 15.1 3 20.1 0 20.1	$\begin{array}{c} \pm 1.4 \\ 2 \pm 1.9 \\ 0 \pm 1.3 \\ 2 \pm 0.9 \\ 0 \pm 1.9 \\ \pm 1.1 \\ \pm 1.9 \\ \pm 1.1 \\ \end{array}$	$\begin{array}{c} 0.8 \pm 1.1 \\ 2.5 \pm 1.5 \\ 0.4 \pm 0.9 \\ -3.0 \pm 1.4 \\ -0.5 \pm 0.8 \\ -2.8 \pm 1.3 \\ -0.3 \pm 0.9 \end{array}$	oup	Our findings suggest that virtual dual task
4.Hyunseun g Kim (2015)	40 subjects	Scale 2. Functional Reach Test 3.10 Meter Walk Test 4.Time Up And Go Test 1. Gait Speed 2.Cadence 3. Stride	BBS(score) FRT(cm) 10MWT(sec) TUGT(sec)	EG CG EG CG EG CG EG CG	$\begin{array}{c} 41.8 \pm 1.1 \\ 39.4 \pm 2.1 \\ 19.5 \pm 1.1 \\ 19.7 \pm 1.1 \\ 15.9 \pm 1.2 \\ 15.6 \pm 1.1 \\ 22.9 \pm 1.1 \\ 20.4 \pm 1.1 \\ \end{array}$	6 44.4 2 40.2 7 22.0 2 20.1 4 12.9 5 15.1 3 20.1 0 20.1 Expension	$\begin{array}{c} \pm 1.4 \\ \pm 1.9 \\ \pm 1.3 \\ \pm 0.9 \\ \pm 1.3 \\ \pm 0.9 \\ \pm 1.1 \\ \pm 1.9 \\ \pm 1.1 \\ \pm 1.9 \\ \pm 1.1 \\ \end{array}$	$\begin{array}{c} 0.8 \pm 1.1 \\ 2.5 \pm 1.5 \\ 0.4 \pm 0.9 \\ -3.0 \pm 1.4 \\ -0.5 \pm 0.8 \\ -2.8 \pm 1.3 \\ -0.3 \pm 0.9 \end{array}$	oup	Our findings suggest that virtual dual task treadmill training using
4.Hyunseun g Kim (2015)	40 subjects	Scale 2. Functional Reach Test 3.10 Meter Walk Test 4.Time Up And Go Test 1. Gait Speed 2.Cadence 3. Stride length	BBS(score) FRT(cm) 10MWT(sec) TUGT(sec)	EG EG EG EG CG EG CG EG CG	$\begin{array}{c} 41.8 \pm 1.1 \\ 39.4 \pm 2.1 \\ 19.5 \pm 1.1 \\ 19.7 \pm 1.1 \\ 15.9 \pm 1.1 \\ 15.6 \pm 1.1 \\ 22.9 \pm 1.1 \\ 20.4 \pm 1.1 \\ \end{array}$	6 44.4 2 40.2 7 22.0 2 20.1 4 12.9 5 15.1 3 20.1 0 20.1 Expension group 0.8 +	$\begin{array}{c} \pm 1.4 \\ \pm 1.9 \\ \pm 1.3 \\ \pm 0.9 \\ \pm 0.9 \\ \pm 1.1 \\ \pm 1.9 \\ \pm 1.1 \\ \pm 1.1 \\ \pm 1.1 \\ \end{array}$	$\begin{array}{c} 0.8 \pm 1.1 \\ 2.5 \pm 1.5 \\ 0.4 \pm 0.9 \\ \hline -3.0 \pm 1.4 \\ -0.5 \pm 0.8 \\ \hline -2.8 \pm 1.3 \\ \hline -0.3 \pm 0.9 \end{array}$	oup	Our findings suggest that virtual dual task treadmill training using a video recording can
4.Hyunseun g Kim (2015)	40 subjects	Scale 2. Functional Reach Test 3.10 Meter Walk Test 4.Time Up And Go Test 1. Gait Speed 2.Cadence 3. Stride length	BBS(score) FRT(cm) 10MWT(sec) TUGT(sec) Gait spe	EG EG EG EG EG EG CG EG CG	$\begin{array}{c} 41.8 \pm 1.1 \\ 39.4 \pm 2.1 \\ 19.5 \pm 1.1 \\ 19.7 \pm 1.1 \\ 15.9 \pm 1.1 \\ 15.6 \pm 1.1 \\ 22.9 \pm 1.1 \\ 20.4 \pm 1.1 \\ \end{array}$	$\begin{array}{c} 6 & 44.4 \\ 2 & 40.2 \\ 7 & 22.0 \\ 2 & 20.1 \\ 4 & 12.9 \\ 5 & 15.1 \\ 3 & 20.1 \\ 0 & 20.1 \\ \end{array}$	$\begin{array}{c} \pm 1.4 \\ \pm 1.9 \\ \pm 0.9 \\ \pm 0.9 \\ \pm 0.9 \\ \pm 0.9 \\ \pm 1.1 \\ \pm 1.9 \\ \pm 1.1 \\ \pm 1.9 \\ \pm 1.1 \\ \pm 0 \\ \pm$	$\begin{array}{c} 0.8 \pm 1.1 \\ 2.5 \pm 1.5 \\ 0.4 \pm 0.9 \\ \hline -3.0 \pm 1.4 \\ \hline -0.5 \pm 0.8 \\ \hline -2.8 \pm 1.3 \\ \hline -0.3 \pm 0.9 \\ \hline \\ $	oup	Our findings suggest that virtual dual task treadmill training using a video recording can improve the gait
4.Hyunseun g Kim (2015)	40 subjects	Scale 2. Functional Reach Test 3.10 Meter Walk Test 4.Time Up And Go Test 1. Gait Speed 2.Cadence 3. Stride length	BBS(score) FRT(cm) 10MWT(sec) TUGT(sec) Gait spe	EG CG EG CG EG CG EG CG ed (m/s)	41.8±1.1 39.4±2. 19.5±1.1 19.7±1.1 5.9±1.1 15.6±1.1 20.4±1.1 20.4±1.1	$\begin{array}{c} 44.4\\ 2 & 40.2\\ 7 & 22.0\\ 2 & 20.1\\ 4 & 12.9\\ 5 & 15.1\\ 3 & 20.1\\ 0 & 20.1\\ \end{array}$ Expending the set of the	$\begin{array}{c} \pm 1.4 \\ \pm 1.9 \\ \pm 1.3 \\ 2 \\ \pm 1.9 \\ 2 \\ \pm 1.3 \\ 2 \\ \pm 1.9 \\ 2 \\ \pm 1.1 \\$	$\begin{array}{c} 0.8 \pm 1.1 \\ 2.5 \pm 1.5 \\ 0.4 \pm 0.9 \\ -3.0 \pm 1.4 \\ -0.5 \pm 0.8 \\ -2.8 \pm 1.3 \\ -0.3 \pm 0.9 \\ \hline \\ $	oup	Our findings suggest that virtual dual task treadmill training using a video recording can improve the gait parameters of chroniestrefa
4.Hyunseun g Kim (2015)	40 subjects	Scale 2. Functional Reach Test 3.10 Meter Walk Test 4.Time Up And Go Test 1. Gait Speed 2.Cadence 3. Stride length	BBS(score) FRT(cm) 10MWT(sec) TUGT(sec) Gait spe	EG CG EG CG EG CG EG CG ed (m/s) ed (step/min)	41.8 ± 1.1 39.4 ± 2. 19.5 ± 1. 19.5 ± 1. 15.6 ± 1. 20.4 ± 1. 20.4 ± 1. Pre Post change Pre	$\begin{array}{c} & 44.4\\ 2 & 40.2\\ 7 & 22.0\\ 2 & 20.1\\ 4 & 12.9\\ 5 & 15.1\\ 3 & 20.1\\ 0 & 20.1\\ \end{array}$	$\begin{array}{c} \pm 1.4 \\ \pm 1.9 \\ \pm 0.9 \\ \pm 0.9 \\ \pm 1.3 \\ \pm 0.9 \\ \pm 1.1 \\ \pm 1.1 \\ \pm 1.9 \\ \pm 1.1 \\ \pm 1.9 \\ \pm 1.1 \\ \pm 1.9 \\ \pm 1.1 \\ \pm 0 \\ (n=20) \\ 0.3 \\ 0.2 \\ \pm 25 \end{array}$	$\begin{array}{c} 0.8 \pm 1.1 \\ 2.5 \pm 1.5 \\ 0.4 \pm 0.9 \\ -3.0 \pm 1.4 \\ -0.5 \pm 0.8 \\ -2.8 \pm 1.3 \\ -0.3 \pm 0.9 \\ \hline \end{array}$	oup	Our findings suggest that virtual dual task treadmill training using a video recording can improve the gait parameters of chronic stroke
4.Hyunseun g Kim (2015)	40 subjects	Scale 2. Functional Reach Test 3.10 Meter Walk Test 4.Time Up And Go Test 1. Gait Speed 2.Cadence 3. Stride length	BBS(score) FRT(cm) 10MWT(sec) TUGT(sec) Gait spe Cadence	EG CG EG CG EG CG EG CG ed (m/s) e (step/min)	41.8±1.1 39.4±2. 19.5±1.1 15.9±1.4 15.6±1. 20.4±1.1 Pre Post change Pre Post	$\begin{array}{c} 44.4\\ 2 & 40.2\\ 7 & 22.0\\ 2 & 20.1\\ 4 & 12.9\\ 5 & 15.1\\ 3 & 20.1\\ 0 & 20.1\\ \end{array}$	$\begin{array}{c} \pm 1.4 \\ \pm 1.9 \\ \pm 1.3 \\ \pm 0.9 \\ \pm 0.9 \\ \pm 1.3 \\ \pm 0.9 \\ \pm 1.3 \\ \pm 0.9 \\ \pm 1.1 \\ \pm 1.9 \\ \pm 1.1 \\ \pm 1.9 \\ \pm 1.1 \\ \pm 1.1 \\ \pm 20 \\ 0.3 \\ 0.2 \\ \pm 25 \\ \pm 27 \\ 2 \end{array}$	$\begin{array}{c} 0.8 \pm 1.1 \\ 2.5 \pm 1.5 \\ 0.4 \pm 0.9 \\ \hline -3.0 \pm 1.4 \\ -0.5 \pm 0.8 \\ \hline -2.8 \pm 1.3 \\ \hline -0.3 \pm 0.9 \\ \hline \end{array}$	oup 	Our findings suggest that virtual dual task treadmill training using a video recording can improve the gait parameters of chronic stroke survivors.
4.Hyunseun g Kim (2015)	40 subjects	Scale 2. Functional Reach Test 3.10 Meter Walk Test 4.Time Up And Go Test 1. Gait Speed 2.Cadence 3. Stride length	BBS(score) FRT(cm) 10MWT(sec) TUGT(sec) Gait spe Cadence	EG EG EG EG CG EG CG EG CG ed (m/s)	41.8 ± 1.1 39.4 ± 2. 19.5 ± 1. 19.7 ± 1.1. 15.9 ± 1.4 15.6 ± 1. 20.4 ± 1.1 20.4 ± 1.1 Pre Post change Pre Post	$\begin{array}{c} 44.4\\ 2 & 40.2\\ 7 & 22.0\\ 2 & 20.1\\ 4 & 12.9\\ 5 & 15.1\\ 3 & 20.1\\ 0 & 20.1\\ \end{array}$	$\begin{array}{c} \pm 1.4 \\ \pm 1.9 \\ \pm 1.3 \\ \pm 0.9 \\ \pm 1.3 \\ \pm 0.9 \\ \pm 1.3 \\ \pm 0.9 \\ \pm 1.3 \\ \pm 1.9 \\ \pm 1.1 \\ \pm 1.9 \\ \pm 1.1 \\ \pm 1.9 \\ \pm 1.1 \\ \pm 1.9 \\ \pm 2.0 \\ \pm 27.2 \\ \pm 27$	$\begin{array}{c} 0.8 \pm 1.1 \\ 2.5 \pm 1.5 \\ 0.4 \pm 0.9 \\ -3.0 \pm 1.4 \\ -0.5 \pm 0.8 \\ -2.8 \pm 1.3 \\ -0.3 \pm 0.9 \\ \end{array}$	oup 5	Our findings suggest that virtual dual task treadmill training using a video recording can improve the gait parameters of chronic stroke survivors.
4.Hyunseun g Kim (2015)	40 subjects	Scale 2. Functional Reach Test 3.10 Meter Walk Test 4.Time Up And Go Test 1. Gait Speed 2.Cadence 3. Stride length	BBS(score) FRT(cm) 10MWT(sec) TUGT(sec) Gait spe Cadence	EG CG EG CG EG CG EG CG ed (m/s) e (step/min)	41.8 ± 1.1 39.4 ± 2. 19.5 ± 1. 19.7 ± 1.1 15.9 ± 1.4 15.6 ± 1. 22.9 ± 1. 20.4 ± 1.4 Pre Post change Pre Post change	$\begin{array}{c} & 44.4\\ 2 & 40.2\\ 2 & 40.2\\ 2 & 20.1\\ 2 & 20.1\\ 4 & 12.9\\ 5 & 15.1\\ 3 & 20.1\\ 0 & 20.1\\ \end{array}$	$\begin{array}{c} \pm 1.9 & (1 \\ \pm 1.9 & (1 \\ \pm 0.9 & (1 \\ \pm 1.3 & 2 \\ \pm 0.9 & (1 \\ \pm 1.9 & -1 \\ \pm 1.9 & -1 \\ \pm 1.1 & -1 \\ \pm 1.9 & -1 \\ \pm 1.1 & -1 \\$	$\begin{array}{c} 0.8 \pm 1.1 \\ 2.5 \pm 1.5 \\ 0.4 \pm 0.9 \\ -3.0 \pm 1.4 \\ -0.5 \pm 0.8 \\ -2.8 \pm 1.3 \\ -0.3 \pm 0.9 \\ \hline \\ $	oup 5 .7 5	Our findings suggest that stroke patients.
4.Hyunseun g Kim (2015)	40 subjects	Scale 2. Functional Reach Test 3.10 Meter Walk Test 4.Time Up And Go Test 1. Gait Speed 2.Cadence 3. Stride length	BBS(score) FRT(cm) 10MWT(sec) TUGT(sec) Gait spe Cadence Stride le	EG CG EG CG EG CG EG CG ed (m/s) e (step/min)	41.8±1.1 39.4±2. 19.5±1.1 19.5±1.1 15.6±1.1 20.4±1.1 20.4±1.1 Pre Post change Pre Post change Pre	$\begin{array}{c} & 44.4\\ 2 & 40.2\\ 7 & 22.0.1\\ 4 & 12.9\\ 5 & 15.1\\ 3 & 20.1\\ 0 & 20.1\\ \end{array}$	$\begin{array}{c} \pm 1.4 \\ \pm 1.9 \\ \pm 0.9 \\ \pm 0.9 \\ \pm 1.3 \\ \pm 0.9 \\ \pm 1.3 \\ \pm 0.9 \\ \pm 1.1 \\ \pm 1.9 \\ \pm 2.1 \\ \pm 27.2 \\ \pm 9.0 \\ \pm 10.3 \\ \pm 10.5 \\ \pm 10.$	$\begin{array}{c} 0.8 \pm 1.1 \\ 2.5 \pm 1.5 \\ 0.4 \pm 0.9 \\ -3.0 \pm 1.4 \\ -0.5 \pm 0.8 \\ -2.8 \pm 1.3 \\ -0.3 \pm 0.9 \\ \hline \end{array}$	5 5 .7 5 .8	Our findings suggest that virtual dual task treadmill training using a video recording can improve the gait parameters of chronic stroke survivors.
4.Hyunseun g Kim (2015)	40 subjects	Scale 2. Functional Reach Test 3.10 Meter Walk Test 4.Time Up And Go Test 1. Gait Speed 2.Cadence 3. Stride length	BBS(score) FRT(cm) 10MWT(sec) TUGT(sec) Gait spe Cadence Stride le	EG CG EG CG EG CG EG CG ed (m/s) e (step/min) ength (cm)	41.8±1.1 39.4±2. 19.5±1.1 15.9±1.4 15.6±1. 20.4±1.1 20.4±1.1 Pre Post change Pre Post change Pre Post change	$\begin{array}{c} & 44.4\\ 2 & 40.2\\ 7 & 22.0.1\\ 4 & 12.9\\ 5 & 15.1\\ 3 & 20.1\\ 0 & 20.1\\ \end{array}$	$\begin{array}{c} \pm 1.4 \\ \pm 1.9 \\ \pm 1.3 \\ \pm 0.9 \\ \pm 1.3 \\ \pm 0.9 \\ \pm 1.3 \\ \pm 0.9 \\ \pm 1.3 \\ \pm 1.9 \\ \pm 1.1 \\ \pm 1.9 \\ \pm 1.1 \\ \pm 1.9 \\ \pm 1.1 \\ \pm 1.1 \\ \pm 2.0 \\ \pm 2.0 \\ \pm 2.5 \\ \pm 27.2 \\ \pm 9.0 \\ \pm 10.3 \\ \pm 10.2 \end{array}$	$\begin{array}{c} 0.8 \pm 1.1 \\ 2.5 \pm 1.5 \\ 0.4 \pm 0.9 \\ \hline -3.0 \pm 1.4 \\ -0.5 \pm 0.8 \\ \hline -2.8 \pm 1.3 \\ \hline -0.3 \pm 0.9 \\ \hline \end{array}$	oup 6 .7 5 .8 .9	Our findings suggest that virtual dual task treadmill training using a video recording can improve the gait parameters of chronic stroke survivors.

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5. Gui bin Song (2015)	40 subjects	1. Berg Balance Scale										According to the results of this study, dual-task training and single-
				DTG			S	TG				task training were effective in improving
				Befor	•	Post	E	Before	Post			balance in stroke
			BBS (scale)	37.5 ±	10.5	45.5 ±	6.3 4	2.3 ± 7.7	45.9 ±	1.2		patients, dual task training is more
C K: Harr	22	1				UDT	CI.	11D		NO /	(D)	effective for increasing balance ability.
6. Ki Hun Cho (2015)	subjects	1. Gait Speed 2. Cadence				group (n =	CL > 11)	$\sqrt{n} = 11$	up)	X2 / values	t (<i>P</i>)	These findings demonstrated the
		3. Stride	Single	Gait	speed,	50.28	3 ±	49.37	±	.173 (.8	64)+	efficacy of VRTCL on
		4. Step	task condition	cm/s Cadence		68.58	3 3 ±	9.48 66.43	±	.382 (.7	(06)+	under the
		Length		steps/mi	1	13.01		13.27				dual task condition.
				Step len	gth, cm	31.70 10.06) ± 5	31.41 7.21	±	.077 (.9	(39)+	that VRTCL may be an
				Stride cm	length,	62.12	2 ±	61.10 10.13	±	.158 (8	76)+	achievement of
			Dual task	Gait cm/s	speed,	34.36	5±	31.27	±	.677 (.5	06)+	 independent walking in chronic stroke patients.
			condition	Cadence	,	55.35	5 ±	53.15	±	.572 (.5	73)+	
			-	Step len	1 gth, cm	26.51	b L ±	25.92	±	.267 (.7	92)+	-
				Stride	length.	6.42 54.56	ó ±	3.61 53.69	±	.166(.8	(70)+	-
7 In Harry	20			cm		12.68	3	8.59	_		,.	
Choi (2015)	subjects	2. Verbal memory	Baseline	Dua	l-task g	group		Control	l group			that dual- task training could be as
		test		Bef	ore	After	P value	Before	Afte	er	P value	effective as conventional balance training for
			K-MMSE	23.9 4.91	0±	26.80± 3.46	0.007	22.90± 5.82	25.5	50±	0.03	improving balance and cognition in subacute
			(Verbal	4.00	±	4.10±	0.79	4.50±	4.90)±	0.23	post-stroke patients.
			DST-forwar	rd 1.41		0.99		0.97	1.00	5		
			DST- backward	3.00 1.05	±	3.20± 0.79	0.53	2.90± 1.20	3.20 0.79)±)	0.32	
8. Ho-Jung An	33	1. Functional										The motor and cognitive
(2014)	subjects	Reach Test 2.10 Meter	Group		MD	GT	CDC	ЭТ	MCE	OGT		dual task gait training was
		Walk Test 3.Time Up	v arrable	Pre	22.5	6±7.86	22.3	6 ± 5.55	22.27	7 ± 6.13		more effective at improving the balance
		And Go Test	FRT (cm)	Post change	26.1 3.57	4 ± 8.06 ± 0.50	23.82	$\frac{2 \pm 5.91}{\pm 3.56}$	5.55	$\frac{2 \pm 6.32}{\pm 1.13}$	_	and gait abilities of chronic stroke patients
			10 MWT (m/s)	Pre Post	19.2	8 ± 9.50 5 ± 6.68	19.3	3 ± 10.99 1 + 9.90	19.45	5 ± 7.92 5 + 7.73		than either the motor dual task gait training or
			()	change	-3.9	4 ± 3.53	-2.0	2 ±1.87	-3.69	9 ± 2.31	_	the cognitive dual task
			TUG (sec)	Pre Post	0.85	± 0.38 + 0.49	0.93	± 0.48 + 0.51	0.89	± 0.38 + 0.54		gait training alone.
			· ,	change	0.13	± 0.11	0.03	± 0.04	0.38	± 0.21		_
9. GyeYeop Kim	20 subjects	1. Stroop Test				Before Interve	ention	After Interve	ention	Fol up	low	Dual-task training
(2014)		2.10 Meter Walk Test	Streen test	Single- training	task ;	32.50	± 14.30	33.10	± 13.07	34. 14.	20 ± 80	improved cognitive and walking abilities, and dual-
		And Go Test	Subopiest	Dual-ta training	sk	40.70	± 15.68	51.00	± 15.88	52. 16.	10 ± 62	task training subjects' performance was better
				group Single-	task	42.41	+ 24 40	40.41	+ 22.88	40	60 +	than single-task training subjects'
			Time up	training	Ş	.2				23.	63	performance. In addition, these training benefits
			and go	Dual-ta	sk	33.56	± 20.71	24.19	± 15.82	25.	38 ±	were maintained for 2
			test	training group	5					16.	13	Dual-task
			10 meter walk test	Single- training	task	30.86	± 14.85	27.46	± 14.65	28. 14.	90 ± 58	cognitive and walking abilities of patients
				Dual-ta training	sk	26.20	± 11.93	18.16	± 12.17	19. 12.	44 ± 16	with stroke.
10 Wani	29	1 Dono	Crown	group) T T	DT (= 12)	TTP	T (= 12	0	
Choi	subjects	Balance	BBS	Pre	40.1	3 ± 7.5	2) VI 41	$.2 \pm 5.7$	42.0	$1 (n=13) \pm 4.4$	ワ	Dual task training
(2014)		Scale 2 Functiona		Post	46.	3 ± 7.4	45	5.1 ± 5.4	45.7	7 ± 4.8		applied with visual restriction and an
		1 Reach	FRT	Change Pre	5.9	± 0.5 6 ± 7.8	3.9	9 ± 0.5 3.8 ± 4.9	3.7	$\pm 0.6 \\ 5 \pm 5.4$	\dashv	unstable base in which
		Test 3.Stroop		Post	21.	1 ± 7.4	22	2.5 ± 4.4	21.8	3 ± 5.3		the subjects attempted to maintain their balance
		Test	Stroop test	Pre	5.5	± 0.5 ± 1.6	3.	1 ± 0.5 9 ± 1.3	4.3	± 0.3 ± 1.2		was effective in

²⁹²

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Review				-											

11. Donghoon Kim (2013)	25 subjects	1.Gait Speed 2.Cadence 3.Stride		Pocha	st 2. ange –2	0 ± 1.0 2.1 ± 0.3	2.9 ± 1 -1.0 ±	1 3 0.2 -	.3 ± 1.1 1.0 ± 0.2		improving the balance and attention of stroke patients, and the VUDT was more effective than VDT or UDT. The experimental group showed significant improvement in all selected gait measures
		4. Stride Length	Speed Caden Stride Stride	(cm/s) ce (step/mi time (s) length (cm	Con Post -12. n) -3.1 -0.0) 2.97	trol (n=12) -Pre 84 ±21.61 6 ±10.07 6 ±0.08 7 ±12.84	Experim Post-Pre 29.74 ± 14.98 ± -0.16 ±0 18.08 ±	nental (n=1 5.66 9.42 0.10 9.97	3)		symmetry index under both task conditions. In the control group, there were no significant changes over the 4-week period for all selected measures. There was a significant difference between groups for all selected gait variables except for temporal symmetry index under both task conditions.
12. Yea-Ru Yang (2007)	37 subjects	1.10 Meter Walk Test	TU G (sec)	Dual-tas (<i>n</i> =19) Pre- 22.74 (15.20)	k group Post- 18.59 (13.97)	Changes between pre a post- interventi n 4.14 (2.16	Sing (n= Pre- nd 5) 26.9 (8.8)	2 22.31 7 (6.12)	UP Changes between pre and post- intervent n 4.61 (7.7	iio 77)	The study results suggest that the performance of a cognitive-motor dual- task using auditory cues may influence balance improvements in chronic stroke patients.
	361 subjects										

DISCUSSION

This systematic review aimed to provide an overview of the dual task training approaches for balance and gait in Patients with Stroke of total 12 studies of dual task training was given in which 4 studies was compared with treatment approaches such as Tai Chi training, cognitive or motor tasks during walking, aquatic dual-task training and virtual dualtask treadmill training using a video recording.

The functional recovery of stroke patients is more effective when their therapies include high-intensity training and appropriate practices that allow voluntary use of specific motions and functions that are similar to actual tasks. Furthermore, adjusting the patient's pelvic movement is dynamic critical because balance is controlled by the harmonious movement between the pelvis and the upper body as well as by the muscles around the hip joint; the weights of the head, upper limbs, and trunk is transferred to the lower limbs through the pelvis. As a therapeutic method for restoration of this function, dual-task training is very popular, and active research is being conducted on the performance of dual tasks that reduce postural sway and improve postural stability.

Tai chi training on dual-tasking performance that involves stepping down was given to stroke survivors and showed significant improvement in dual-tasking performance was still found. This may support the value of Tai Chi training on dual-tasking performance in stroke survivors. The outcomes used were Auditory Stroop test, Stepping down test, Dual-tasking involving test both simultaneously. The main reasoning for the enhanced dual-tasking performance after Tai Chi training could be the increased attentional resources available to perform both the cognitive and physical tasks simultaneously.^[6]

Cognitive and motor dual task gait training was given to improve dual task gait performance after stroke and showed significant improvement in DTC-speed and increase in stride length during cognitivemotor dual task walking after CDTT in stroke patients. No significant improvements in single walking or motor dual task walking performance after CDTT.

These results suggest training-specific improvements. MDTT was also found to have significant training-specific effects. Significant improvements in gait speed and stride length during motor dual task walking were found after MDTT. On the other hand, gait speed, cadence, and stride length were all found to improve during motor dual task walking after conventional physical therapy training. The outcome used were three test conditions to evaluate the training effects were Single walking, Walking while performing cognitive task (serial subtraction), Walking while performing task (tray-carrying). motor Parameters included Gait speed, Dual task cost of gait speed (dtc speed), Cadence, Stride time, and Stride length. The main reasoning may be conventional physical the therapy intervention. including muscle strengthening, balance, and gait training, might have improved motor capacity and reduced the attention needed to perform the motor task, permitting greater attention to directed toward performing other be concurrent tasks. The decrease in motor DTC-speed by 10.3% after CPT may also partly the above mentioned reflect speculation. Another reason may be different types of gait included in current study (cognitive dual task gait training, dual training, motor task gait and conventional physical therapy) may all positively impact single walking performance but through different effects on walking characteristics.^[4]

Aquatic dual task training on balance and gait was given to stroke patients and showed that on intergroup comparison, the experimental group showed a relatively significant change after more the experiment in all balance and gait assessment tests. The outcome measures used were Berg balance scale, Five Times Sit-to Stand Test, and Functional Reach Test to measure Balance. 10-Meter Walk Test, Timed Up and Go Test. and Functional Gait Assessment to measure Gait. The main reasoning may be that Aquatic exercise uses the resistance and buoyancy of water to increase muscle strength and sensory feedback, leading to improved balance and gait ability. Therefore, aquatic dual-task training has a positive effect on balance and gait by activating sensory input in stroke patients. [1]

Virtual dual-task treadmill training using a real-world video recording of the gait was observed on individuals with chronic stroke and revealed significant improvement in the gait variables in both groups. The Outcome used were Temporospatial parameters of gait. A video recording was performed in a large supermarket, and the subjects could walk at their favorable speed on a treadmill. The main reason may Automatization of the control group which was improved due to the repetition of treadmill walking, whereas the proper allocation ability of coordination and attention was improved in the experimental group by virtual dual-task training, which led to the decreased CMI. CMI is a phenomenon that results in the deterioration in many aspects of gait ability, such as slower gait speeds, reduced cadence, and shorter stride length. Another reason may be Visual feedback in the virtual reality environment motivates the participants to participate in the training. actively Improvements in concentration as well as postural stability contribute to a normal gait pattern. Through this, the gait ability of stroke patients was improved. Similarly, virtual dual-task treadmill training using a video recording has strengths related to both dual-tasks and virtual reality. The intervention of virtual reality provided stroke survivors with motivation and stability. their emotional and Neuroplasticity increased through repetitive training of their damaged lower extremities, resulting in improved gait ability. Therefore, the control group probably showed more efficient improvements in gait ability.^[7]

CONCLUSION

From the study it can be concluded that dual task training was found to be

effective in improving functional performance when examine singly. When it was compare to other interventions such as tai chi training, cognitive or motor tasks during walking, aquatic dual task training and virtual dual task treadmill training dual task training was again found to be more effective. Therefore dual task training conventional should be a part of rehabilitation program for patients with stroke.

REFERENCES

- 1. Kim K, Lee DK, Kim EK. Effect of aquatic dual-task training on balance and gait in stroke patients. Journal of physical therapy science. 2016;28(7):2044-7
- 2. Kim GY, Han MR, Lee HG. Effect of dualtask rehabilitative training on cognitive and motor function of stroke patients. Journal of physical therapy science. 2014;26(1):1-6.
- 3. An HJ, Kim JI, Kim YR, Lee KB, Kim DJ, Yoo KT, Choi JH. The effect of various dual task training methods with gait on the

balance and gait of patients with chronic stroke. Journal of physical therapy science. 2014;26(8):1287-91.

- Liu YC, Yang YR, Tsai YA, Wang RY. Cognitive and motor dual task gait training improve dual task gait performance after stroke-A randomized controlled pilot trial. Scientific Reports. 2017 Jun 22;7(1):4070.
- 5. Kim D, Ko J, Woo Y. Effects of dual task training with visual restriction and an unstable base on the balance and attention of stroke patients. Journal of physical therapy science. 2013;25(12):1579-82.
- Chan WN, Tsang WW. Effect of Tai Chi Training on Dual-Tasking Performance That Involves Stepping Down among Stroke Survivors: A Pilot Study. Evidence-Based Complementary and Alternative Medicine. 2017;2017.
- Kim H, Choi W, Lee K, Song C. Virtual dual-task treadmill training using video recording for gait of chronic stroke survivors: a randomized controlled trial. Journal of physical therapy science. 2015; 27(12):3693-7.

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