Use of a novel cable-driven gait trainer to restore walking in patients post stroke: a pilot randomised controlled trial

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BACKGROUND

- Stroke is the 3rd leading cause of disability adjusted life years worldwide[1]
- Only 65% of stroke patients who are discharged from in-patient rehabilitation can walk independently[2]
- Walking presents a significant challenge to patients and physiotherapists, who undergo significant strain to provide support for posture & the paretic limb
- A novel cable-driven gait training (CDGT) device has been developed to allow patients to engage in walking training soon after sustaining a stroke

AIMS & OBJECTIVES

1. To assess if the combination of CDGT and conventional physiotherapy (CPT) significantly improves mobility
2. To determine if the combination of CDGT and CPT improves mobility outcomes compared to CPT alone

METHODS

A novel cable-driven gait training device was used for this study (figure 2). The device contains cables that are situated to the front and rear of a treadmill apparatus . The cables were adjustable both in tensile strength and location, and provided a combination of resistance and assistance to facilitate correction of abnormal walking patterns. Body weight support was provided for patients who were unable to weight-bear.

23 patients approved for in-patient neurorehabilitation at the Royal Melbourne Hospital with a primary diagnosis of stroke were randomised into either an intervention group that received a combination of CDGT and CPT, or a control group that received CPT only (figure 1). The Control (CPT) group underwent 60 minutes of CPT, 5 days per week until discharge from in-patient rehabilitation, whilst the intervention (CDGT) group received 30 minutes of CPT followed by 30 minutes of CDGT, 5 days per week until discharge.

The primary outcome measure was walking velocity over 10m (10MWT). Secondary outcome measures include walking endurance (6MWT), timed up and go, and balance test (step test).

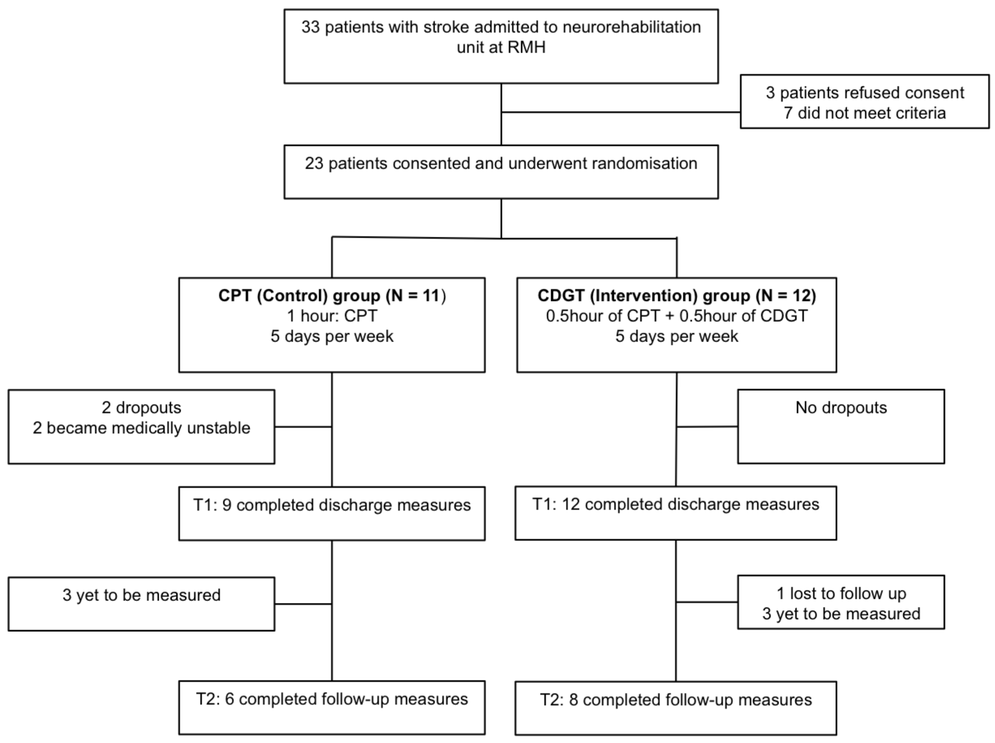

Figure 1. Consecutive recruitment of patients

Figure 2. Patient undergoing CDGT with cables attached to the hemiparetic limb

RESULTS

Significant differences between groups were found in stroke type (p = .02) and stroke location (p = .03). Mean age was 66.3 years and 71.6 years in the CPT and CDGT group respectively (table 1). Patients in the CPT group participated in a mean of 16 sessions whilst patients in the CDGT group participated in 14 sessions (p = .64).

Table 1. Mean baseline characteristics of participants (n = 21)

Characteristics		CPT group (n = 9)	CDGT group (n = 12)	*p*- Values
		n, (%) (unless stated different)		
Age {years}	(SD)	66.3 (18.9)	71.6 (9.1)	.45
Sex	Male	9 (75.0)	5 (55.6)	.40
Days post stroke		45 (53)	11 (7)	.15
No. of physiotherapy sessions		16 (12.5)	14 (8.9)	.98
Left sided stroke		6 (66.7)	5 (41.7)	.39
Stroke type				
	Ischaemic	5 (55.6)	12 (100)	.02*
	Haemorrhagic	4 (44.4)	0 (0)	
Stroke location				
	MCA	0 (0.0)	6 (44.0)	.03*
	Sub-cortical	5 (71.4)	5 (44.4)	
	Cerebellar	3 (33.3)	0 (0)	
	Pontine	1 (11.1)	0 (0)	
	Medullary	0 (0.0)	1 (8.3)	
Hemiplegia				
	Left	5 (55.6)	6 (50.0)	.71
	Right	3 (33.3)	3 (25.0)	

CPT = conventional physiotherapy, CDGT = cable-driven gait trainer, n = total number, SD = standard deviation, MCA = middle cerebral artery, significance = p <0.05

Mean walking velocity scores significantly increased from baseline (T0) to discharge (T1) in the intervention group only (p = .002). No differences between CPT and CDGT groups at discharge (p = .34) and follow up (T2) (p = .48) were noted.

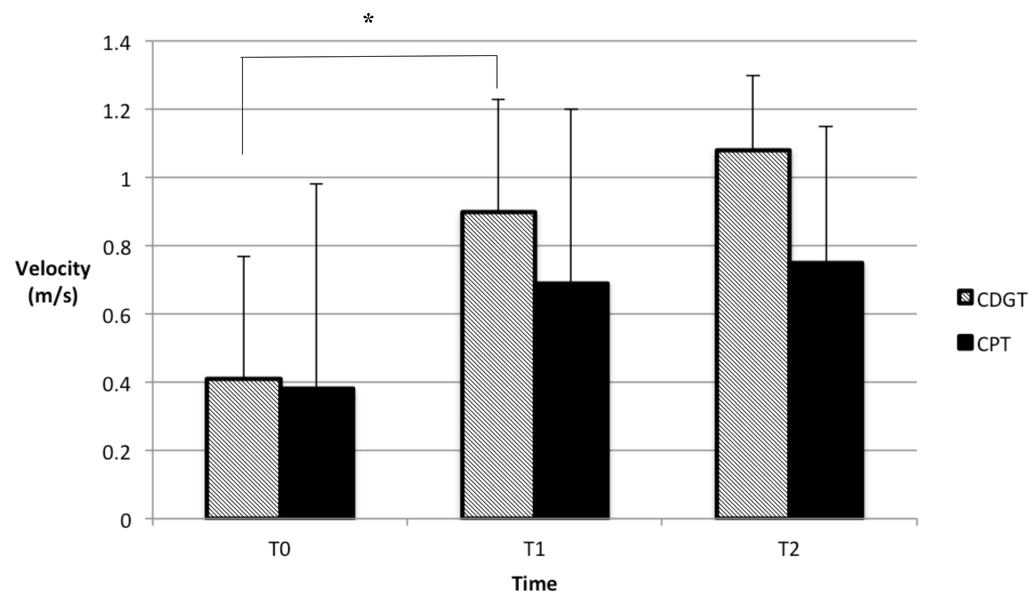

Figure 3. Mean Velocity during the 10MWT. Error bars denote standard deviation

In the CDGT group, cadence (p =.002), walking endurance (p = .004) and balance (p = .029) significantly improved at discharge. No difference between CPT and CDGT groups were noted (table 2).

Table 2. Summary of intention to treat analysis with mean scores (standard deviation) of secondary gait measures

Scales	CPT (Mean, SD)			CDGT (Mean, SD)			Between group p values	
	T0 (n =9)	T1 (n = 9)	T2 (n = 6)	T0 (n = 12)	T1 (n = 12)	T2 (n = 8)	T0 –T1	T1-T2
10m WT – Cadence (steps/min)	37.25 (46.57)	82.27 (40.30)	93.98 (18.68)	54.78 (43.35)	104.02 (16.13)	113.09 (4.94)	.82	.96
Within group *p* values		.07	.58		.002*	.31		
TUG	34.42 (31.29)	34.76 (25.83)	22.99 (10.93)	29.42 (24.44)	15.00 (8.45)	12.15 (2.34)	.39	.88
Within group *p* values		.96	.27		.13	.64		
6m WT (meters)	124.44 (182.42)	199.89 (171.36)	242.83 (135.40)	137.83 (133.56)	259.00 (110.54)	343.38 (55.27)	.38	.57
Within group *p* values		.09	.13		.004*	.08		
Step test								
Less affected leg	3.56 (4.39)	4.78 (5.29)	5.83 (2.71)	5.67 (4.54)	8.17 (4.6)	11.50 (1.77)	.49	.27
Within group *p* values		.22	.16		.10	.27		
Affected leg	3.0 (4.0)	9.00 (4.77)	6.67 (2.58)	6.33 (4.87)	9.00 (4.77)	11.63 (1.85)	.91	.69
Within group *p* values		.03*	.40		.10	.64		

T0 = baseline, T1 = discharge, T2 = 4wks follow-up, CPT: conventional physiotherapy, CDGT = cable-driven gait trainer, n = total number, Within group = dependent t test, between group = independent t test, * = significance (p <0.05)

CONCLUSIONS

1. CDGT significantly improved gait speed, endurance and balance from baseline to discharge
2. No differences were seen between the CDGT and CPT groups
3. Following this pilot study, we recommend studies with larger numbers to demonstrate a significant difference between CDGT and CPT

REFERENCES

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2. Jorgensen HS, Nakayama H, Raaschou HO, Olsen TS. Recovery of walking function in stroke patients: the Copenhagen Stroke Study. Arch Phys Med Rehabil. 1995;76(1):27-32.