TITLE:

Treadmill Training to improve mobility for people with sub-acute Stroke: A Phase II Feasibility Randomised Controlled Trial.

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Cover title

Treadmill Training in Sub-Acute Stroke

Itemised list of the number of tables and number and types of figures included in the manuscript.

Key Words:

Gait; Treadmill, participation; rehabilitation; exercise, physical therapy; stroke

Abstract

Objective: This phase II study investigated the feasibility and potential effectiveness of treadmill training versus normal gait re-education for ambulant and non-ambulant people with sub-acute stroke delivered as part of normal clinical practice.

Design: A single-blind, feasibility randomised controlled trial.

Setting: Four hospital-based Stroke units

Subjects: Participants within three months of stroke onset.

Interventions: Participants were randomised to treadmill training (minimum twice weekly) plus normal gait re-education or normal gait re-education only (control) for up to eight weeks.

Main Measures: Measures were taken at baseline, after eight weeks intervention and at six months follow up. The primary outcome was the Rivermead Mobility Index. Other measures included the Functional Ambulation Category, 10 metre walk, six minute walk, Barthel Index, Motor Assessment Scale, Stroke Impact Scale and a measure of confidence in walking.

Results: Seventy seven patients were randomised, 39 to treadmill and 38 to control. It was feasible to deliver treadmill training to people with sub-acute stroke. Only two adverse events occurred. No statistically significant differences were found between groups. For example, Rivermead Mobility Index, median (IQR): after eight weeks treadmill 5 (4-9), control 6 (4-11) p = 0.33; or six months follow-up treadmill 8.5 (3 -12), control 8 (6 – 12.5) p = 0.42.

The frequency and intensity of intervention was low.

Conclusions: Treadmill training in sub-acute stroke patients was feasible but showed no significant difference in outcomes when compared to normal gait re-education. A large definitive randomised trial is now required to explore treadmill training in normal clinical practice.

INTRODUCTION:

Regaining mobility is a key goal for many stroke survivors, yet optimal methods for gait rehabilitation have not yet been determined [1] [2]. In around 50% of stroke survivors who regain ambulation, walking impairments persist long term and therefore considerable attention has been given to re-establishing walking post-stroke [3] [4].

Treadmill training can be used to deliver task specific gait training after stroke. A recent Cochrane review found that walking speed and endurance significantly increased after treadmill training in those already able to walk [2]. However in those unable to walk at baseline, treadmill training was not shown to improve the ability to walk independently. Interestingly their sub-analysis revealed that if the frequency of treadmill training was less than three times a week there was no effect on walking speed or endurance, although only small numbers were included in this sub-analysis and further investigation is required. No analysis of secondary measures of quality of life or activities of daily living were carried out due to insufficient data from the included trials [2]

The delivery of treadmill training interventions can be intensive in terms of number of staff and the time required to deliver the intervention. For example, a number of studies have provided treadmill training to participants for 5 days or more per week and for up to 60 minutes per session [5] [6] and for prolonged periods - 3 times a week for 4 months [7], 3x week for 6 months [8], 3x a week for 3 months [9], daily for 6 weeks followed by 3xweek for 6 weeks [10]. This intensity may not be practical in all stroke rehabilitation services and therefore exploring the availability of treadmill training to use for training gait as part of normal clinical practice is important.

The aims of this pilot study were therefore to:

- evaluate the feasibility of delivering treadmill training as part of a normal clinical service in the United Kingdom, in ambulant and non-ambulant stroke patients within the first 3 months post-stroke;
- test the feasibility of performing a randomised controlled trial to evaluate the effectiveness of treadmill training in a normal clinical service in the United Kingdom.

and

- establish whether access to treadmill training improved walking ability, measures of activities of daily living and participation in people with sub-acute stroke accepting that this phase II trial was not powered to demonstrate a difference.

METHODS:

This was a phase II, feasibility randomised parallel group controlled trial with 1:1 allocation, with blinded outcome assessment. The trial took place within the United Kingdom National Health Service, in four stroke units within Lothian. Ethical approval was received from Scotland A Multi-centre Research Ethics Committee (06/MRE00/82). The trial was retrospectively registered with the ISRCTN registry (Study ID ISRCTN50570295). Written consent was obtained by the research assistant from each participant and for participants unable to give consent from their relative or legal representative.

Feasible treatment parameters and eligibility criteria were developed by the research team (GB, LS, MS) in conjunction with a representative from each clinical site involved in the study. The frequency, duration and number of concurrent patients who could be treated with treadmill by the National Health Service staff available was established to ensure consistency across all sites. Inclusion criteria: aged over 18 years; stroke as defined by World Health Organisation [11]; able to stand for one minute with or without support (to allow harness fitting if required); medically stable; within three months of stroke onset; able to understand and follow verbal instructions; and informed consent had been obtained. Exclusion criteria: co-existing non-stroke related neurological impairments, co-morbidities precluding gait training, non-ambulant prior to stroke, body weight greater than 138kg or clinically determined to be unsafe to use treadmill.

The research assistant collected all baseline data. Clinical staff used these data for randomisation which occurred via computer by accessing a remote, secure server. Participants were randomised into block sizes of five by computer generated randomisation to the treadmill or control group 1:1, using minimisation [12] to account for side of stroke and whether the participant was functionally ambulant without physical assistance (Functional Ambulation Category 4-6) or non-ambulant / ambulant with physical assistance (Functional Ambulation Category 1-3) [13]. Each site could only recruit a maximum of five participants to the trial at any one time to ensure the randomisation algorithm could assign to either group and that if a participant was randomised to treadmill training, there would be sufficient resources available to deliver the intervention. An independent statistical consultant devised the web-based randomisation process to assign eligible participants. No-one directly involved in the project had access to allocation codes.

Participants were randomised to an agreed eight week programme of intervention of either a control or an experimental treadmill training intervention group. Each unit had a Biodex™ treadmill. Participants in the control group were to receive at least three intervention sessions per week of normal physiotherapy and gait training (which included assisted / independent activities such as weight transfer, stepping with either leg, walking, step ups and stairs, movement control and strengthening) with no access to a treadmill. Treadmill participants were to receive at least three sessions per week of normal physiotherapy and gait training which would include a minimum of two sessions a week of gait training using the treadmill. After eight weeks of intervention, treadmill participants reverted to normal physiotherapy with no further access to the treadmill, control participants continued to receive intervention as normal (if still required) with no access to a treadmill. The protocol intended every participant to have approximately the same amount of time in physiotherapy focused on walking. If participants were transferred or discharged prior to 8 weeks, trial intervention ceased.

The intervention delivered to treadmill participants was not dictated by the trial team as one of the study aims was to determine how the treadmill was used within the United Kingdom National Health Service clinical setting and within available staffing resources. On average, each unit had a staffing ratio of 1 qualified physiotherapist to 9 beds with additional assistant therapy staff available of 1: 33 beds which equated to an average 0.8 whole time equivalent therapy assistant per unit. Body weight support with a treadmill harness was used based on clinical reasoning for individual cases.

Neither the patients or their therapists were blind to treatment allocation but the outcomes were measured by a research assistant blinded to treatment group allocation. A battery of standardised validated measures were applied by the research assistant blinded to treatment allocation, at baseline (prior to randomisation), eight weeks (“end of intervention”) and six months post randomisation (“six month follow up”). The Rivermead Mobility Index (0-15) [14] was designated the primary outcome measure. Secondary outcomes included the Timed Up and Go, (seconds) [15]; a 10 metre walk, (seconds) [3]; a six minute walk test (metres) [16] [17] and a vertical 10cm Visual Analogue Scale, (0-100) to measure confidence in walking. The Motor Assessment Scale, (0-48) was used to measure general recovery of impairments [18], Activities of Daily Living were measured using the Barthel Index (0-100) [19], and participation was measured by the Stroke Impact Scale v3.0 (0-100), [20]. Higher scores, except for the Timed Up and Go and the 10metre walk test, reflect better performance. Data were also collected on duration and intensity of treatment and adverse events for both groups and resource issues across all sites to inform feasibility.

No formal power calculation was carried out since the purpose of this phase II trial was to establish the feasibility of delivering treadmill training in routine National Health Service setting, and also the feasibility of performing a larger randomised controlled trial which would determine if the treadmill was effective in improving recovery in walking after sub-acute stroke. Based on available service data, funding and resources it was anticipated that 100 participants might be recruited to this feasibility study.

Patients were analysed according to their original treatment allocation irrespective of the treatment they actually received. Outcome data were plotted and tested for normality of distribution. As the majority were non-normally distributed, medians and upper and lower-quartile range data are presented. Non-parametric statistical analysis were undertaken with comparisons taken between groups at each time point using a Mann-Whitney U test and a Kruskal-Wallis was employed to look for change within groups longitudinally. No adjustment was made for minimisation variables or any baseline imbalance.

There were some missing data points due to drop out, death and inability to perform tasks (e.g. unable to walk). We aimed to perform an intention to treat analysis however after consideration of dealing with missing data, imputing data from last observation carried forward was discounted as the technique assumes that outcome remains constant at the last observed value after dropout and this is unlikely in many clinical trials [21]. Analysis was therefore only undertaken on completed outcome measures.

RESULTS:

A CONSORT diagram is given in figure 1. Of the 526 people with stroke assessed for eligibility to the trial over a 15 month period between April 2007 and June 2008, only 15% were recruited. Of the 77 people with stroke who were recruited into the trial, 38 were allocated to the control group and 39 to the experimental group. All participants completed baseline measures as ability allowed (non ambulant participants were unable to undertake the 10metre walk test, 6 minute walk test or the Timed Up and Go; ambulant participants that were unable to stand up independently were unable to undertake the Timed Up and Go). Participant baseline characteristics are presented in table 1 and reasons for ineligibility in table 2.

Figure 1 about here

Tables 1 and 2 about here

It was feasible to deliver treadmill training, however participants in this group received only the minimum two sessions of treadmill training per week, a further two general physiotherapy sessions per week were also received. The intensity of treadmill training was low, with the weekly median times spent on the treadmill equating to between 8 - 16 minutes a week, at a median speed of 0.6m/s. 49% of people receiving treadmill training used a body weight support harness in week one, this reduced to 23% in week eight.

A number of operational issues that prohibited more intensive treadmill training delivery were identified by therapy staff at each site. The main issues reported were:

- time-consuming set-up of the harness system particularly in non-ambulant participants and those with poor standing balance
- the need, for two or three members of staff to deliver the treadmill intervention
- difficulty in delivering treadmill training interventions when staffing levels were reduced due to sickness absence or holiday leave

Table 3 presents the primary outcome measure and other mobility and activities of daily living measures at eight weeks and six months for both the control and treadmill groups. Table 4 summarises participation outcomes from the participant perspective as measured by the Stroke Impact Scale.

Table 3 and 4 here

For the primary outcome, the median Rivermead Mobility Index score at eight weeks was 6 for the control group and 5 for the treadmill training group, there was no statistically significant difference between the groups at this time point (p = 0.33). At six months the median Rivermead Mobility Index score for the control group was 8 and the treadmill training group was 8.5, with no statistically significant difference (p=0.42). For all other outcomes analysis of between group differences at each time point using Mann Whitney U tests showed no statistically significant differences for any outcome at baseline, at 8 weeks post intervention or at 6 months follow up between the two groups.

Complete data were available for Rivermead Mobility Index, Functional Ambulation Category and Barthel Index at baseline, with over 84% completion at follow-up. Completion of other secondary measures varied, with the timed walking tests proving the most challenging with only 28 – 47% completing measures at baseline rising to a maximum completion rate of 68% during the trial (table 5). Reasons for non-completion at 8 weeks included deaths (n=3; [2 control ; 1 treadmill]); refused or withdrew (n = 3; [2 control ; 1 treadmill); unwell (n= 1 [treadmill]); or unable to contact (n = 1 [treadmill]). At 6 months non-completions included death (n=7; [4 control ; 3 treadmill]); refused or withdrew (n = 3; [1 control ; 2 treadmill); and one participant [control] was unwell.

Only two adverse events occurred during treadmill training. In one case a patient developed chest pain, fainted, vomited and became short of breath while on the treadmill. The session ceased and the participant sustained no further adverse effects. In the second case, a participant fell during a treatment session but no injury was sustained. Both participants continued in the trial. No adverse events were reported for control participants.

As expected, during this post-stroke recovery period, within group analyses showed statistically significant improvements within each group for the Rivermead Mobility Index (control : p<0.0005; treadmill training: p<0.005), the Functional Ambulation Category (control : p<0.005;

treadmill training: $p<0.005$), and the Barthel Index (control : $p<0.005$; treadmill training: $p<0.005$) over time.

Finally, an exploratory analyses of initially non-ambulant and ambulant participants (Functional Ambulation Category 1-3 vs Functional Ambulation Category 4-6 at baseline), showed that there were no significant differences in any of the mobility outcomes at any time-point for either treadmill training or control participants.

DISCUSSION:

One of the key findings from this phase II feasibility study is that we were able to deliver treadmill training to people with sub-acute stroke in the United Kingdom in a National Health Service setting, but the intensity was less than that which is likely to be effective [2]. While we did find that it was feasible to undertake treadmill training within the clinical setting, the frequency of treadmill training was on average only two sessions per week and the amount of actual treadmill training received was low (between median durations of only 8 – 16 minutes per week). It is questionable whether this frequency and intensity of input would be sufficient to effect change. It has been found previously that treadmill training delivered with a frequency of less than 3 times a week showed no effect on walking speed or endurance although only small numbers were included in these analyses[2], our study would concur with these findings. While it appears that the intervention intensity in our study was of too low an intensity to effect a change, the approach to intervention was dictated by available resources in the four sites and therefore this study is clinically relevant, particularly for the United Kingdom setting.

Nearly 60% of the participants were non-ambulant or dependent on at least one therapist for ambulation at baseline (Functional Ambulation Category 1-3) and this requires considerable staff input during gait re-education often with the assistance of two staff. If clinical therapists are unable to deliver high intensity interventions due to lack of adequate resources and given that this study identified that there was no difference in outcome between the groups it may be that therapists should consider whether use of the treadmill as a component of gait re-education is only indicated for people with sub-acute stroke when sufficient intervention time is feasible or when there is clear evidence of a positive effect on a specific impairment. While interventions in our study may well have been task specific, our data do not indicate that intensive training was received which may have affected the outcome. While we investigated the differences in outcome between initially ambulant versus non-ambulant participants we found no differences. This finding is in contrast to a recent Cochrane review [2] but may be due to our small sample size and lower intensity interventions.

In any future work, we would recommend that a minimum intensity intervention was prescribed. We would suggest that this would need to equate to at least three treadmill training sessions per week [2], with time spent actually walking on the treadmill requiring to be substantially increased from that delivered in this study. The actual amount of time walking requires further investigation. Furthermore, sub-analyses should be undertaken to investigate whether there are specific sub-populations of stroke for whom treadmill training gait re-education is indicated, however this would require a much larger sample size.

We used specific measures of walking ability, activities of daily living and participation measures in this feasibility randomised controlled trial of treadmill training in ambulant and non-ambulant people with sub-acute stroke. We found no significant differences between the groups for any of the outcome measures at eight weeks or six months. In terms of determining feasibility of outcome measure use for future trials, we found that all the outcome measures were feasible to use with people with sub-acute stroke and sensitive to change over time, however 16% of potential measures from the primary outcome were not captured, mainly due to death, illness or dropout (Table 5). Additionally there were missing data for physical gait based measures due to the high numbers of non-ambulant participants at baseline.

For subsequent work, we have used the Rivermead Mobility Index data from all participants at six months to estimate the sample size needed in a future randomised controlled trial of treadmill training in sub-acute stroke. A sample size of at least 180 per group would be required to identify a clinically significant two-point change in mean score for the Rivermead Mobility Index (assuming a standard deviation of 4.16) at the 0.05% level of significance and 90% power. Given that our Rivermead Mobility Index data were skewed, this sample size should be viewed as a conservative estimate.

A study investigating a comparable population to ours took outcomes before and after 4 weeks of intervention as well as at 6 months follow up [5]. Similar to this study, they found that while all participants showed meaningful improvement in the outcomes tested, no differences were seen between the groups at any of the time points. However in contrast to their findings that all participants were "able to walk at discharge with Functional Ambulation Category $\geq$ 1", we had six participants at 6 month follow up that were "non functional ambulatory" (Functional Ambulation Category =1). In terms of walking ability, our treadmill training participant data are comparable although slightly lower at post intervention for gait speed over 10m (0.45m/s vs

0.5m/s) and walking endurance over 6 minutes (119m vs 160m). For activities of daily living measures our participants had a slightly higher median Barthel Index score at baseline but outcomes at six months were comparable.

The spontaneous element to recovery in the first few months following stroke is well documented, however it would have been unethical to have a third true control group where gait re-education was withheld. While some authors have demonstrated significant improvements with intensive treadmill intervention [22] [23], these findings are contradicted by small scale studies that had highly intensive gait re-education inputs and found no significant differences in gait outcomes [24]. It has been suggested that four weeks of treadmill training in ambulant sub-acute stroke patients may be sufficient to improve walking endurance and velocity [2].

Finally, one of the main strengths of this feasibility study is that it was possible to undertake a multi-site evaluation of treadmill training in sub-acute stroke, with the intervention delivered as part of normal clinical practice. Participants were representative of the general sub-acute stroke population in terms of age and gender [25]. The randomisation system was robust and outcomes were collected by a blinded outcome assessor adding to the strength of the work. We now have a realistic estimation of recruitment rates in future trials and can identify an appropriately powered sample size.

Limitations of the study include the low recruitment rate and subsequent small sample size which was appropriate for this type of feasibility design but does not allow generalisations. The recruitment rate may have been influenced by the type of unit (three were rehabilitation only, while the fourth was a mixed acute and rehabilitation setting). An interesting finding was that nearly one third of the ineligible participants were excluded due to imminent discharge and needs to be considered in the design of future trials. It could be speculated that more people with sub-acute strokes would be found on acute units.

This study has shown that it is feasible to enrol sub-acute stroke patients into a randomised controlled trial of gait re-education incorporating the a treadmill as a component of rehabilitation. There were no statistically significant differences between treatment groups with respect to mobility, activities of daily living or participation outcomes, but this trial was not powered to detect these. The outcome measures used were mostly sensitive to improvements over time but due to the feasibility study sample size, it is unclear whether they would be able to identify between group differences. However, the intensity of treadmill training which was delivered within the National Health Service was low, and unlikely to be sufficient to improve outcomes. Future trials may need additional staff to deliver a more intensive treadmill training intervention.

Key Clinical Messages

- It is feasible to enrol people with sub-acute stroke into a randomised controlled trial to evaluate treadmill training , however

- Adequate resources are required to ensure sufficient intensity of treadmill training can be delivered safely to impact on outcomes

Contributions of authors

Baer, Salisbury, Smith and Dennis contributed substantially to: obtaining funding; the study concept and design; the analysis and interpretation of data; drafting of the manuscript; and critical revision for important intellectual content.

Pitman contributed substantially to: the study design; the acquisition, analysis and interpretation of data and critical revision for important intellectual content.

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Conflicts of Interest/Disclosures

There are no conflicts of interest

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Table 1. Participant Characteristics at baseline

Participant characteristics	**CONTROL**	**TREADMILL TRAINING**
Number	38	39
Gender Male : Female	18 : 20	22 : 17
Mean age in years (SD)	74.5 (11.7)	71.23 (12.52)
Mean days post stroke (SD)	40.26 (21.43)	42.13 (19.48)
Side of paresis Right : Left : bilateral	22: 15: 1	21: 15: 3
Initial FAC 1-3 : 4-6	22 : 16	23: 16
Baseline measures	**CONTROL** Median (IQR) Completion rates	**TREADMILL TRAINING** Median (IQR) Completion rates
Rivermead Mobility Index (score 0 -15)	4 (2 – 5.25)	4 (3 – 5)
Functional Ambulation Category (score 1 – 6)	3 (1 – 4)	3 (1 – 4)
Timed Up and Go (seconds)	33 (18.25 – 48.75)	34.1 (22.5-39)
Visual Analogue Scale – confidence in walking (0-100)	66 (50 – 87.3)	65 (47.5 – 84)
10 metre walk test (seconds)	24 (15.86 – 44.25)	24.21 (15.75-33.27)
Gait speed (m/s)	0.42 (0.26-0.63)	0-41 (0.3-0.63)
6 minute walk test (metres)	120 (56.75-177.5)	120 (60 – 160)
Barthel Index (0-100)	40 (33.8 - 65)	40 (30 – 55)
Motor Assessment Scale (0-48)	19 (14 – 30.3)	23.5 (12.3 - 33)

SD – Standard Deviation; IQR - Inter Quartile Range; m/s – metres per second

FAC – Functional Ambulation Category (1-3 - non-ambulant or requiring physical assistance; 4-6 – ambulant independent or with non physical supervision)

Table 2 Reasons for Ineligiblity for the trial

Reason for exclusion from trial	**Number of participants (%)**
Imminent discharge predicted	137 (30.5%)
Unable to stand for one minute	90 (20.0%)
Medically unstable	36 (8.0%)
Refused to participate	32 (7.1%)
Unable to co-operate due to inability to follow simple commands	32 (7.1%)
Not doing mobility work	27 (6.0%)
Not receiving physiotherapy	23 (5.1%)
More than three months post stroke	21 (4.7 %)
Co-morbidity precluding stroke training	20 (4.5 %)
Participation in other research trial that would contaminate intervention or outcomes	10 (2.2%)
Co-existing non-stroke related neurological impairment	6 (1.3%)
Non-ambulant prior to stroke	5 (1.1%)
Trial full	4 (0.9%)
Already had exposure to the treadmill during rehabilitation	2 (0.4%)
Body weight greater than 138 kg	2 (0.4%)
Reason unknown	2 (0.4%)

Table 3. Primary and secondary outcomes in Control and Treadmill Training groups

		Control Group		Treadmill Training Group		Median of differences	
		N	Median (IQR)	N	Median (IQR)	(95% CI)	p value
Rivermead Mobility Index (0 - 15)	8 weeks post intervention	34	6.0 (4.0, 11.0)	35	5.0 (4.0, 9.0)	-1 (-3 to 1)	0.33
	6 months follow-up	32	8.0 (6.0, 12.5)	34	8.5 (3.0, 12.0)	-1 (-3 to 1)	0.42
Functional Ambulation Category (1 - 6)	8 weeks post intervention	34	4.5 (4.0, 5.0)	35	4.0 (3.0, 5.0)	0.0 (-1.0 to 0.0)	0.17
	6 months follow-up	32	5.0 (4.0, 6.0)	34	5.0 (3.0, 6.0)	0.0 (-1.0 to 0.0)	0.46
Timed Up and Go (seconds)	8 weeks post intervention	26	20 (14, 43)	21	30 (16, 34)	4 (-6 to 14)	0.45
	6 months follow-up	21	22 (16, 43)	21	28 (19, 34)	2 (-10 to 12)	0.69
Confidence in walking VAS (0 - 100)	8 weeks post intervention	31	79 (65, 90)	32	71 (52, 91)	-4 (-17 to 5)	0.32
	6 months follow-up	27	74 (62, 99)	28	79 (64, 92)	-1 (-12 to 10)	0.81
Ten metre walk test (seconds)	8 weeks post intervention	26	15 (12, 36)	23	20 (12, 26)	-1 (-7 to 6)	0.79
	6 months follow-up	23	22 (14, 44)	23	22 (13, 39)	0 (-10 to 10)	0.96
Gait speed over 10 metres (m/s)	8 weeks post intervention	26	0.66 (0.28, 0.83)	23	0.50 (0.38, 0.83)	0.02 (-0.21 to 0.22)	0.80
	6 months follow-up	23	0.46 (0.23, 0.70)	23	0.45 (0.26, 0.76)	-0.01 (-0.19 to 0.17)	0.95
Six minute walk test (metres)	8 weeks post intervention	26	143 (83, 186)	20	120 (66, 209)	-8 (-66 to 50)	0.74
	6 months follow-up	19	134 (60, 290)	21	120 (83, 225)	-6 (-65 to 64)	0.90
Barthel Index (0 - 100)	8 weeks post intervention	34	83 (55, 95)	35	60 (45, 90)	-5 (-20 to 5)	0.16
	6 months follow-up	32	85 (70, 98)	33	80 (60, 95)	-5 (-15 to 5)	0.32
Motor Assessment Scale (0 - 48)	8 weeks post intervention	32	30 (16, 41)	31	26 (16, 38)	-2 (-5 to 8)	0.63
	6 months follow-up	26	29 (23, 42)	30	29 (20, 42)	-2 (-9 to 5)	0.50
Overall Stroke Impact Scale recovery (0 - 100)	8 weeks post intervention	33	56 (43, 72)	32	55 (50, 73)	1 (−9 to 10)	0.91
	6 months follow-up	31	54 (50, 80)	28	61 (48, 79)	2 (−9 to 13)	0.67

† Estimate of difference in population medians (Intervention − Control)
* p-value from Mann-Whitney-Wilcoxon test comparing two groups
m/s - metres per second; N – number; IQR – Inter Quartile Range; CI – Confidence Interval

Table 4. Stroke Impact Scale scores in Control and Treadmill Training groups

		Control Group		Treadmill Training Group		Difference in medians †	
SIS domain or scale		**N**	**Median (IQR)**	**N**	**Median (IQR)**	**(95% CI)**	**p-value ***
Strength (0 - 100)	8 weeks post intervention	34	56 (38, 75)	32	56 (44, 78)	0 (−13 to 13)	0.91
	6 months follow-up	32	63 (41, 72)	31	56 (38, 75)	0 (−13 to 13)	0.96
Memory (0 - 100)	8 weeks post intervention	33	71 (61, 93)	32	80 (66, 93)	4 (−7 to 14)	0.49
	6 months follow-up	31	79 (57, 93)	30	86 (71, 96)	4 (−4 to 14)	0.40
Emotion (0 - 100)	8 weeks post intervention	33	72 (58, 81)	32	68 (53, 76)	−3 (−11 to 6)	0.39
	6 months follow-up	31	72 (58, 83)	28	72 (61, 82)	3 (−8 to 11)	0.83
Communication (0 - 100)	8 weeks post intervention	33	93 (75, 100)	32	96 (73, 100)	0 (−4 to 7)	0.54
	6 months follow-up	31	89 (75, 100)	28	89 (82, 100)	0 (−4 to 11)	0.65
Activities of daily living (0 - 100)	8 weeks post intervention	33	58 (40, 65)	32	55 (45, 66)	0 (−10 to 10)	1.00
	6 months follow-up	31	50 (43, 65)	29	58 (35, 70)	5 (−8 to 15)	0.47
Mobility (0 - 100)	8 weeks post intervention	33	67 (44, 78)	32	49 (35, 83)	−6 (−19 to 8)	0.33
	6 months follow-up	31	58 (50, 75)	29	67 (42, 81)	6 (−8 to 17)	0.47
Hand function (0 - 100)	8 weeks post intervention	33	35 (0, 70)	32	25 (0, 70)	0 (−15 to 15)	0.97
	6 months follow-up	31	30 (0, 75)	29	30 (10, 70)	0 (−10 to 20)	0.65
Social participation (0 - 100)	8 weeks post intervention	33	50 (34, 63)	32	45 (31, 66)	0 (−13 to 13)	0.97
	6 months follow-up	31	53 (34, 69)	28	59 (44, 80)	6 (−3 to 19)	0.16
Overall recovery scale (0 - 100)	8 weeks post intervention	33	56 (43, 72)	32	55 (50, 73)	1 (−9 to 10)	0.91
	6 months follow-up	31	54 (50, 80)	28	61 (48, 79)	2 (−9 to 13)	0.67

† Estimate of difference in population medians (Intervention − Control)
* p-value from Mann-Whitney-Wilcoxon test comparing two groups
N – number; IQR – Inter Quartile Range; CI – Confidence Interval

Table 5: Percentage of participants completing each measure at 3 timepoints

	Control (n=38) Number of outcomes completed	**Treadmill (n=39)** Number of outcomes completed
Rivermead Mobility Index (score 0 -15)		
Baseline		
Post intervention	38/38 (100%)	39/39 (100%)
Follow up	34/38 (89.5%)	35/39 (89.7%)
	32/38 (84.2%)	34/39 (87.2%)
Functional Ambulation Category (score 1 – 6)		
Baseline	38/38 (100%)	39/39 (100%)
Post intervention	34/38 (89.5%)	35/39 (89.7%)
Follow up	32/38 (84.2%)	34/39 (87.2%)
Timed Up and Go (sec)		
Baseline	16/38 (42%)	13/39 (33.3%)
Post intervention	26/38 (68.4%)	21/39 (53.8%)
Follow up	21/38 (55.3%)	21/39 (53.8%)
Visual Analogue Scale – confidence in walking (0-100)		
Baseline	32/38 (84.2%)	37/39 (94.9%)
Post intervention	31/38 (81.6%)	32/39 (82.1%)
Follow up	27/38 (71.1%)	28/39 (71.8%)
10 metre walk test (seconds)		
Baseline	18/38 (47.4%)	16/39 (41%)
Post intervention	26/38 (68.4%)	23/39 (60%)
Follow up	23/38 (60.5%)	23/39 (60%)
Gait speed (m/s)		
Baseline	18/38 (47.4%)	16/39 (41%)
Post intervention	26/38 (68.4%)	23/39 (60%)
Follow up	23/38 (60.5%)	23/39 (60%)
6 minute walk test (metres)		
Baseline	13/38 (34.2%)	11/39 (28.2%)
Post intervention	26/38 (68.4%)	20/39 (51.3%)
Follow up	19/38 (50%)	21/39 (53.8%)
Barthel Index (0-100)		
Baseline	38/38 (100%)	39/39 (100%)
Post intervention	34/38 (89.5%)	35/39 (89.7%)
Follow up	32/38 (84.2%)	34/39 (87.2%)
Motor Assessment Scale (0-48)		
Baseline	36/38 (95%)	36/39 (92%)
Post intervention	32/38 (84.2%)	31/39 (79.5%)
Follow up	26/38 (68.4%)	30/39 (76.9%)

At 8 weeks a number of participants did not complete the outcomes these were 4 CON (x2 death; x2 refused) and 4 TT (x1 unwell; x1 death; x1 withdrew; x1 unable to contact). At 6 months a number of participants did not complete the outcomes these were 6 CON (x4 death; x1 refused; x1 unwell) and 5 TT (x3 death; x2 withdrew).
m/s – metres per second; n - number

Figure 1. **Consort diagram of participant recruitment**