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Research

People with stroke spend more time in active task practice, but similar time in walking practice, when physiotherapy rehabilitation is provided in circuit classes compared to individual therapy sessions: an observational study

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KEY WORDS

Stroke
Rehabilitation
Motor activity
Physical therapy (specialty)

ABSTRACT

Question: Do people with stroke spend more time in active task practice during circuit class therapy sessions versus individual physiotherapy sessions? Do people with stroke practise different tasks during circuit class therapy sessions versus individual physiotherapy sessions? **Design:** Prospective, observational study. **Participants:** Twenty-nine people with stroke in inpatient rehabilitation settings. **Interventions:** Individual therapy sessions and circuit class therapy sessions provided within a larger randomised controlled trial. **Outcome measures:** Seventy-nine therapy sessions were video-recorded and the footage was analysed for time spent engaged in various categories of activity. In a subsample of 28 videos, the number of steps taken by people with stroke per therapy session was counted. **Results:** Circuit class therapy sessions were of a longer duration (mean difference 38.0 minutes, 95% CI 29.9 to 46.1), and participants spent more time engaged in active task practice (mean difference 23.8 minutes, 95% CI 16.1 to 31.4) compared with individual sessions. A greater percentage of time in circuit class therapy sessions was spent practising tasks in sitting (mean difference 5.3%, 95% CI 2.4 to 8.2) and in sit-to-stand practice (mean difference 2.7%, 95% CI 1.4 to 4.1), and a lower percentage of time in walking practice (mean difference 19.1%, 95% CI 10.0 to 28.1) compared with individual sessions. Participants took an average of 371 steps (SD 418) during therapy sessions and this did not differ significantly between group and individual sessions. **Conclusion:** People with stroke spent more time in active task practice, but a similar amount of time in walking practice when physiotherapy was offered in circuit class therapy sessions versus individual therapy sessions. There is a need for effective strategies to increase the amount of walking practice during physiotherapy sessions for people after stroke. **[English C, Hillier S, Kaur G, Hundertmark L (2014) People with stroke spend more time in active task practice, but similar time in walking practice, when physiotherapy rehabilitation is provided in circuit classes compared to individual therapy sessions: an observational study. *Journal of Physiotherapy* 60: 50–54]**

Introduction

The Australian National Clinical Guidelines for Stroke[1] recommend that at least 1 hour of active task practice be offered daily to people with stroke receiving inpatient rehabilitation therapy. This recommendation is based on clinical trials that have demonstrated benefits from a greater amount of therapy time.[2] However, few studies have examined in detail what people with stroke do during physiotherapy sessions. A recent systematic review identified seven studies that reported on the content of physiotherapy sessions provided to people with stroke in rehabilitation settings.[3] On average, participants in those studies spent 60% of physiotherapy sessions in active task practice, and spent 9 minutes in walking practice, 8 minutes in standing activities, and 4.5 minutes in sitting activities. In all but one of those studies, physiotherapy was provided in individual therapy sessions. There is good evidence that physiotherapy provided in circuit class therapy sessions is effective at improving walking ability of people with stroke,[4] and is highly effective at increasing the amount of time people with stroke spend in physiotherapy sessions.[5] However, few studies have examined the content of circuit class therapy sessions in detail. One single-centre study[6] found that people with stroke spent a lesser percentage of physiotherapy time engaged in walking practice, but more time practising tasks in standing during circuit class therapy versus individual therapy sessions.

A recent multi-centre trial – titled Circuit Class Therapy for Increasing Rehabilitation Intensity of Therapy after Stroke: a Pragmatic Randomised Controlled Trial, with the acronym

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CIRCIT – investigated two alternative models of increasing the intensity of inpatient stroke physiotherapy.[7] Participants in this trial received one of three interventions: up to 90 minutes of usual care therapy on 5 days per week; up to 90 minutes of usual care therapy on 7 days per week; or up to 180 minutes of group circuit class therapy on 5 days per week. Usual care therapy included group or individual therapy sessions, as was consistent with usual practice at the recruitment sites. Therefore, participants from any of the groups could have contributed data to this study. As this was a pragmatic trial, the content of therapy sessions provided to participants receiving usual care (provided over 5 or 7 days a week) was not mandated. Broad guidelines were provided for the organisation and content of circuit class therapy sessions via an intervention manual. For example, the manual states that activities should be goal directed, tailored to the individual participant, and progressed; and that the time spent in active task practice should be maximised during therapy sessions. In order to assess adherence to the trial protocol and intervention fidelity, selected therapy sessions, both individual and circuit class therapy sessions were videoed in their entirety.

Data collected during these sessions were used to describe the content of physiotherapy provided in detail. The specific questions to be answered with these data were:

(1) What is the content of individual therapy sessions and group circuit class sessions provided to people receiving physiotherapy rehabilitation after stroke, in terms of total active and rest time, time spent practising specific tasks, and number of steps taken?
(2) Does the degree of disability influence the total active time in these sessions?

Method

Design

This observational study was embedded within a randomised trial. Full details of the CIRCIT trial protocol have been published.[7] Recruitment for the CIRCIT trial commenced in July 2010 and finished in June 2013. Data collection for the current observational study occurred during four time periods throughout the trial (September/October 2010, December 2010 to February 2011, August/September 2012, and December 2012 to January 2013). The time periods and specific days on which therapy sessions were videotaped were based on research assistant staff availability.

Participants

The CIRCIT trial participants were people with a stroke of moderate severity who were admitted to an inpatient rehabilitation facility, and who were able to walk independently (with or without a walking aid) prior to their stroke.[7] Moderate stroke severity was defined as either a total Functional Independence Measure (FIM) score of between 40 and 80 points, or a motor sub-score of the FIM of 38 to 62 points at the time of recruitment to the trial.

Outcome measures

Physiotherapy sessions were videoed in their entirety. Standard definitions were used to identify the beginning and end of therapy sessions, as presented in Box 1. The videos were viewed and data regarding content of therapy extracted. Definitions of physical activity and inactivity were also standardised, as presented in Box 1, and categorised, as presented in Box 2. This method of video

Box 1. Operational definitions for analysing the content of physiotherapy sessions.

Item	Definition
Therapy sessions	The time that participants spend in interaction with the therapist with the aim of improving functional skills. It also includes any physical activity done under the supervision and direction of the therapist.[13]
Beginning of a session	When participants get into the therapy area and start performing an active task with the aim of improving functional skills OR when a therapist enters into the therapy session and starts interacting with the participants. This does not include the therapist greeting the participant briefly or the therapist directing the participant to their station during circuit class therapy.
End of a session	When the end of the session is announced by the therapist OR when the patient leaves the therapy area. If the therapist walked with the participant back to their room or lunch, the session was said to finish when the participant reached their room or dining room, respectively.
Physical activity	Engaging in task practice such as walking, standing, sit-to-stand, and using the paretic arm.[13]
Inactivity	Engaging in unrelated activities, such as solely using the nonparetic arm and periods of rest in sitting or lying[13] for greater than 15 s. Passive movements or stretching in lying or sitting were also considered to be inactive.

Box 2. Category definitions for analysing the content of active therapy time.

Category	Definition
Activities in lying	Rolling, bridging, hip/knee control exercises, lie-sit and sit-lie
Active sitting	Weight shift and equilibrium exercises, reaching, turning, leg exercises in sitting
Transfers and sit to stand practice	Transfers bed to chair, chair to bed Repeated sit to stand exercises
Standing	Facilitation of symmetrical posture, weight shift any direction, turning and reaching, stepping in any direction (without progression) including on and off step, step ups
Walking practice	Any surface, with or without supervision Includes outdoors, obstacles, steps and ramps (not treadmill)
Treadmill	Time spent walking on treadmill
Upper limb activities	Includes facilitation of movement, treatment of stiffness or pain as well as active task practice

analysis has been shown to have acceptable intrarater reliability.[6] Total active time was determined as the sum of time spent in each category of physical activity. Total inactive time was determined as total therapy time minus total active time. The number of steps participants took during the physiotherapy sessions was also analysed in a subsample of the videos.

Each participant's level of disability at admission to rehabilitation was rated using the FIM, which was scored in the ward team meeting, according to the published guidelines.[8]

Data analysis

Total therapy session duration, total active time, and the time spent in various categories of activity and inactivity were compared between the two therapy formats: individual therapy sessions versus circuit class therapy. Clustered linear regression was used for these analyses because some individual participants were videoed on more than one occasion. The significance level was set at $\alpha = 0.05$, with sequential Bonferroni adjustment applied to account for multiple comparisons. Differences in the percentage of therapy sessions devoted to activities in various categories were analysed in the same way. The numbers of steps taken in therapy sessions were descriptively analysed. Simple linear regression was used to investigate the influence of degree of disability (ie, admission FIM score) on the amount of time spent active in therapy.

Results

Flow of participants through the study

Seventy-nine therapy sessions (34 individual therapy sessions and 45 circuit class therapy sessions) of 29 participants were video-recorded in three different inpatient rehabilitation centres in South Australia. A subsample of 28 videos (13 individual therapy sessions and 15 circuit class therapy sessions) was further analysed with regard to the number of steps taken by participants during circuit class therapy sessions and individual therapy sessions. The participants were aged between 50 and 84 years. A summary of their baseline characteristics is presented in Table 1. The average duration of physiotherapy sessions was 56.4 minutes (SD 24.0, range 18 to 90).

Therapy duration and content

Circuit class therapy sessions were of a longer duration than individual therapy sessions, with a mean difference of 38.0 minutes (95% CI 29.9 to 46.1). Participants also spent more time engaged in active task practice in circuit class therapy sessions than individual therapy sessions, with a mean difference of 23.8 minutes (95% CI 16.1 to 31.4). Participants in circuit class therapy sessions spent significantly more time resting, practising tasks in sitting, practising transfers, and practising upper limb activities, as presented in Table 2. Due to the difference in therapy session duration between circuit class therapy sessions and individual therapy sessions, it is useful to examine differences in the percentage of therapy time devoted to different activities. A significantly greater percentage of time in circuit class therapy sessions was spent practising tasks in sitting (mean difference 5.3%, 95% CI 2.4 to 8.2) and practising transfers (mean difference 2.7%, 95% CI 1.4 to 4.1), as presented in Table 3. A significantly smaller percentage of circuit class therapy sessions were spent practising walking, compared to individual therapy sessions (mean difference −19.1%, 95% CI −28.1 to −10.0).

Participants took a mean of 371 steps (SD 418) during therapy sessions. This did not differ significantly between therapy formats, with 338 steps (SD 430) in individual therapy sessions and 398 steps (SD 420) in circuit class therapy sessions.

There was a low, but statistically significant correlation between admission FIM scores and the amount of active task practice in therapy ($r = 0.22$, $p = 0.02$). Therefore, admission FIM explained only 5% of the variance in activity time, as presented in Figure 1.

Table 1
Characteristics of the participants.

Characteristic	Participants (n = 29)
Age (*yr*), mean (SD)	64.6 (10.3)
Gender, n male (%)	16 (55)
Stroke lesion, n (%)	
Right	18 (62)
Left	10 (34)
Bilateral	1 (3)
Admission FIM, mean (SD)	
Total	60.8 (14.3)
Motor	37.0 (11.7)

FIM = Functional Independence Measure.

Discussion

This is the largest study to date to investigate the content of physiotherapy sessions for stroke using a direct measure of therapy content (ie, video analysis) and the only such study to involve multiple data collection sites. While the longer duration of circuit class therapy sessions meant that participants in these sessions spent a longer time physically active per therapy session, the intensity of therapy – that is, the time spent in active task practice, in particular walking practice, during therapy sessions – was low in both models of care.

A recent systematic review examined the content of physiotherapy sessions aimed at improving motor function during stroke rehabilitation with respect to time spent in physical activity.[3] This review identified three previous studies, all of which used video recordings of therapy sessions for people with stroke in inpatient rehabilitation settings similar to the current study. Only one of the studies included circuit class therapy sessions. The amount of walking practice per therapy session in the current study (11.8 and 10.5 minutes in individual and circuit class therapy sessions, respectively) was very similar to that reported in the previous studies (10 minutes). In the only other study to report average number of steps during physiotherapy sessions, participants took more than double the number of steps in therapy (886 versus 371 in the current study).[9] Given that therapy sessions are the most active part of the day in rehabilitation, this low level of walking practice is concerning.

If the primary aim of physiotherapy early after stroke is to restore safe and independent walking ability, the content of therapy sessions should reflect this. Naturally, therapy sessions consist of not only 'whole task' practice of walking, but also part practice (which may include activities in standing to promote stability and control of stepping), and activities/tasks directed at impairments (such as isolated movements aimed at improving active control). The balance between the time devoted to part and whole practice within a single therapy session must also take into consideration the amount of assistance a participant needs to complete a task. In an individual therapy session, a therapist is available to the participant for the duration of the therapy session. This allows for greater opportunity to practise tasks that require supervision or assistance to complete safely. In circuit class therapy – where there are more patients than therapists – there may be less opportunity for direct supervision and assistance for challenging tasks. This may go some way towards explaining the differences in content of therapy between these two formats of therapy delivery.

Table 2
Mean (SD) therapy duration, total active time and time spent in categories of activity for individual therapy sessions and circuit class therapy sessions (in minutes) and mean (95% CI) differences between therapy formats.

	Individual sessions Mean (SD)	Circuit classes Mean (SD)	Mean difference Circuit minus individual (95% CI)
Total therapy duration	34.7 (11.8)	72.7 (18.8)	38.0 (29.9 to 46.1)[a]
Total active time	23.3 (8.3)	47.1 (15.9)	23.8 (16.1 to 31.4)[a]
Total rest time	11.6 (7.1)	24.2 (12.7)	13.6 (8.0 to 19.2)[a]
Activities in lying	0.9 (2.4)	5.0 (9.0)	4.1 (0.3 to 7.9)
Active sitting	0.5 (1.2)	5.2 (6.2)	4.7 (2.6 to 6.9)[a]
Transfers and sit-to-stand practice	0.3 (0.7)	2.8 (3.2)	2.5 (1.6 to 3.3)[a]
Standing	6.1 (5.9)	11.0 (11.1)	4.9 (−1.1 to 10.9)
Walking practice	11.8 (7.1)	10.5 (8.0)	−1.3 (−6.0 to 3.5)
Treadmill	0.9 (5.0)	0.8 (4.0)	−0.8 (−2.2 to 2.1)
Upper limb activities	1.0 (2.2)	6.7 (8.0)	5.7 (3.5 to 7.9)[a]
Other therapeutic activities	2.2 (4.4)	5.0 (8.8)	2.6 (−2.7 to 8.0)

[a] Statistically significant difference after application of sequential Bonferroni adjustment.

Table 3
Mean (SD) therapy duration, total active time and time spent in categories of activity as a percentage of individual therapy sessions and circuit class therapy sessions, and mean (95% CI) differences between therapy formats.

	Individual sessions Mean (SD)	Circuit classes Mean (SD)	Mean difference Circuit minus individual (95% CI)
Active time	67.8 (15.8)	65.4 (16.4)	−2.4 (−12.1 to 7.4)
Rest time	32.7 (15.7)	34.1 (16.1)	1.4 (−8.3 to 11.0)
Activities in lying	2.8 (7.3)	6.3 (10.8)	4.1 (1.8 to 8.9)
Active sitting	1.5 (4.0)	6.8 (7.8)	5.3 (2.4 to 8.2)[a]
Transfers and sit-to-stand practice	1.2 (2.1)	4.0 (4.6)	2.7 (1.4 to 4.1)[a]
Standing	17.7 (17.3)	17.4 (20.3)	0.3 (−13.2 to 12.6)
Walking practice	33.5 (16.7)	1.4.5 (10.5)	−19.1 (−28.1 to −10.0)[a]
Treadmill	1.3 (7.8)	1.4 (7.8)	0.1 (−3.6 to 3.7)
Upper limb activities	3.4 (8.6)	8.5 (9.8)	5.1 (1.2 to 9.0)
Other therapeutic activities	7.2 (13.1)	6.6 (11.7)	0.6 (−12.3 to 11.2)

[a] Statistically significant difference after application of sequential Bonferroni adjustment.

More concerning is the large amount of time in circuit class therapy sessions spent performing activities in either lying or sitting. Obviously it is more challenging to provide appropriate assistance to participants to perform activities in standing and walking in circuit classes. The challenge for therapists is to design task practice that is both safe for an individual to perform without direct supervision and also effective. However, principles of task-specificity of practice suggest that activities in weight-bearing positions are likely to be more effective at promoting safe and independent mobility and therefore should be prioritised over activities in lying. Some activities in sitting – such as graded reaching tasks – have been shown to be effective at improving both

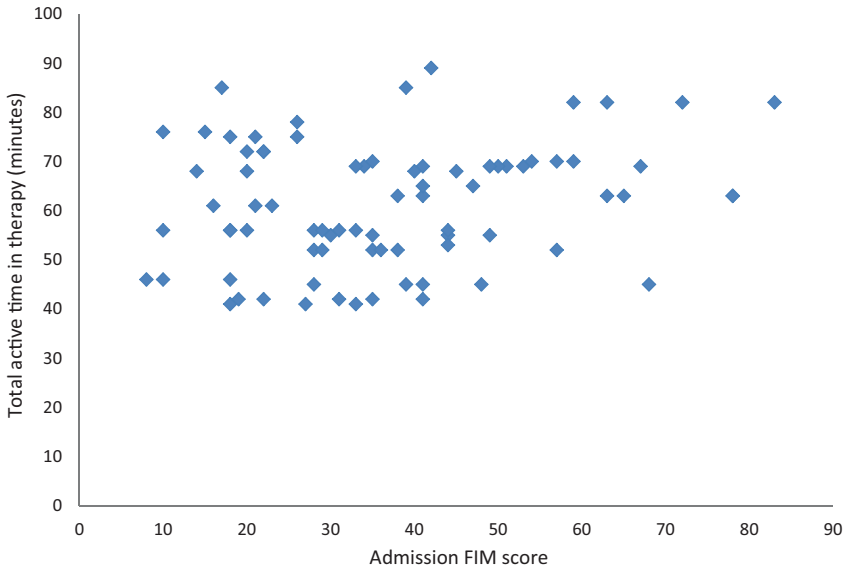

Figure 1. Correlation between Functional Independence Measure (FIM) score on admission and active therapy time.

sitting balance and motor activation in the affected lower limb.[10,11] In this study we were not able to determine the appropriateness of the specific activities in sitting for each participant. Notwithstanding the fact that some time spent practising tasks in sitting may be appropriate, the challenge for therapists is to find ways to convert at least some of the time that people with stroke spend engaged in activities in lying and sitting to more walking practice. Similarly, while some rest time is needed during physiotherapy sessions, therapists should aim to maximise the time that people with stroke are active within each therapy session – bearing in mind that therapists are known to underestimate the amount of time that their patients rest in therapy sessions.[12]

This study has several strengths; it involved multiple rehabilitation centres, examined both individual and circuit class therapy sessions, and involved clinicians with a range of experience. A limitation of the study is that a simple measure of time spent in particular activities does not allow for an assessment of the appropriateness of the activities for the participants, and whether tasks were optimally tailored to drive recovery. This study was embedded within an ongoing randomised trial. Some, but not all, of the circuit class therapy sessions within this trial were mandated in terms of duration. However, the specific content of therapy sessions (ie, what exercises and activities were performed within therapy sessions) was not mandated.

While we know that increasing therapy time is beneficial for our patients and that we should be aiming for our patients to be as physically active as possible, we have very little evidence from research to guide the specific tasks and activities that we ask our patients to do in therapy sessions – or how to best structure our sessions to achieve the optimal balance between part and whole practice. Further research is also needed to clarify the nature of active practice, the quality of the practice, and its relationship to therapy components that do not involve physical activity, such as mental imagery, relaxation, and education. The challenge for therapists is to reflect upon and objectively measure their own practice and to look for ways to increase active practice time in rehabilitation centres. Overall, the results of this study suggest that providing therapy in group circuit class sessions allows for people with stroke to spend more time engaged in active task practice.

What is already known on this topic: More time spent undertaking physiotherapy rehabilitation provides greater benefits for people after stroke. Circuit class therapy allows greater time in physiotherapy sessions and improves some outcomes such as walking ability.
What this study adds: In inpatient rehabilitation, people with stroke receive longer physiotherapy sessions and spend more time engaged in active task practice with circuit classes than with individual therapy sessions. However, the percentage of time spent in walking practice was lower in circuit classes than in individual sessions.

Ethics: The University of South Australia Human Research Ethics Committee, the Royal Adelaide Hospital Research Ethics Committee, the Flinders Medical Centre Clinical Research Ethics Committee and the Queen Elizabeth Hospital Ethics of Human Research Committee approved this study. Participants gave separate written informed consent for both the trial participation and video recording before data collection began.

Competing interests: Nil.

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References

1. National Stroke Foundation. *Clinical Guidelines for Stroke Management, Melbourne*; 2010. http://strokefoundation.com.au/site/media/Clinical_Guidelines_Acute_Management_Recommendations_2010.pdf [Accessed September 2, 2013].
2. Kwakkel G, van Peppen R, Wagenaar R, Wood Dauphinee S, Richards C, Ashburn A, et al. Effects of augmented exercise therapy time after stroke: a meta-analysis. *Stroke*. 2004;35:2529–2539.
3. Kaur G, English C, Hillier S. How physically active are people with stroke in physiotherapy sessions aimed at improving motor function? A systematic review. *Stroke Res Treat*. 2012;2012:820673.
4. English C, Hillier SL. Circuit class therapy for improving mobility after stroke. *Cochrane Database Syst Rev*. 2010;7:CD007513.
5. English CK, Hillier SL, Stiller KR, Warden-Flood A. Circuit class therapy versus individual physiotherapy sessions during inpatient stroke rehabilitation: a controlled trial. *Arch Phys Med Rehabil*. 2007;88:955–963.
6. Elson T, English C, Hillier S. A comparison of patient activity levels during circuit class therapy and individual physiotherapy sessions. *Int J Ther Rehabil*. 2009;16:78–84.
7. Hillier S, English C, Crotty M, Segal L, Bernhardt J, Esterman A. Circuit class or seven-day therapy for increasing intensity of rehabilitation after stroke: protocol of the CIRCIT trial. *Int J Stroke*. 2011;6:560–565.
8. Uniform Data System for Medical Rehabilitation. *Adult FIM workshop – participant manual, version 5.1. (Australia). Buffalo, NYi4214: State University of New York at Buffalo.*; 2008.
9. Moore JL, Roth EJ, Killian C, Hornby TG. Locomotor training improves daily stepping activity and gait efficiency in individuals poststroke who have reached a "plateau" in recovery. *Stroke*. 2010;41:129–135.
10. Dean C, Shepherd R, Adams R. Sitting balance II: reach direction and thigh support affect the contribution of the lower limbs when reaching beyond arm's length in sitting. *Gait Posture*. 1999;10:147–153.
11. Dean CM, Shepherd RB. Task-related training improves performance of seated reaching tasks after stroke. A randomized controlled trial. *Stroke*. 1997;28:722–728.
12. Kaur G, English C, Hillier S. Physiotherapists systematically overestimate the amount of time stroke survivors spend engaged in active therapy rehabilitation: an observational study. *J Physiother*. 2013;59:45–51.
13. Ada L, Mackey F, Heard R, Adams R. Stroke rehabilitation: does the therapy area provide a physical challenge? *Aust J Physiother*. 1999;45:33–38.