

Original Research Article

## Effect of Provision of Cane on Walking Adaptability in Community Dwelling Post Stroke Patients

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### ABSTRACT

**Background of the study:** Walking aids are sometimes prescribed after stroke with the aim of improving safety and walking ability. The prescription of single point cane could be more helpful to post stroke people who already have some ability to ambulate around their community.

**Objective:** To find the effect of single point cane on walking adaptability and willingness to use the same in community dwelling post stroke patients.

**Design:** Repeated measure design

**Setting:** Department of Neurology and Stroke rehabilitation centre, PSG Hospitals, Coimbatore.

**Participants:** 52 post stroke patients.

**Experimental conditions:** Walking with and without cane

**Main outcome measures:**

Time taken to complete 6 meter walk test and TUG test with and without cane and the willingness of patients to use cane is considered.

**Results:**

Wilcoxon signed rank test 'z' value for all participants in TUG test with and without cane is 2.36 (p<0.05) therefore, there is significant difference in TUG test with and without cane.

For slow walkers calculated paired 't' test value for TUG test with and without cane is 0.239 (p>0.05) therefore, there is no significant difference in TUG test with and without canes.

For intermediate and fast walkers calculated paired 't' test value and Wilcoxon test 'z' for TUG test with and without cane is 2.24 and 2.93 respectively (p<0.05) therefore, there is a significant difference in TUG test with and without cane.

Among 52 participants 63.46% were not willing to use cane for their day to day activities and 36.54% were willing to use cane for their day to day activities.

**Conclusion:** In conclusion this study found that the provisions of cane have both positive and negative impact on functional mobility in independent community ambulatory post stroke patients.

For slow walkers the provision of cane resulted in more benefit by decrease in time taken for completion of task therefore, cane may be recommended for their functional activities

For intermediate and fast walkers the provision of cane resulted in increase in time taken for completion of task therefore, cane may not be recommended for their functional activities. Even though using cane can have impact on walking adaptability, willingness of the patients to use cane should be considered.

**Keywords:** stroke, cane, walking adaptability, rehabilitation

### INTRODUCTION

Although most stroke survivors regain the ability to walk, their speed, step

length and cadence remain significantly reduced. [1] Walking aids are prescribed after stroke with the aim of improving

safety and walking ability. Walking aids improves stability, [2] thereby boosting patients' sense of security and reducing fear of falling. Such mobility aids are often required by older adults or by people with various clinical conditions, so that they can move independently and maintain their balance.

The simple cane with ergonomic handgrip is most useful among the other walking aids in post stroke patients. [3] Generally canes are prescribed for people who have moderate level impairment. [4] Mobility aids have the potential to enhance postural stability by increasing the base of support and allows stabilizing hand reaction forces to be generated. These forces help to control the COM by augmenting the stabilizing joint movements that are generated by rapid postural reaction at the ankle, hip, trunk and neck. Cane also tends to have more effective ground push off. Empirical evidence that a cane provides biomechanical stabilization is found in several studies, although enhanced somatosensation may have also contributed. [3]

The prescription of cane could be more helpful to post stroke people who already have some ability to ambulate around their community. [5] Studies also concluded that patients also achieved their highest walking velocity using the simple cane with ergonomic hand grip. [2] This type of cane is usually preferred by patients and it requires less oxygen at a given speed. There are evidences to show that provision of cane helps in increasing the efficiency of walking. Other studies have concluded that provision of cane improves the walking speed in intermediate walkers among community dwelling people after stroke. [4]

Walking requires the ability to adapt walking to the environment. After stroke this adaptability is often impaired, and this might contribute to the increased fall risk. Our study focuses on effect of provision of cane on walking adaptability. Walking adaptability, which is the ability to modify walking to meet behavioral task, goals and

demands of the environment. One component of a tripartite model of locomotor control is the walking adaptability along with the ability to generate stepping and maintain postural equilibrium.

Walking function in those who have sustained a stroke may range from complete dependence to independent walking and by 6 months approximately 85% of stroke survivors are able to walk independently without physical assistance from others. Individuals with limited ability to appropriately adjust to changes in the task and environment may either choose to avoid walking in these contexts (a safety strategy) or experience a heightened risk of fall when required to fall under these challenging circumstances. Walking is the most frequently reported activity at the time of fall in stroke survivors suggesting the reduced ability of individuals with stroke to adjust walking to tasks and environmental needs. But there is lack of studies to show benefits of cane in improving the walking adaptability in post stroke patients. [6]

The straight line walking may be achieved by the post stroke patients easily. It is important to analyze the walking adaptability such as postural transition. TUG test [7] is a frequently used test to assess walking recovery after stroke. Moreover, the willingness of patient about using cane is an important thing to be considered among community-dwelling post stroke patients.

The objective of the study were to find the effect of single point cane on walking adaptability in community dwelling post stroke patients and to find the willingness of community dwelling post stroke patients to use cane for their day to day activities.

## **METHODOLOGY**

**Study design:** Repeated measure design.

**Study setting:** Department of Neurology and Stroke Rehabilitation Center, PSG Hospitals, Coimbatore.

**Participants:** In this study 52 community dwelling post stroke patients were selected by convenience sampling. Participants were included if 1) age with 40-60 years, 2) Post stroke duration from 6 months to 1 year, 3) able to walk independently at least 10 meters, 4.) Medically stable and able to follow commands, 5) who gave consent to participate in this study, 6) who have not used cane before for regular walking. The participants were excluded if they have visual defects, other neurological, orthopedic, and cardiovascular unstable conditions, vestibular dysfunction.

**Ethical clearance:** The study obtained ethical clearance from Institutional Human Ethics Committee, PSG institute of Medical Sciences and Research (ref no.17/289).

**Intervention:** Patients were assessed for eligibility based on the inclusion and exclusion criteria. The informed consent was obtained from the eligible patients. The patient was provided a single point cane with ergonomic hand grip. The height of the cane was individually adjusted to the height of the ulnar process of participants. The patients were then assessed for walking speed at 6 meters straight path based on their walking speed they were categorized as slow (<0.4meters/second), intermediate (0.4-0.8metres/second), fast (>0.8metres/second). Then the patients were allowed to take rest for few minutes.

We gave instructions on how to walk with the cane and five minutes of practice was allowed. When necessary, extra time was allowed until participant was feeling comfortable to walk with the cane. And then

the patients were assessed by TUG test under two conditions-with and without cane. They were instructed to walk at their comfortable speed following the command “Walk at your normal speed on the walkway”. The participants were closely supervised and a period of rest between trials was allowed as needed. The collected data was analyzed using appropriate statistical tools.

**Outcomes:** Walking adaptability was assessed using TUG test and reported as walking speed with and without cane. Willingness of the patients to use cane for community walking was also assessed.

### DATA ANALYSIS

The data were analyzed using IBM SPSS 16 software. Descriptive statistics for all outcomes. Normality was tested using Shapiro-Wilk test. Mean difference (95% CI) in walking speed between conditions (with and without cane) for slow, intermediate and fast walkers were calculated separately. Paired ‘t’ test was used to measure the difference in walking speed between walking with cane and without cane in TUG test. Wilcoxon test for non-normally distributed data

**Table 1** Baseline characteristics

Items	values
Age (Years)	54 (± 5)
Gender	Male(39):Female(13)
Post stroke duration (M)	7 (± 2)
Hemi paretic side	Right - 28 Left - 24
Baseline walking speed in 6m walk test(m/s)	
All participants (n=52)	0.69(±0.25)
Slow walkers (n=14)	0.34(±0.02)
Intermediate walkers (n=21)	0.70(±0.11)
Fast walkers (n=17)	0.95(±0.09)

Note: Values are mean (±SD)

**Table 2** Difference in TUG test on both conditions

Participants	TUG test(secs)		Mean difference(SD)	95% CI
	<i>With cane Mean (SD)</i>	<i>Without cane Mean (SD)</i>		
All participants	16.88(±5.78)	16.23(±6.16)	-0.64(±1.64)	-1.10 to -1.18
Slow walkers	25.26(±1.37)	25.36(±1.83)	0.94(±1.47)	-0.75 to 0.944
Intermediate walkers	14.99(±3.24)	13.96(±2.86)	-1.02(±2.09)	-1.98 to 0.07
Fast walkers	12.30(±1.92)	11.52(±2.22)	-0.77(±0.82)	-1.20 to 0.35

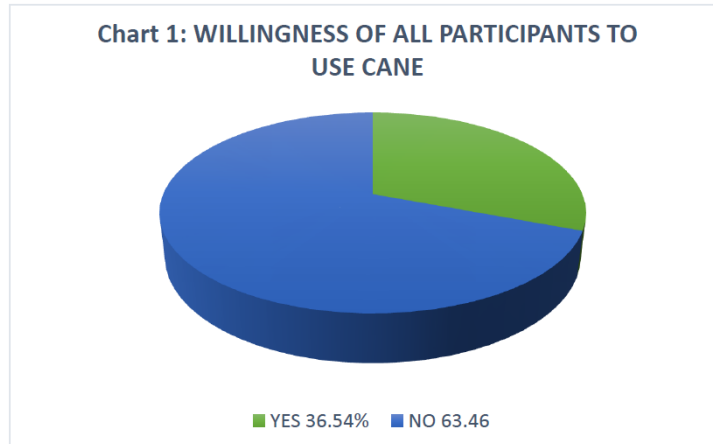
The negative sign indicates that time is increased with provision of cane

**Table 3 Paired ‘t’ test and Wilcoxon test for TUG on both condition**

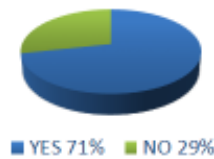
Participants	Z value	‘t’ value	P value
All participants (n=52)	2.36	-	0.01
Slow walkers (n=12)	-	0.239	0.81
Intermediate walkers (n=21)	-	2.24	0.03
Fast walkers (n=17)	2.93	-	0.03

**Table 4 Effect size and power calculation for outcome measures**

	All participants (n=52)	Intermediate walkers (n=21)	Fast walkers (n=17)
Effect size	0.39	0.48	0.93
Power	0.79	0.57	0.95



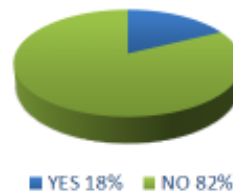
**Chart 2: WILLINGNESS OF SLOW WALKERS TO USE CANE**



**Chart 3: WILLINGNESS OF INTERMEDIATE WALKERS TO USE CANE**



**Chart 4: WILLINGNESS OF FAST WALKERS TO USE CANE**



**RESULTS**

A total of 76 post stroke patients were screened for eligibility, of these 24 were excluded because they did not meet the inclusion criteria. Therefore 52 community dwelling post stroke patients were participated in this study.

Characteristics of the participants were reported in table 1. The mean age of the participants was 54 years (SD ±5), with a mean post stroke duration of 7months

(SD±2). The mean walking speed during 6 meter walk test for overall participants was 0.69m/s(SD±0.25).Of the total participants 14 participants were categorized as slow (<0.4m/s),21 as intermediate (0.4-0.8m/s) and 17 as fast walkers (>0.8m/s). The mean walking speed during 6MWT for slow, intermediate, and fast walker was 0.34(SD±0.02), 0.70(SD±0.11), 0.95 (SD±0.09) respectively.

Table 2 provides the mean speed for both conditions with and without cane in TUG test and the mean difference, 95% CI between conditions. The mean speed of all participants with cane was 16.88(SD±5.78) without cane was 16.23(SD±6.16) and the mean difference between these condition was -0.64(SD±1.64), 95% CI(-1.10 to -1.18). The mean speed of slow walkers with cane was 25.26(SD±1.37), without cane was 25.36(SD±1.83) and the mean difference between these condition was 0.94(SD±1.47), 95% CI(-0.75 to 0.944). The mean speed of intermediate walkers with cane was 14.99(SD±3.24), without cane was 13.96(SD±2.86) and the mean difference between these condition was -1.02(SD±2.09), 95% CI(-1.98 to 0.07). The mean speed of fast walkers with cane was 12.30(SD±1.92), without cane was 11.52(SD±2.22) and the mean difference between these condition was -0.77(SD±0.82), 95% CI(-1.20 to 0.35). Therefore for slow walkers time was decreased with cane and time was increased with cane in intermediate and fast walkers.

Table 3 provides the values of paired 't' test (t value) and Wilcoxon test (z value) for TUG on both conditions. Wilcoxon signed rank test 'z' value for all participants in TUG test with and without cane is 2.36 (p<0.05) therefore, there is significant difference in TUG test with and without cane.

For slow walkers calculated paired 't' test value for TUG test with and without cane is 0.239 (p>0.05) therefore, there is no significant difference in TUG test with and without canes. For intermediate and fast walkers calculated paired 't' test value and Wilcoxon test 'z' for TUG test with and without cane is 2.24 and 2.93 respectively (p<0.05) therefore, there is a significant difference in TUG test with and without cane.

Table 4 provides the effect size and power calculation for the outcome measures. The effect size and power for all participants was moderate (0.39) and 0.79 respectively. The effect size and power

for intermediate walkers was moderate (0.48) and 0.57 respectively. The effect size and power for fast walkers was large (0.93) and 0.95 respectively.

Chart 1 shows that among 52 participants 63.46% were not willing to use cane for their day to day activities and 36.54% were willing to use cane for their day to day activities. Chart 2,3 and 4 showed that in slow walkers (n=14) 71% were willing to use cane and 29% were not willing to use cane, in intermediate walkers (n=21) 29% were willing to use the cane and 71% were not willing to use the cane and in fast walkers (n=17) 18% were willing to use the cane and 82% were not willing to use the cane for their daily activities respectively.

## DISCUSSION

The aim of our study was to find the effect of cane on walking adaptability and willingness of patient to use cane in community. From the results we have found that provision cane results in no significant changes in walking adaptability in slow walkers, whereas, in intermediate and fast walkers there were significant changes. Even though, there were no significant changes in slow walkers, there was more number of patients among them who prefer to use cane. The result of this study showed both positive and negative effects in provision of cane on walking adaptability, when participants were analyzed all together.

The provision of cane for slow walkers may have improved stability and confidence for walking. This has been reflected in the willingness of more number of slow walker to use the cane in community. But other impairments such as pronounced muscle weakness and lack of co-ordination may have reduced the walking adaptability of the participants, using cane. In case of intermediate and fast walkers who were already able to fully ambulate around the community without help has introduced a confounding factor that reduced their walking adaptability. This may be due to a

new motor task which is compromising their walking.

In a similar study by Lucas R et al. the provision of a cane produced no significant change in speed or cadence, but a small increase in step length. For the intermediate walkers, the cane increased speed by 0.18 metres/second, step length by 0.07metres, but not cadence. The provision of a cane to the intermediate walkers also produced 0.27 metres/second more increase in speed compared with the fast walkers, and 0.12 metres/second more increase compared with the slow walkers. They concluded that the provision of a cane produced most benefit to a subgroup of intermediate walkers in a group of community-dwelling people with chronic stroke whose walking had stabilized, without detriment to quality of walking. [4]

Though, there are positive and negative effects for post stroke patients with the provision of cane, the willingness of the participants to use the cane in community is also considered. In our study, most of the patients were not willing to use the cane, when analyzed as a whole, as they prefer to be an independent walker in the community.

### Limitations

- Small Sample size reduces the generalizability of the results
- Only the immediate effects of provision of a cane after a short period of practice were measured.

### Suggestions for future studies

- Future studies can include other gait variables such as cadence, step length etc.
- Study can be performed with participants in their living environment
- Future studies can be done relating fall risk and using cane during functional activities.
- Cane can be used as a modality for dual task training.
- Factors associated with increased and decreased time taken to complete TUG test with cane should be identified in future studies.

- It would be useful for further studies to investigate the long term effect of providing cane, and its effect on daily activities that require acceleration, such as crossing streets
- EMG activities during cane walking can be studied to find the differences in muscle activity. Kinematic and kinetic analysis during cane walking could be studied.

### CONCLUSION

In conclusion, this study found that the provision of cane have both positive and negative impact on functional mobility in independent community ambulatory post stroke patients. For slow walkers, the provision of cane resulted in more benefit by decrease in time taken for completion of task therefore, cane may be recommended for their functional activities. For intermediate and fast walkers, the provision of cane resulted in increase in time taken for completion of task therefore, cane may not be recommended for their functional activities. Even though using cane can have impact on walking adaptability willingness of the patients to use cane should be considered.

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