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Marion A. Lisenby
Old Dominion University

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OPEN

Gait Speed and Confidence Levels in Persons Using 1 and 2 Canes While Walking a 4-m Course

Marion A. Lisenby, MSPT

This is the first article that the researcher is aware of that compares walking speed and confidence levels with 1 cane versus 2 canes. An observational study was conducted with 30 participants who had difficulty walking. Gait speed was assessed on a 4-m course with the participants using 1 cane, then 2 canes. Of 30 participants, 28 walked faster and demonstrated improved confidence with 2 canes. Use of 2 canes with gait might be a technique that people want to consider to improve confidence or to improve walking speed, or improve both.

Key words: confidence, gait speed, geriatrics

Helping people walk faster and with more confidence is a challenging task in today's world. Gait speed is an important measure of health in older individuals,¹ and decreased gait speed is a predictor of falls, mortality, disability, and functional decline.^{1,2} Gait speed improvements are associated with decreases in mortality.³ Many people have a fear of falling, which is associated with decreased quality of life and difficulty moving outdoors.^{4,7}

Instructional textbooks for physical therapists discuss the use of walkers, crutches, and canes to assist patients in ambulation.^{8,9} The discussion of canes, however, is limited to the use of a single-point cane (SPC) or quad cane unilaterally. The use of bilateral SPCs is not generally considered as a treatment option, and yet this author's experience as a physical therapist in a home health setting has been that some patients improve their walking speed and confidence when using 2 canes. A review of the literature did not find any studies examining the bilateral use of SPCs.

Author Affiliation: Ms Lisenby is a former student of Old Dominion University, Norfolk, Virginia.

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Correspondence: Marion A. Lisenby, MSPT, 120 Saw Grass Bend, Virginia Beach, VA 23451 (Marion122@cox.net).

Physical therapists will prescribe the least restrictive assistive device available that the patients can handle¹⁰ and that ultimately can be 1 SPC; however, we have not really measured whether using 1 SPC is the best option for the patient. We have not examined the trade-off in gait speed or confidence using 1 versus 2 canes. This researcher was interested in whether the use of 1 cane resulted in slower gait speed or less confidence when compared with the use of 2 canes. One is less restrictive; however, have we decreased the person's ability to ambulate in the community by decreasing the amount of support?

Two important performance measures of gait are speed and confidence. Perera et al¹¹ studied gait speed in 692 people comprising older adults with mobility disabilities, subacute stroke survivors, and community-dwelling older adults. They found that a change in gait speed of just 0.05 m/s was clinically significant (small, meaningful change) and a change in speed of 0.1 m/s was a substantial meaningful change.¹¹

Perry et al¹² proposed functional ambulation classifications based on speed. They include household ambulation (<0.4 m/s), limited community ambulation (0.4-0.8 m/s), and full community ambulation (>0.8 m/s). In addition, older adults can be classified as slow (<0.6 m/s), intermediate (0.6-1.0 m/s), or fast walkers (>1.0 m/s).¹³

Schmid et al¹⁴ studied 64 subacute stroke survivors in rehabilitation and found that a gait velocity gain that resulted in a transition to a higher class of ambulation resulted in better quality of life.

The combination of significant clinical change in speed and the functional ambulation classifications give us a framework through which we can interpret whether an intervention or assistive device has made any significant difference in a person's ability to function. This is an important determination for making decisions with patients.

The purpose of this study is to determine any differences in gait speeds in persons with difficulty walking using 1 and 2 canes on a 4-m course and to evaluate their confidence levels after each trial. A secondary purpose is to record patients' subjective reactions to walking with 1 cane versus 2 canes. The hypothesis is that certain persons with difficulty walking will be more confident and/or have faster gait speeds when using 2 canes with gait.

PARTICIPANTS

This sample of convenience participants was recruited from patients seen by the principle investigator in her home health work, from volunteers from a Multiple Sclerosis (MS) group, and volunteers who heard about the study

through word of mouth. Each person was tested in his or her own home or at his or her MS group meeting site. The period of recruitment was from 021712 to 102613. The requirement was that they be able to independently walk with a cane but have difficulty walking. Ages ranged from

TABLE 1 Subject Characteristics

Participant	Age, y	Gender	Diagnosis	Diagnosis 2	Days Postoperation/ Hospital Stay	Fall History Within 1 y
1	78	M	L TKR	CAD, OA R knee	39	0
2	82	M	L TKR	OA R knee	30	0
3	68	F	Fx L hip with PHR	Charcot-Marie-Tooth syndrome	38	2
4	70	F	R THR	L THR	11	0
5	77	F	R THR	Bilateral TKR, L THR	35	1
6	69	F	Lumbar fusion	Genu valgus	28	0
7	68	M	R TH revision	OA L knee	17	1
8	78	F	L THR	OA	50	2
9	81	F	R THR	OA	41	0
10	58	F	R TH revision	OA	22	0
11	65	M	R TKR	OA	15	0
12	71	M	Sepsis	Polio, Pneumonia	N/A	0
13	70	F	R THR	OA	9	0
14	85	F	Syncope	OA B knees	N/A	5
15	75	F	R THR	OA	12	0
16	87	M	Pneumonia	CHF	N/A	2
17	61	M	L TKR	OA R knee	18	0
18	68	F	L THR	OA	13	0
19	66	F	R TKR	OA	19	0
20	79	F	Polymyalgia rheumatica	AFIB	N/A	3
21	81	M	OA	HTN	N/A	0
22	61	M	R THR	OA	26	0
23	60	F	R TKR	OA L knee	38	1
24	84	F	Lumbar decompression	OA	85	6
25	86	M	CHF	CVA R sided weakness	N/A	0
26	51	F	MS	MS	N/A	5
27	66	F	MS	MS	N/A	1
28	95	F	Syncope	OA	N/A	6
29	84	M	OA	Vertebral compression Fx x 5	N/A	0
30	86	F	Pneumonia	CHF	N/A	0
Mean ± SD	73.67 ± 10.42				28.74 ± 18.12	

Abbreviations: AFIB, atrial fibrillation; CAD, coronary artery disease; CHF, congestive heart failure; CVA R sided weakness, cerebrovascular accident; Fx L hip with PHR, fracture of the left hip with partial hip replacement; HTN, hypertension; L THR, left total hip replacement; L TKR, left total knee replacement; MS, multiple sclerosis; N/A, no hospital stay; OA, osteoarthritis; OA B knees, osteoarthritis bilateral knees; OA L, osteoarthritis left knee; OA R, osteoarthritis right knee; R THR, right total hip replacement; R TKR, right total knee replacement.

TABLE 2 Data Collected						
Participant	Gait Speed m/s 1 Cane	Gait Speed m/s 2 Canes	Difference in Gait Speed m/s	Confidence Level 1 Cane	Confidence Level 2 Canes	Difference in Confidence Level
1	0.60	0.80	0.20	0.90	1.00	0.10
2	0.57	0.64	0.06	0.60	0.80	0.20
3	0.57	0.70	0.13	0.90	1.00	0.10
4	0.53	0.56	0.03	0.90	1.00	0.10
5	0.44	0.58	0.15	0.80	0.90	0.10
6	0.51	0.48	-0.03	0.80	0.90	0.10
7	0.68	0.71	0.03	0.90	1.00	0.10
8	0.45	0.53	0.07	0.90	1.00	0.10
9	0.47	0.52	0.05	0.50	0.90	0.40
10	0.25	0.45	0.20	0.80	0.90	0.10
11	0.38	0.41	0.04	0.50	0.80	0.30
12	0.57	0.64	0.08	0.70	0.90	0.20
13	0.49	0.55	0.06	0.80	0.90	0.10
14	0.52	0.53	0.00	0.80	0.90	0.10
15	0.44	0.58	0.14	0.80	0.90	0.10
16	0.57	0.84	0.27	0.70	0.90	0.20
17	0.40	0.44	0.03	0.70	1.00	0.30
18	0.55	0.56	0.01	0.60	1.00	0.40
19	0.76	0.81	0.04	0.90	1.00	0.10
20	0.71	0.87	0.16	1.00	1.00	0.00
21	0.36	0.40	0.04	0.30	0.60	0.30
22	0.47	0.54	0.07	0.40	0.80	0.40
23	0.53	0.87	0.34	0.50	0.90	0.40
24	0.95	0.94	-0.02	0.80	0.90	0.10
25	0.43	0.52	0.09	0.90	1.00	0.10
26	0.28	0.33	0.04	1.00	1.00	0.00
27	0.38	0.40	0.03	0.90	1.00	0.10
28	0.60	0.80	0.20	0.90	1.00	0.10
29	0.57	0.64	0.06	0.60	0.80	0.20
30	0.57	0.70	0.13	0.90	1.00	0.10
Mean ± SD	0.52 ± 0.14	0.61 ± 0.16	0.09 ± 0.08	0.76 ± 0.18	0.93 ± 0.09	0.17

51 to 95 years (mean age = 73.7, SD = 10.4), with 11 males and 19 females. Twelve reported between 1 and 6 falls within the last year (Table 1).

METHODS

The principles outlined in the Declaration of Helsinki were followed. As a Quality Improvement exercise, data collected were standard of practice. Participants read

about the study and had a chance to get their questions answered. They then signed the informed consent document. A 4-m course was marked on the floor or carpet. The walking surface was not standardized and, in some cases, was carpet and other times wood or tile. The walking surface remained the same for both conditions. Next, 2 padded T-handled SPCs (Carex brand) were adjusted in height to fit the participants correctly. They were then

instructed in how to walk with 2 canes with reciprocal arm swing and returned demonstration. All participants were timed and recorded by the same physical therapist. Gait speed was measured as distance in meters divided by time in seconds. Distance was 4 m. Participants were instructed in how to report confidence with levels calculated with 0% as no confidence to 100% as completely confident. Participants, from a standing start, were told to “walk as if you are walking down the street” and given no further encouragement or instruction. Timing started as soon as the first foot crossed the starting line and ended when the last foot crossed the finish line. The first trial consisted of timing the participants walking the 4-m course with 1 cane. When they completed the trial, they were asked “how confident were you that you would not lose your balance or become unsteady on a scale of 0, no confidence, to 100, completely confident?” Gait speeds and confidence levels were recorded. Right after the first trial the participants were timed walking the 4-m course with 2 canes and were asked the same question: “how confident were you that you would not lose your balance or become unsteady on a scale of 0, no confidence, to 100, completely confident?” Gait speeds and confidence levels were recorded. The participants then gave any comments they had in the use of 1 versus 2 canes with their trial and these were recorded by the researcher.

ANALYSIS

All statistical analyses were performed with SPSS version 19 (IBM Corporation, Armonk, New York). Gait speed results were analyzed using the paired *t* test. Confidence levels were analyzed with nonparametric statistics (related samples Wilcoxon signed rank test).

RESULTS

Of 30 participants, 28 walked faster with 2 canes ($M = 0.52$ m/s, $SD = 0.14$ m/s), as opposed to using 1 cane ($M = 0.61$ m/s, $SD = 0.16$ m/s) (Table 2 and Figure 1). This represents an increase in gait speed of 0.09 m/s, 95% confidence interval (0.06-0.12). A paired *t* test

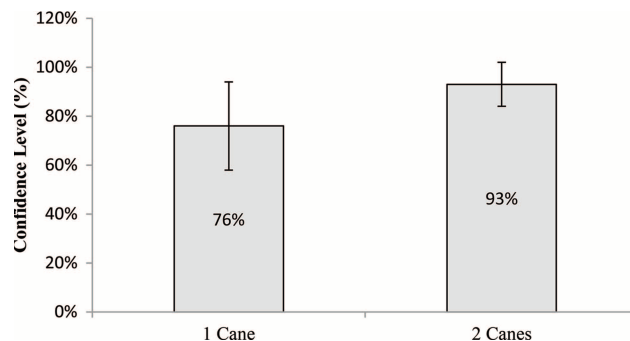


Figure 2. Mean confidence level 1 and 2 canes.

indicated a statistically significant difference between the 2 conditions: $t_{29} = 5.79, P \leq .001$.

The results of the 0 to 100 confidence scale demonstrated that 28 of the 30 participants reported more confidence when using 2 canes compared with 1 cane (Table 2 and Figure 2). Nonparametric statistics showed a mean confidence level of 76.0% with 1 cane and 93.0% with 2 canes, an increase in confidence of 17.0% using 2 canes. Participants’ comments are shown in Appendix 1.

DISCUSSION

Among 30 participants with a variety of diagnoses and movement problems, using 2 canes with gait resulted in greater improvements in gait speed and perceived confidence levels when compared with using 1 cane with gait.

The average difference in gait speed with 1 and 2 canes was 0.09 m/s, which met the threshold for small meaningful change (Table 2). Using 2 canes, 6 participants had substantial meaningful change, 14 demonstrated small meaningful change, and 10 demonstrated no meaningful change (Figure 3). With 2 canes, 4 household ambulators increased speed such that they would be classified as limited community ambulators, and 4 limited community ambulators transitioned to full community ambulators (Figure 4). In addition, 6 participants went from slow walking with 1 cane (<0.6 m/s) to intermediate walking with 2 canes (0.6-1.0 m/s) (Appendix 2).

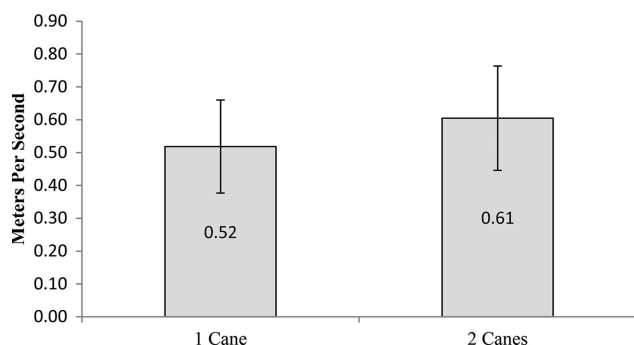


Figure 1. Mean gait speed with 1 and 2 canes.

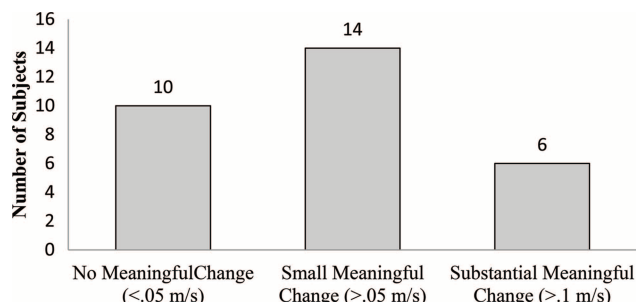


Figure 3. Meaningful change in gait speed using 2 canes.

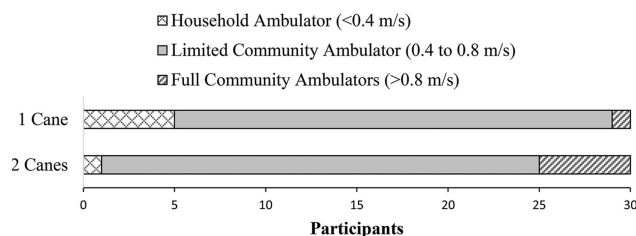


Figure 4. Gait classification (household to community ambulator) with 1 and 2 canes.

These improvements in gait speed are important as they can improve function and quality of life and hopefully predict better survival in older adults.

The use of 2 canes with gait demonstrated significant improvements in confidence levels, with an average increase of 17.0% (Table 2 and Figure 2). This is very important to allow people to be inclined to walk more, to participate in activities, and to get out maintaining their independence.

The participants' comments were largely positive in the use of 2 canes (Appendix 1).

Study limitations included small number of subjects, no follow-up to determine how many people in the study began using 2 canes in their daily lives, and whether participants experienced a long-term change in function. In addition, the researcher chose subjects from her practice and community contacts who would likely be able to ambulate with 2 canes. Even with this bias in mind, it is notable that so many of the participants were able to walk faster and with more confidence using 2 canes. The use of bilateral canes should, therefore, at least be considered as a valuable training tool for the gaining of short-term confidence and speed in gait.

Further research is needed to investigate the effects of using 2 canes with gait with energy cost of walking, weaning someone off a walker, moving outdoors, activity and participation, postural retraining, improving movement patterns and biomechanics, pain, balance, and fall risk (Appendix 1).

The mechanism of the effect of using 2 canes with gait to improve gait speed and confidence is not clear and requires further investigation.

CONCLUSION

Rather than always going for the least restrictive unilateral SPC, therapists could consider patient function and confidence as a community ambulator when selecting assistive devices. The use of 2 canes with gait in persons with difficulty walking might be a technique that people want to consider to improve confidence or to improve walking speed or to improve both.

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APPENDIX 1

Subject Comments

1. I've got to get use to the 2 canes.
2. No comment
3. I feel more steady and safer with the 2 canes.
4. The limp isn't as bad with the 2. I'm more steady. I stand more upright.
5. I feel more steady with the 2 canes.
6. I feel more confident with the 2 canes; it helps my limp.
7. The 2 canes provide me with the stability to balance the body and walk with a normal walk. As the result of the confidence level, I walk faster. The 2 sticks improve my confidence.
8. The pain is less when I use the 2 canes.
9. I don't feel the tendency to limp with the 2 canes. I'm standing straighter. I don't have the tendency to give in to the weaker side.
10. I feel safer with the 2 canes. The second cane gives the extra stability in case of unexpected uneven surface.
11. 2 canes give you more stability; feel more relaxed.
12. With the 2 canes, I can walk better and my limp is not as bad.
13. Using 2 canes is cumbersome because it's new. I can see the advantage of support on both sides.
14. I can walk better with 2 canes.
15. 2 canes make me feel more stable. I feel more confident and it helps my leg feel more comfortable. I can walk straighter with the 2 canes.
16. I can go further with the 2 canes; I don't get so tired.
17. 2 canes feel better than 1.
18. I think your weight is more evenly balanced with 2 canes. With 1 cane, I feel less in control and slower.
19. 2 canes made me feel more confident, more balanced, felt good. It's like they are an extension of your arms.
20. No comment.
21. No comment.
22. With 1 cane, I seem to walk leaning to the side. With 2 canes, my spine felt straight and more even.
23. 2 canes are too much.
24. I push down on the canes and stand up much straighter with the 2 canes.
25. I think the 2 canes help my balance.
26. I feel like I'm more balanced with the 2 canes.
27. With 2 canes, I feel I could stay up better.
28. With 2 canes, I feel much safer. It feels normal with 2 canes.
29. 2 canes are better than a walker because a walker is hard to maneuver in tight places. Starting out is a little unsteady with the 2 canes but I can go faster with the 2 canes.
30. I feel more secure with 2 canes; very easy. My back doesn't hurt as much when I use the 2 canes.

APPENDIX 2

Physical Performance Measure of Gait Speed

