Trekking Poles to Aid Multiple Sclerosis Walking Impairment

An Exploratory Comparison of the Effects of Assistive Devices on Psychosocial Impact and Walking

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CME/CNE Information

Activity Available Online: To access the article, post-test, and evaluation online, go to https://www.highmarksce.com/mscare.

Target Audience: The target audience for this activity is physicians, physician assistants, nursing professionals, rehabilitation therapists, physical therapists, and other health care providers involved in the management of patients with multiple sclerosis (MS).

Learning Objectives:
1) Identify the three subscales of the Psychosocial Impact of Assistive Devices Scale.
2) Compare and contrast the three assistive devices used in this study in terms of psychosocial impact, walking, and perceived fatigue.

Accreditation Statement:

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Background: Walking dysfunction is reported by two-thirds of persons with multiple sclerosis (MS). Assistive devices are frequently recommended to improve walking; however, it is uncommon to consider their psychosocial impact, although many users abandon their assistive devices. The psychosocial impact, walking, balance, and fatigue associated with three assistive devices were compared to guide clinical decision making.

Methods: Twenty-five persons with MS (median Expanded Disability Status Scale score, 4.0; range, 2.5-6.0) who reported walking difficulty were trained in the use of three assistive devices—a single-point cane (SPC), a four-point cane (FPC), and a trekking pole (TP)—at 1- to 2-week intervals, then used the assistive device for their usual activities. Outcome measures included the Psychosocial Impact of Assistive Devices Scale (PIADS), the 6-Minute Walk Test (6MWT), walking speed, cadence, stride length, stride time, the 12-item Multiple Sclerosis Walking Scale (MSWS-12), the Activities-specific Balance Confidence (ABC) scale, the 5-item Modified Fatigue Impact Scale (MFIS-5), and a visual analogue scale of fatigue (VAS-F).

Results: The SPC and TP were more positive in the PIADS adaptability, competence, and self-esteem subscales. The SPC and TP resulted in higher 6MWT, walking speed, cadence, stride length, stride time, and MSWS-12 scores compared with the FPC. No differences were found in ABC scale, MFIS-5, or VAS-F scores.

Conclusions: Participants reported more positive psychosocial impact, and walked faster and with higher quality, with the SPC and TP than with the FPC. Clinicians should consider suggesting an SPC or TP to patients who may benefit from assistive device use and for whom psychosocial impact is an important consideration. *Int J MS Care.* 2021;23:135-141.

Multiple sclerosis (MS) is a demyelinating disease of the central nervous system that affects more than 2.2 million persons worldwide.[1] Walking problems are reported by more than two-thirds of persons with MS[2] and are an important function affected by MS.[3] Walking limitations in persons with MS are primarily caused by impairments in motor control and sensation in the lower extremities[4] and can substantially impact participation and quality of life.[5]

A common intervention for walking limitations is use of an assistive device. A properly sized and used assistive device may help a person compensate for limitations in strength, motor control, balance, or pain and may reduce fear of falling.[6] Administration of an assistive device to persons with MS using a standardized program that includes appropriate selection, fitting, and training

has been associated with prevention of future falls, a reduction in sitting time, and a possible increase in walking time.[7] Although assistive device use is thought to improve walking ability, the psychosocial impact of their use must be addressed.[8] Anecdotally, many persons with MS resist the recommendation to use an assistive device and either reject or abandon its use. In one survey, 30% of participants abandoned assistive devices because of nonacceptance,[9] indicating a need for assistive devices that facilitate walking ability while reducing the negative psychosocial impact of use. A trekking pole (TP) may be a viable alternative to traditional assistive devices. Our clinical experience is that some persons who are reluctant to use a traditional assistive device were more open to using a TP. A TP has a handgrip and a wrist strap, similar to a single-point cane (SPC). An SPC or other type of cane is typically sized so that the handle is held with the elbow flexed to approximately 30°, whereas the TP is sized with the elbow flexed to 90° (Figure S1, which is published in the online version of this article at ijmsc.org).

The purposes of this study were to examine differences in 1) the psychosocial impact of three unilateral walking assistive devices (SPC, four-point cane [FPC], and TP), 2) walking and gait with each assistive device, and 3) fatigue induced during walking with each assistive device. Understanding the psychosocial impact of different assistive devices and how they affect walking

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may help clinicians make sounder decisions regarding their prescription.

Methods

Design and Participants

A randomized crossover model was used to examine differences in psychosocial impact, walking, and fatigue when using three assistive devices: SPC, FPC, and TP. Procedures were approved by the researchers' institutional review boards. Participants provided informed consent before initiating study procedures.

Participants were recruited from the practice of an MS specialist physician. Inclusion criteria were age 18 to 64 years, physician-confirmed MS diagnosis, Expanded Disability Status Scale (EDSS)[10] score of 6 or less, and some self-report of walking difficulty. The lack of a minimum EDSS score was determined a priori because the investigators thought it important to recruit persons with a self-identified walking problem. The walking component of the EDSS at lower levels is useful for determining MS-related disability but may not discriminate a person's current status from their previous one. Many individuals with low EDSS scores (0-2.5) have abnormalities in walking compared with controls.[11] Thus, a self-report of difficulty walking was deemed the appropriate inclusion criterion. Exclusion criteria were MS exacerbation within the past 8 weeks, score greater than 2 on the Functional Systems Score mental functions item, or presence of comorbid conditions that would limit participation. In addition, individuals were excluded if the study team deemed that they could not safely use the assigned assistive device.

Procedure

Participants attended five sessions. The first session included the physician's examination of disease severity using the EDSS and the Functional Systems Score.[10] The examining physician determined the participant's ability to participate safely. Demographic data included sex, age, MS subtype, time since diagnosis, and previous assistive device use. At session 2, each participant was assigned to a condition order (SPC, FPC, TP; SPC, TP, FPC; FPC, SPC, TP; FPC, TP, SPC; TP, SPC, FPC; TP, FPC, SPC) by random number drawing. Study staff sized the first assistive device using existing recommendations.[12] The participant was instructed in using the assistive device on a variety of indoor and outdoor surfaces, including regular and irregular surfaces, until the participant could demonstrate safe technique. Training for each assistive device lasted approximately 10 to 15 minutes. Once the participant and the study staff determined that walking with the assistive device was competent and safe, sessions 3 to 5 were scheduled, during which testing with the respective assistive devices was conducted. Participants were instructed to use the assistive device as much as was possible until the next session. Each appointment was separated by 1 to 2 weeks to minimize the impact of fatigue between sessions and to provide participants with sufficient practice with the assistive device to pass through initial skill acquisition to a steady state of performance for testing. The SPCs (item G05355, Medline Industries), the small-based FPCs (item G05345S, Medline Industries), and the TPs (Pyrite 7075, Mountainsmith LLC) were all commercially available and height adjustable.

At sessions 3 to 5, the psychosocial impact of each assistive device was measured using the Psychosocial Impact of Assistive Devices Scale (PIADS), a 26-item questionnaire that measures the impact of assistive device use on quality of life.[13]

It consists of three subscales: competence, adaptability, and self-esteem, each scored from –3 to +3. Adaptability pertains to the ability to participate, willingness to take chances, and eagerness to try new things; self-esteem pertains to security, sense of power and control, and self-confidence; and competence pertains to productivity, usefulness, and independence.[13] Then each participant completed the 5-item Modified Fatigue Impact Scale (MFIS-5), the 12-item Multiple Sclerosis Walking Scale (MSWS-12), and the Activities-specific Balance Confidence (ABC) scale. The MFIS-5 is an abbreviated version of the MFIS. This 5-item questionnaire measures the impact of fatigue on quality of life.[14] It is scored from 0 to 20, with higher scores indicating more severe fatigue. The MSWS-12 is a 12-item questionnaire that measures a person's perception of how MS has affected their walking ability. The MSWS-12 is a valid and reliable measure of perceived walking ability.[15,16] It is scored from 0 to 100, with higher scores indicating poorer walking ability.[17] The ABC scale is a 16-item questionnaire that quantifies a person's confidence in completing several functional activities. It is valid and reliable for persons with MS.[18,19] The ABC scale is scored from 0 to 100, with higher scores indicating greater balance confidence. Participants answered each survey using the time frame since the previous visit and with consideration of the assistive device. For example, the instruction on the MSWS-12 reads: "These questions ask about limitations to your walking due to MS during the past 2 weeks."[15] This was altered to read: "These questions ask about limitations to your walking due to MS while using the [name of assistive device] since your last session."

At sessions 3 to 5, walking endurance and gait were measured in two parts with the assigned assistive device. Temporospatial gait parameters were measured with three walking passes across a 14-ft (4.27-m) instrumented walkway (GAITRite, CIR Systems) and collected using gait analysis software (PKMAS [ProtoKinetics Movement Analysis Software], ProtoKinetics Inc). Mean values were calculated from the three passes for walking speed, cadence, stride length, and stride time. Walking speed is the quotient of distance divided by walking time and is reported in meters per second. Cadence is the quotient of the number of steps divided by walking time and is reported in steps per minute. Stride length is the distance from initial contact of one foot to the next initial contact of the same foot. Stride length is the average length of each stride with each limb and is reported in centimeters. Stride time is the time from initial contact of one foot to the next initial contact of the same foot. Stride time is the average duration of each stride with each limb and is reported in seconds. These parameters were selected because the investigators posited that they would be impaired in the sample[20] and thus responsive to changes induced by assistive device use. Participants took a 10-minute rest break after the walking passes were completed. After the break, participants completed a visual analogue scale of fatigue (VAS-F). The VAS-F form has a 100-cm line printed on it. The participant marks the line along the continuum from "least fatigue" to "greatest fatigue" as an immediate measure of fatigue.[21] Participants were provided with standard instructions for a 6-Minute Walk Test (6MWT).[22] The 6MWT measures walking endurance and has been validated for use in persons with MS.[23,24] Total walking distance (in meters) was recorded. Immediately after the 6MWT, participants completed another VAS-F. The change in VAS-F was the difference between VAS-F after and before

the intervention. Once participants felt adequately rested, they were provided with the next assistive device, instructed in its use, and directed to use it as much as possible until the next visit. This procedure was repeated until testing was completed.

Statistical Analysis

Statistical analyses were conducted using SPSS Statistics for Windows, version 26.0 (IBM Corp). Differences in each dependent variable between assistive device conditions were calculated using repeated-measures analyses of variance. If sphericity was violated, the conservative Greenhouse-Geisser correction was used. Bonferroni corrections were used for planned pairwise analyses. The alpha value was set at $P < .05$. Effect sizes (*d*) were calculated from partial eta squared values using G*Power, version 3.1.3.[25]

Results

Participants

Of 31 people recruited, four did not meet the inclusion criteria and two who provided consent were not allocated assistive devices: one due to safety concerns and the other due to an unrelated injury before the start of assistive device training. In total, 25 participants completed the study. Participant characteristics are reported in Table 1.

Outcomes

The results are summarized in Table 2.

Psychosocial Impact

There were significant main effects of assistive device on all PIADS subscale scores. Pairwise comparisons showed that the TP and the SPC had higher scores than the FPC in all three subscales.

Walking, Gait, and Balance

There were significant main effects of assistive device on 6MWT distance, walking speed, cadence, stride length, stride time, and MSWS-12 and ABC scale scores. Pairwise comparisons showed that these measurements were better with the SPC and the TP than with the FPC in all measures except for the ABC scale, where the effect did not persist in planned comparisons.

Table 1. Participant characteristics

Characteristic	Value
Age, y	
Mean ± SD	52.3 ± 7.8
Range	33-64
Sex, F/M	20/5
EDSS score	
Median	4.0
Interquartile range	1.5
Range	2.5-6.0
Time since MS diagnosis, y	
Mean ± SD	7.0 ± 5.5
Range	1-23
Previous assistive device use, no/yes	19/6

Note: Unless otherwise indicated, values are given as number.
Abbreviations: EDSS, Expanded Disability Status Scale; MS, multiple sclerosis.

Fatigue

There was no main effect of assistive device on change in VAS-F score. There was a significant main effect of assistive device on MFIS-5 score. The effects on the MFIS-5 score did not persist in the planned comparisons, but there was a trend toward lower fatigue with the TP.

Discussion

Walking impairment is the most common form of disability in persons with MS.[3,4,25] Reduced mobility has been associated with reduced quality of life and community participation.[26,27] Canes are commonly used by persons with MS.[28] Although assistive devices are thought to improve mobility, they are sometimes abandoned due to nonacceptance. This creates a need for considering assistive devices that may be most appealing.[9]

Psychosocial Impact

For each PIADS subscale, participants scored higher (ie, more positive/less negative) with the SPC and the TP than with the FPC. Greater adaptability may be attributed to the positional flexibility afforded by the SPC and the TP. Each has a single point of ground contact, enabling their use on any surface. Conversely, the multipoint bottom on the FPC makes use on uneven surfaces difficult because the device may become uneven or unstable. Participant feedback included that several felt that it was more difficult to walk on hills, grass, and other uneven surfaces with the FPC than with the SPC and the TP.

The lower competence with the FPC than with the TP or the SPC can be attributed to several factors. Participants have likely never used such a device before or may not have reported a lack of understanding during instruction. As such, the 1- to 2-week "training" time may have been insufficient for acquisition of skills for effective FPC use. These problems might be overcome with practice and proper instruction.[7] Alternatively, the FPC may simply be more cumbersome, thus affecting performance.

Participants reported greater self-esteem with the SPC and the TP than with the FPC. Many reported that using the FPC felt laborious, requiring greater effort for community walking. This is likely because the FPC weighs substantially more than either the SPC or the TP. The SPC and the TP are, generally, more discrete than the FPC. They are smaller, and participants may feel that they blend in more easily. One might expect the increase in perceived effort to correlate with increased fatigue, but the mismatch between the perception of higher effort without an increase in fatigue is consistent with other studies.[29] Conversely, participants reported that the FPC is large and difficult to hide. Several individuals reported that using the FPC made them

Table 2. **Summary of results**

Measure	Group scores, mean ± SD			Within-group effect P value	Effect size (Cohen's d)	Pairwise comparison P values		
	SPC	FPC	TP			SPC to FPC	FPC to TP	SPC to TP
Psychosocial impact								
PIADS-A[a]	0.507 ± 0.891	−0.393 ± 0.963	0.667 ± 1.32	<.001[b]	0.65	.004[b]	.002[b]	>.99
PIADS-C[a]	0.623 ± 0.865	−0.357 ± 0.867	0.603 ± 1.16	<.001[b]	0.72	<.001[b]	.003[b]	>.99
PIADS-SE[a]	0.375 ± 0.594	−0.425 ± 0.800	0.725 ± 1.12	<.001[b]	0.75	.002[b]	<.001[b]	.392
Walking and gait								
6MWT, m[a]	303.9 ± 90.4	262.1 ± 87.8	304.1 ± 93.8	<.001[b]	1.09	<.001[b]	<.001[b]	>.99
Walking speed, m/s[a]	0.90 ± 0.25	0.78 ± 0.25	0.93 ± 0.27	<.001[b]	1.27	<.001[b]	<.001[b]	.309
Cadence, steps/min[c]	95.4 ± 11.3	87.8 ± 14.5	96.1 ± 12.8	<.001[b]	1.05	<.001[b]	<.001[b]	>.99
Stride length, cm[a]	111.4 ± 23.9	105.6 ± 14.5	114.2 ± 25.0	<.001[b]	0.77	.015[b]	<.001[b]	.146
Stride time, s[c]	1.27 ± 0.16	1.41 ± 0.29	1.27 ± 0.21	<.001[b]	0.88	.002[b]	<.001[b]	>.99
Perceived walking and balance								
MSWS-12[a]	49.8 ± 16.3	61.8 ± 12.9	47.3 ± 17.2	<.001[b]	0.70	<.001[b]	.002[b]	>.99
ABC scale[a]	62.6 ± 19.0	57.5 ± 19.9	62.2 ± 21.5	.047[b]	0.33	.160	.112	>.99
Fatigue[a]								
ΔVAS-F[a]	26.2 ± 16.7	25.92 ± 20.7	26.24 ± 21.9	.995		NA	NA	NA
MFIS-5[c]	10.7 ± 3.5	11.5 ± 3.1	9.6 ± 4.5	.022[b]	0.44	.256	.057	.261

Abbreviations: ABC, Activities-specific Balance Confidence; FPC, four-point cane; MFIS-5, 5-item Modified Fatigue Impact Scale; MSWS-12, 12-item Multiple Sclerosis Walking Scale; NA, not applicable; PIADS, Psychosocial Impact of Assistive Devices Scale (A = adaptability, C = competence, and SE = self-esteem subscales); SPC, single-point cane; TP, trekking pole; 6MWT, 6-Minute Walk Test; ΔVAS-F, change in visual analogue scale for fatigue.
[a]Analysis with one-factor repeated-measures analysis of variance.
[b]Statistically significant (*P* < .05).
[c]Analysis with one-factor repeated-measures analysis of variance with Greenhouse-Geisser–corrected degrees of freedom.

self-conscious. The SPC is more commonly used, thus it may be perceived as more normal. Although nontraditional, the TP has the appearance of a piece of sporting equipment conventionally used for outdoor activities and typically performed by the seemingly healthy and able-bodied. This is in contrast to the dehumanized, freaky, or comical appearance that people historically report using traditional assistive devices such as FPCs and walkers.[30] There is a paucity of literature on this topic; however, one study that examined the psychosocial effects of assistive device use by a mixed population of people with neurologic pathologies reported positive-leaning psychosocial impact in some PIADS subscales for an SPC and a TP, although an FPC was not included in that study.[31]

Walking, Gait, and Balance

In this study, participants walked faster and with higher quality with the SPC and the TP than with the FPC. Use of the TP and the SPC resulted in better scores in walking and gait measures than did use of the FPC. Participants reported better perceived walking on the MSWS-12 with the SPC and the TP than with the FPC (12 and 14.5 points, respectively). These values exceed the 8-point estimate for meaningful improvement.[32] Although participants perceived meaningful

improvements, differences in walking performance did not exceed minimal detectable change (MDC) levels. Walking speed was calculated from mean values from three walking passes along the instrumented walkway. The closest comparison is to walking speed during a 10-m walk test, where the MDC is 0.26 m/s.[24] Compared with walking speed with the FPC, participants in this study walked 0.12 and 0.15 m/s faster with the SPC and the TP, respectively; however, this finding must be considered with caution because the MDC used herein was derived from 10-m walk test speeds. The 6MWT distances were also greater with the SPC and the TP than with the FPC (41.8 and 42.0 m, respectively). Although statistically significant, the values did not exceed the MDC of 92.16 m.[24] These differences indicate that use of the SPC or the TP resulted in a higher perception of walking ability and better performance in walking and gait than did the FPC. Gianfrancesco and colleagues[33] examined gait and walking in people with MS who regularly used an SPC (median EDSS score, 4.8) and found that maximal walking speed over a short distance was significantly faster with the SPC than without, although that difference was not present at the preferred walking speed. Martini and colleagues[7] found that fewer people with MS who used an assistive device

(median self-reported EDSS score, 6.0) and underwent a six-session assistive device training program sustained falls than did those who did not. This program also resulted in improved time spent walking, but the program did not result in changes in performance on timed tests of walking.[7] More comprehensive assessment of how walking changes with different assistive devices and training programs is warranted.

There was some evidence that balance perception was different between assistive device conditions, but this could not be confirmed by between-group comparisons. It is possible that the relatively small effect size of assistive device use on the ABC scale (Cohen's $d = 0.37$) means that the sample size was insufficient to adequately detect change. Balance performance, or a prospective tracking of falls, was not measured in this study and may have been a more sensitive measure of how assistive devices affect balance. This should be recommended for inclusion in future studies.

Fatigue

No difference in change in VAS-F score was found between assistive device conditions; however, there was a difference between assistive device conditions on the MFIS-5. The difference was not confirmed by between-group comparisons, but there was a notable trend toward less fatigue ($P = .057$) on the MFIS-5 with the TP compared with the FPC. As with the ABC scale scores, the small effect size of MFIS-5 scores may indicate an insufficient sample size. Use of the full MFIS, or some other fatigue measure, may have been more sensitive to changes in perceived fatigue.

Participant Preferences

At study completion, participants were asked whether they had an assistive device preference. Of the 23 who did, 77% preferred the TP, 14% preferred the SPC, and 9% equally preferred the TP or the SPC. Informal follow-up revealed that nine persons acquired and started using a TP and that two persons acquired and started regularly using an SPC after completion of the study.

Limitations

This study was not without limitations. Six participants previously used SPCs, with all six reporting that the SPCs were used infrequently and only outside of the home. Thus, not all participants were naive to one of the assistive devices. This may have resulted in some bias in performance or perception of walking or in psychosocial impact. Although all the participants noted walking difficulty, it is likely that some would not have been recommended an assistive device by their clinical team. However, even those with low EDSS scores have changes in walking and gait compared with controls.[11] It is our clinical experience that many people with low EDSS scores who perceive difficulty walking may still

seek out a walking assistive device. The data could not support analyzing differences between those who were naive to assistive device use and those who were not or between stratified groups based on other characteristics (eg, EDSS score, previous walking ability, or fall history). A future study should consider differentiating these groups to determine whether they affect the results.

Psychosocial impact of assistive device use may have positive or negative contributors that were not addressed in this study. Sex, time since MS diagnosis, or other personality traits may have affected acceptance and use of assistive devices. There was some control of individual traits due to the study design; however, the sample size did not support more granular analysis. In addition, measurement of readiness for change or personality inventory may provide additional insight into traits that predict assistive device acceptance and adherence. A more robust examination of these traits would be beneficial.

Once instructed in the use of each assistive device, participants were directed to use it for all walking activities until the next session. This was monitored only with a question about whether the assistive device was used sufficiently so that the participant felt comfortable with its use. Each participant affirmed this at each session. However, assistive device use was not closely monitored. It is possible that participants did not use the assistive devices regularly, limiting learning so that performance did not reflect a mastery of assistive device use. Because time was generally consistent between assistive device introduction and testing, it is likely that any error here would be a systematic one, similarly influencing the results for all assistive devices. It is, however, possible that a longer training period may have affected the results.[7]

PRACTICE POINTS

- In this sample of persons with MS, a trekking pole had an equally positive psychosocial impact as a single-point cane. Both the trekking pole and the single-point cane had significantly more positive psychosocial impact than a four-point cane.
- Objective and patient-reported measures of walking were generally better with a trekking pole or a single-point cane compared with a four-point cane.
- Clinicians should equally consider a trekking pole or a standard single-point cane when a unilateral assistive device is deemed necessary. Psychosocial impact is a factor that may influence compliance.

The assistive devices were selected for this study for several reasons: they were similar in use (eg, one-sided devices used in a self-selected hand), commercially available, and relatively inexpensive. We chose to limit the number of assistive devices, excluding others that might have been considered (eg, an axillary or forearm crutch or a hemi-walker cane). Bilateral assistive devices, which are more stable and may have provided a perception of greater balance than the unilateral assistive devices,[34] were also excluded. The TP was selected as an alternative assistive device because our clinical experience is that some persons who are reluctant to use a traditional assistive device are more open to using a TP. It is possible that an excluded assistive device might have been superior or inferior to those tested in this study. Additional studies that include a wider variety of assistive devices should be considered.

Because the goal of this study was to examine differences in psychosocial impact, walking, and fatigue among different unilateral assistive devices, data were not recorded without the assistive device. Having these data would have enabled comparison of assistive device use with the baseline condition without an assistive device. This should be considered in future studies.

Conclusions

Participants reported a more positive/less negative psychosocial impact with the SPC or the TP than with the FPC. Participants walked faster and with higher quality and had higher perceived walking ability with the SPC and the TP compared with the FPC. No assistive device was superior in minimizing perceived fatigue. For persons with MS who will benefit from using a unilateral assistive device, clinicians should consider offering an SPC or a TP. Clinicians should also consider which device has the most positive/least negative psychosocial impact to maximize the likelihood of adherence to assistive device use. □

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