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Novel walking pole gait pattern improves activity in an older adult with chronic low back pain

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Accepted 8 November 2021

SUMMARY

A 65-year-old woman with chronic low back pain participated in a 1-week community walking poles course. Although the participant received instruction in the standard Nordic walking method, she independently adopted a novel, modified, two-point gait pattern. Subsequently, her pain and activity tolerance using walking poles were monitored at 6 and 12 months. The participant ambulated two times the distance and reported lower ratings of perceived exertion and pain at 6-month and 12-month follow-ups when walking with poles compared with walking without poles. This case highlights the potential effect of respecting patient preference within the clinical decision-making model. Doing so empowered a participant with chronic low back pain to adopt a novel, self-selected gait pattern and improve her short-term and long-term outcomes associated with chronic musculoskeletal disease.

BACKGROUND

The WHO cites low back pain as the leading cause of years lived with disability and recommends physical and psychological therapies rather than pain medication and surgery.¹ Walking programmes for those with chronic low back pain (CLBP) have demonstrated decreased pain, improved function and increased physical activity² and may be more cost-effective than usual physiotherapy.³ Similarly, the use of walking poles (WPs), an alternative ambulation assistive device, is associated with increased aerobic capacity, strength, balance and quality of life in older adults.⁴ The use of WPs by people with chronic disease is associated with benefits including improved oxygen uptake without an increase in dyspnoea or perceived exertion for persons with chronic obstructive pulmonary disease,⁵ improved distance before claudication pain in persons with peripheral arterial disease,⁶ improved postural stability and gait pattern in persons with Parkinson's disease⁷ and for persons participating in conventional cardiovascular rehabilitation, the additional use of WPs resulted in increased exercise capacity. Quantitative studies exploring the use of WPs to address musculoskeletal issues such as CLBP have shown mixed results.^{8–10} Of note, previous studies reported no variation from the standard WP gait method that was instructed to participants. According to Sackett *et al*, clinical decision-making is informed by three domains: research evidence, expertise of the practitioner and patient preference.¹¹ Research protocols in past WP studies have instructed participants to use the traditional, two-point gait pattern of Nordic walking, during which

the foot and the contralateral pole tip contact the ground simultaneously.¹² In contrast, the principal investigator in this case study made an a priori determination to respect participant preference if they devised an alternate gait pattern that was deemed safe and functional. Following the CAse REports guidelines, we present a participant with CLBP and grade 1 lumbar spondylolisthesis and degenerative disc disease who devised a novel, self-selected WP gait pattern that achieved short-term and long-term relief of low back and right lower extremity radicular symptoms. We believe that this is the first case examining changes in CLBP symptoms when respecting patient preference by permitting a self-selected WP gait pattern.

CASE PRESENTATION

The participant was a 65-year-old woman, who had been diagnosed with lumbar spondylolisthesis at age 33. At age 51, she was injured in a motor vehicle crash that left her unable to ambulate in the community without exacerbation of her CLBP and right lower extremity radicular symptoms. The participant had previously undertaken pain interventions such as physical therapy, chiropractic and prolotherapy, but as these interventions did not provide long-term pain relief, she discontinued them. However, on a weekly basis, she received therapeutic massage and participated in Tai Chi classes. The participant also consumed an over-the-counter, non-steroidal anti-inflammatory drug as needed. The participant did not use any prescription analgesics.

INVESTIGATIONS

At age 52, radiographs confirmed that she had grade 1 spondylolisthesis of the lumbar vertebrae (L) four on L5 and degenerative disc disease.

TREATMENT

The community-based WP course in which the participant enrolled was advertised in a municipal Parks and Recreation department's quarterly schedule of classes for older adults, with course instruction and supervision provided by three physical therapists and assisted by four physical therapy students. All personnel were trained by the principal investigator in the Nordic walking method. It was decided in advance that if a participant self-initiated a safe and functional gait pattern that deviated from the Nordic walking method, the instructors would be permissive regarding the technique and respect the participant's preference.



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To cite: Prost EL, Abbott CC, Dannecker EA, *et al*. *BMJ Case Rep* 2021;**14**:e245807. doi:10.1136/bcr-2021-245807

Table 1 Lower Extremity Functional Scale (LEFS)

	Preclass	Postclass	6-month postclass	12-month postclass
1 Work, housework, school activities	1	3	2	2
2 Hobbies, recreational, sporting activities	2	3	3	3
3 Getting into or out of the bath	4	4	4	4
4 Walking between rooms	4	4	4	4
5 Putting on your shoes or socks	4	4	4	4
6 Squatting	1	4	3	4
7 Lifting an object, like a bag of groceries	2	1	2	2
8 Performing light activities around home	3	4	4	3
9 Performing heavy activities around home	1	1	1	2
10 Getting into or out of a car	4	4	4	4
11 Walking two blocks	4	4	4	4
12 Walking a mile	1	3	4	2
13 Going up or down 10 stairs	4	4	4	3
14 Standing for 1 hour	3	3	3	2
15 Sitting for 1 hour	3	4	4	4
16 Running on even ground	3	1	0	2
17 Running on uneven ground	0	0	0	2
18 Making sharp turns while running fast	3	0	0	2
19 Hopping	1	4	1	2
20 Rolling over in bed	2	3	3	3
Total score	50	58	54	58

Directions: today, do you or would you have any difficulty at all with.

LEFS Scoring: 0=extreme difficulty or unable to perform activity, 1=quite a bit of difficulty, 2=moderate difficulty, 3=a little bit of difficulty, 4=no difficulty.

The WP course lasted 1 week, with three 60 min sessions of instruction and practice in using WPs. The first class was taught indoors, walking around an auditorium. The second class was taught outdoors on a large asphalt parking lot, with one section on an incline. Participants were also encouraged to walk on the surrounding flat, grassy area. The third class took place at a local recreational nature trail that was flat and covered with chat gravel.

Although the participant in this case report had initially been instructed in the Nordic walking pattern, she reported that it felt 'awkward and unnatural'. Therefore, early in the WP course, she adopted an atypical, modified, two-point pole/heel strike pattern and reported that it 'felt comfortable'. After termination of the WP course, the principal investigator obtained the participant's consent to conduct institutional review board (IRB)-approved assessments (IRB project number 2003152), including follow-up visits at 6-month and 12-month post-termination of the course.

Data gathered included the participant's perception of the functional ability of her legs using the Lower Extremity Functional Scale¹³ (LEFS), which subjectively assesses the level of difficulty (5-point Likert scale, from no difficulty (4) to extreme

difficulty or unable to perform (0)) regarding daily self-care, work or leisure activities such as walking, stair climbing, running, squatting and lifting (table 1).

Additionally, the participant reported her exercise walking activity distance (kilometres), duration (min), frequency (times per week), level of physical effort using the Borg's Rating of Perceived Exertion¹⁴ (RPE). The worst level of pain experienced while walking was reported using the Numeric Rating Scale¹⁵ (NRS). Of note, the outdoor circular concrete walking track the participant used had signage with subkilometre markers, which improved the accuracy of distance reporting.

OUTCOME AND FOLLOW-UP

Prior to starting the WPs course, the participant reported she walked (without WPs) 1 km in 15 min, one or two times per week, with an RPE of 17/20 ('very hard'), a low back pain NRS of 10/10 ('worst pain imaginable') and a reported score on the LEFS of 50/80 (table 2). At the conclusion of the WP course (table 2), the participant doubled her distance (2 km) and duration (30 min) and increased the frequency of her walking to four

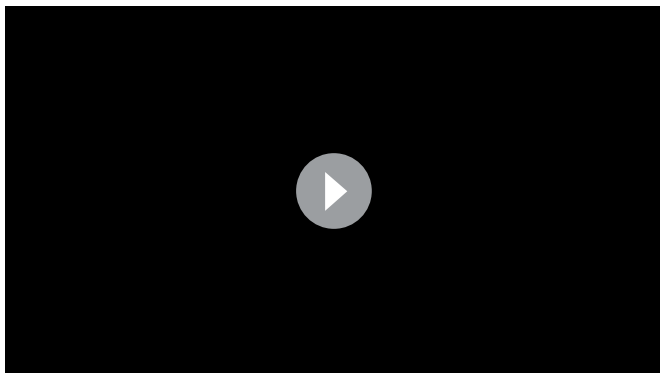
Table 2 Self-reported walking pole activity log

	Prior to WPs course (not using WPs)	At conclusion of WPs course (using WPs)	6-months post WPs course (using WPs)	12-month post WPs course (using WPs)
Distance	1.0 km	2.0 km	2.0 km	2.0 km
Duration	15 min	30 min	30 min	30 min
Frequency	1–2 times weekly	4–5 times weekly	3–4 times weekly	2–3 times weekly*
Pain NRS	10/10	0/10	3–4/10	0–3/10
RPE	17/20 ('very hard')	11/20 ('fairly light')	11/20 ('fairly light')	11/20 ('fairly light')
LEFS†	50/80 (62.5%)	58/80 (72.5%)	54/80 (67.5%)	58/80 (72.5%)

*Reduced frequency due to inclement winter weather, per client report.

†Minimally clinically important difference for the LEFS is nine scale points.

LEFS, Lower Extremity Functional Scale; NRS, Numeric Rating Scale; RPE, Rating of Perceived Exertion; WPs, walking poles.



Video 1 Video of participant's gait using walking poles

or five times per week using WPs. Her RPE improved to 11/20 ('fairly light'), and her low back pain NRS while walking using WPs was reduced to 0/10. She reported that WPs had provided 'immediate' relief of her CLBP symptoms during gait. Notably, the client reported an 8-point increase on the LEFS from baseline (minimally clinical important difference is 9 points).¹³ Following continued use of the WPs at 6 months postcourse (table 2), the participant maintained her improvements in walking distance, duration and RPE, though her walking frequency decreased slightly to three or four times per week coupled with a 3–4/10 on the NRS and 54/80 on the LEFS. The participant attributed this slight decrease in overall WP performance to a flare up of knee pain she experienced while not using WPs when walking a distance of five miles. She received two corticosteroid injections to her knee after this occurred. At the 12-month follow-up (table 2), initial improvements in walking distance, duration and RPE were maintained, with the participant reporting that winter weather had caused her to reduce the frequency of engaging in the outdoor WP routine. Furthermore, at the 12-month follow-up, the participant reported improved scores in pain on the NRS (0–3/10) and LEFS (58/80) as compared with 6 months prior, while maintaining progress similar to what was experienced at the conclusion of the WPcourse in distance, duration and RPE.

Video Gait Analysis (Video 1): the 6-month follow-up visit was conducted at the participant's customary paved walking path. An investigator recorded her preferred WP gait pattern using an iPhone 6 (Apple, Cupertino, California) at 120 frames per second to video. The investigator recorded video from the side, front and behind and determined that the gait pattern was most clearly evident in the view from behind. Two investigators later reviewed all video clips, confirmed the consistency of the

self-selected WP gait pattern and chose a short video clip that best showed both the pole and heel strikes. Editing was done with Final Cut Pro X (Apple, Cupertino, California) to slow the footage and add color-coded overlays to demonstrate the synchrony of the pole and foot strikes.

Specifically, the participant exhibited pole striking in a regular temporal pattern; however, pole strikes were at half the frequency of heel strikes (figure 1). Likewise, a consistently biased pole strike on both the right and left sides was synchronised to occur only during the heel strike for the right heel (of the symptomatic lower extremity). Coincidentally, the participant had previously reported a history of right lower extremity radicular pain during ambulation activities.

DISCUSSION

This report highlights three observations of clinical interest: (1) a participant adopted a novel, modified two-point WP gait pattern; (2) walking distance, duration and frequency increased, while the RPE and pain concurrently decreased and these improvements were maintained after 12 months when the participant used a novel, self-selected WP gait pattern and (3) a patient-centred approach, which respected her preference for a self-selected WP gait pattern, helped mitigate activity limitations and participation restrictions. Particularly noteworthy was the participant's adoption of a novel self-selected gait pattern, which displayed sequential right and left pole strikes synchronised with heel strike for only the right (symptomatic) lower extremity, potentially altering the degree of weight bearing on the right painful limb. Interestingly, electromyographic (EMG) studies of healthy, young adults using the traditional Nordic WP method on level ground have demonstrated higher EMG activation of the multifidi muscles as compared with walking without WPs.¹⁶ While core stabilisation exercises, including coordinated activation of the transversus abdominus and multifidus to accomplish a functional task, have been suggested as a useful intervention to mitigate the negative consequences of CLBP,¹⁷ it is important to note that literature on the topic is mixed. Specifically, while a recent meta-analysis by Owen *et al.*,¹⁸ identified core stability training to be associated with clinically meaningful reductions in pain among those with CLBP, multiple systematic reviews have concluded that core stabilisation exercises are no more effective than other exercise interventions to reduce pain in clients with CLBP.^{19 20} Consequently, given the unique findings from this case report and literature highlighted above, future investigations leveraging more robust study designs and the inclusion of kinematic, kinetic and EMG data are suggested to better explore the association between WP usage, the adoption of a

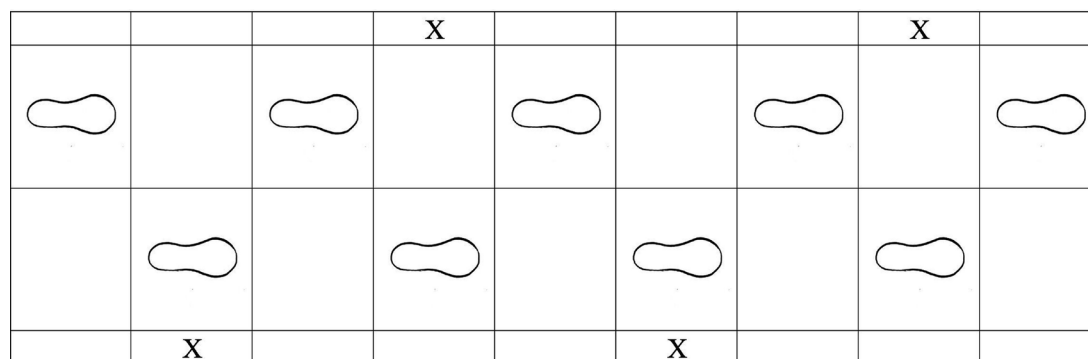


Figure 1 Novel, self-selected, modified two-point walking pole gait pattern.

novel self-selected gait pattern and symptom management for those with CLBP.

Such findings underscore the value of patient preference, described by Sackett *et al* as a foundational pillar of clinical decision-making that optimises and works in conjunction with evidence-based practice and clinical expertise to enhance client outcomes within dynamic healthcare contexts.¹¹

A limitation of this case report was the retrospective reporting of the NRS pain score, RPE score and walking distance and frequency from the participant's walking routine prior to the WP course. Another limitation is that other than the radiological findings, there is a lack of objective assessment such as back strength and flexibility or lower extremity sensation and proprioception. A strength of the case report was that the participant used WPs on the same outdoor concrete sidewalk where she had conducted her personal walking routine (without WPs) prior to taking the WP course.

Patient's perspective

I attempted to use the poles the way it was being taught, but it felt awkward and unnatural. I decided to do it in a way that felt comfortable. The pain relief was immediately noted with first time use. My experience while participating in the project was positive. I was always made to feel knowledgeable, educated on the process and felt valued. My input was requested and welcomed. I was shown the write up of the project as well as the pictures and video and was given an explanation of the findings.

Learning points

- ▶ Using walking poles (WPs) is beneficial for older adults and persons with chronic health conditions and may be beneficial for persons with chronic low back pain (CLBP).
- ▶ When performing the standard Nordic walking pole method, this participant reported it as being awkward and providing no relief for her CLBP. Instead, she independently adapted a novel WP gait pattern, which brought relief of CLBP that maintained through a 12-month follow-up.
- ▶ Patient preference, evidence-based protocols and experience of the clinician are three elements informing clinical decision-making.
- ▶ Keeping an open mind when the patient prefers an alternative protocol, different from the standard method that the clinician has instructed, may be beneficial for the patient.

Acknowledgements The authors wish to acknowledge Stephen P Sayers for reviewing the manuscript, Trent M. Guess for support with gait analysis; Hannah R. Williams for assistance with WPs classes; Brad B. Russell for gait videography and editing; Nancy Browning for proofreading; and Claire Garden for project inspiration.

Contributors ELP, CCA and BWW contributed to the conception and design of the work. ELP contributed to the acquisition, analysis, and interpretation of the data. ELP, EAD, and BWW drafted the manuscript. ELP, CCA, EAD and BWW critically revised the manuscript. All authors read and approved the final version.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Consent obtained directly from patient(s)

Provenance and peer review Not commissioned; externally peer reviewed.

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Case reports provide a valuable learning resource for the scientific community and can indicate areas of interest for future research. They should not be used in isolation to guide treatment choices or public health policy.

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